3.10 Increasing Societal Resilience to Winter Weather

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1. INTRODUCTION

In November 2005, the Weather and Society: Integrated Studies (WAS*IS) Workshop was held in Boulder, Colorado. The workshop brought together participants from many disciplines and backgrounds, such as operational meteorologists, physical and social scientists, professionals and students. In the course of the workshop, the participants developed projects based on their interests and utilized various tools, techniques and research methods learned during the workshop. One of these projects focused on increasing societal resilience to heat and winter weather. This paper focuses on the winter weather portion of the project.

The goal of the project was to determine feasibility for assessing vulnerability to winter storms and extreme cold events, determine ways to improve outreach to vulnerable populations as a mitigation measure, and to assess potential impacts that could be highlighted in watch, warning or advisory products issued by the National Weather Service.

2. WINTER WEATHER MORTALITY DATA COLLECTION

Winter weather mortality information was obtained from the National Weather Service's Storm Event Data database (NWS 2006). The data for the entire United States was analyzed for the 1984-2004 time period. For each state, the analysis included documenting deaths by gender, age, location at time of death, and cause of death. The data was further analyzed for two locations with similar climate, but different population characteristics. The first location was the state of Montana. It is the 4th largest state in the nation, with a mostly rural population just over 900,000 people. The largest city is Billings, and it has fewer than 100,000 people (US Census Bureau 2006). The second study location was the state of Colorado, the 8th largest in the nation with a population of near 4.3 million people, 2.4 million of which reside in the Denver metro area (US Census Bureau 2006).

Data analysis for the entire United States revealed that more deaths were attributed to winter storms rather than to cold weather events, by a margin of nearly 2 to 1. Demographic analysis of mortality data showed that male population between 40 and 49 years old were most vulnerable to winter storms and cold weather events. The second vulnerable group was the female population between 20 to 29 years old. 55 percent of winter weather related deaths occurred in a vehicle, while 30 percent of deaths occurred outdoors.

Analysis of mortality data for the US helped constructing a methodology for assessing vulnerabilities in two cases: Montana and Colorado. It also provided insights on areas where outreach on preparedness and prevention can be done to help reduce the loss of life from winter storms and cold weather.

In Montana, between 1996 and 2005, a total of 15 deaths and 11 injuries due to winter weather were reported. Demographic analysis showed that there was no major difference in mortality numbers between male and female populations. While victims' age ranged from 24 to 87 years old, 27 percent of deaths (majority) occurred in the 30 to 39 year old age group. While some observations were made regarding the impacts of winter weather on Montana's population, the amount of data available was not sufficient for a statewide vulnerability assessment.

In Colorado, between 1994 and 2005, there were 57 reported deaths (65 percent male, 21 percent female and 14 percent unknown) and 54 injuries. 26 percent of the deaths (majority) were in the 20 to 29 year old category with the second most number of deaths (18 percent) in the 30 to 39 year old category. The ages of deaths varied from 11 to 92 years old. 70 percent of deaths occurred outdoors, 25 percent of deaths occurred in vehicles. Colorado is a large recreation state and has many opportunities for skiing, snowboarding and backpacking through the high country. Preliminary analysis suggests that high percentage of deaths in the two age categories mentioned earlier, could be attributed to "extreme" recreational activities and risk taking. More data needed to verify preliminary assumption.

3. GEOSPATIAL ANALYSIS

The second type of data that was used in this study was data from the US Census Bureau on a Census block group level (State of Montana 2006). Demographic and socio-economic factors contributing to societal vulnerability to winter weather were analyzed in a

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Geographic Information System (GIS). Among the factors used in the analysis were age, gender, ethnicity, and household characteristics. Preliminary spatial analysis and vulnerability mapping identified "hot spots" of vulnerable populations. This assessment can be useful for identifying appropriate mitigation measures and educational programs. Additional data is needed for detailed analysis of societal vulnerability (e.g., income and level of education).

4. DATA LIMITATIONS

To fully access societal vulnerability to winter weather, more data and detailed analysis are needed. One observation concerns the way in which deaths are reported in the NWS Storm Data database and the limitation of collecting mortality data (Dixon 2005). There is also lack of consistency between databases of different National Weather Service offices. In addition, with winter time deaths, there are different ways a death can be reported. For example, an avalanche death could be listed under the "Avalanche" category, but if it occurred during or immediately following a heavy snowstorm (which could cause the avalanche) the death may be reported under the "Heavy Snow" or "Blizzard" categories (NWS Directives 2006).

The geospatial data was analyzed using U.S. Census Bureau block groups. In rural locations, where population density is lower than in urban areas, population characteristics have to be generalized for a larger geographical area, which makes vulnerability analysis and the identification of targeted mitigation measures more challenging.

6. SUMMARY AND FUTURE PLANS

This study focused on analysis of winter-weather related deaths across the United States. The mortality data helped to identify demographic characteristics of vulnerable populations. Spatial vulnerability assessment was conducted for two states: Montana and Colorado. Preliminary results of mortality and vulnerability analysis suggest a number of potential mitigation measures in addition to further research on this topic.

Detailed investigation of weather related mortality and morbidity in relation to societal vulnerability is needed to improve the hazardous weather products such as watches, warnings and advisories. These products, for example, could include impact statements that discuss more specific impacts targeted for specific vulnerable populations. This could potentially be the persuading factor that keeps someone from doing an activity that could place their life at risk. *Call To Action* statements are currently included with all products, but they are fairly uniform throughout the United States, and have not been updated much over the years. Oftentimes they do not capture local or regional impacts that an additional impact statement would be able to communicate to the public.

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