COMMUNICATING CLIMATE CHANGE INDUCED HEAT WAVE HEALTH RISK ISSUES WITH URBAN COMMUNITIES: THE CASE OF WINNIPEG (CANADA)

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Received October 13,2007 *Accepted April 14, 2008*

ABSTRACT

Recent scholarly works have claimed that heat wave occurrences in recent years are correlated with the global warming of the atmosphere. Concerns about heat wave vulnerability of communities have been accentuated by the current "graying" trend of population in the developed world and the marginalization of some socio-economic groups, particularly in urban areas. Reaching these vulnerable groups and the aging population through conventional means of communication means has been a challenge to the service providers. In this backdrop, the specific focus of this research was chosen to examine how well prepared individuals are to deal with climate change-induced heat wave hazards in some selected urban communities of Canada. As management knowledge and practice concerning urban risk and disaster mitigation and response regarded them as matters of dealing with 'crisis situation' without paying much attention to how people recognize and perceive the danger, which consequentially created a serious communication gap between the service providers and the community-based first responders. The intention of the research is to identify these gaps through "Knowledge Model" approach and explore possible alternative approaches to improve risk communication outcomes.

Key Words : Heat wave, Human health risk, Risk communication, Knowledge model.

INTRODUCTION

There is a consensus in the scientific community that the global climate is changing at a pace that surpasses the natural projections, and the incremental change is being regarded as to the effects of the anthropogenic release and accumulation of greenhouse gas emissions in the earth's atmosphere.[1,2] The specific effects of global climate change are complex and wide-ranging but the overall effects are observed in the consistent trend of the warming of global atmosphere in recent years. A positive correlation between the global warming and severe weather events has been postulated by many researchers[3], which has been based on more common occurrences of heat waves and

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other weather related calamities than in the past.[4] The effect of extreme temperatures on human mortality has been analyzed in numerous contemporary studies. A record heat wave scorched Europe in August 2003 claimed an estimated 35,000 lives[5]; similarly, heat-related fatalities across the United Kingdom reached 2,045 in year 2003.[6] A heat wave in India in June 1998 was estimated to have caused 2600 deaths over 10 weeks of high temperatures.[7] During a record-setting heat wave in Chicago (USA), July 1995, there were at least 514 heat related deaths, and 3300 excess emergency admissions.[8]

Heat waves carry a significant amount of risk, through posing both the threat of heat-related illnesses and the aggravation of pre-existing conditions. Skin eruptions, heat fatigue, heat cramps, heat syncope, heat exhaustion and heat stroke are classical heat related illnesses. Most heat-related illnesses (except for skin eruptions and heat cramps) are in essence consequences of varying severity of failure in the thermoregulatory system. Complications of heat stroke may lead to adult respiratory distress syndrome, kidney failure, liver failure and disseminated intravascular coagulation.[9] Severe functional impairment was observed in 33% of 58 patients admitted with heat stroke during the Chicago heat-wave, with no improvement has been observed among the survivors after one year.[10] Heat waves have been implicated in the aggravation of existing conditions such as heart disease, high blood pressure, kidney failure, and psychiatric disorder.

Literature suggests that the mortality due to heat waves is preventable through effective preparedness, prevention and mitigation strategies, which requires an effective risk-communication. It is generally contended that by increasing citizens' participation in mitigation and response strategies, emergency managers can build an informed constituency for mitigation and response, as well as earn a real commitment among elected officials to take action. Public communication and involvement, including public participation and public consultation, is therefore increasingly becoming a more common method in the risk mitigation, emergency management and recovery decision making processes.[11] Successful communication of health risk of heat wave risk requires that the public properly identify the risks and undertake mitigation strategies, and that this knowledge diffuses quickly throughout the community within a certain period of time. As used here, "risk Communication in heat wave hazards" means communication intended to supply laypeople with the information they need to make informed, independent judgments about risks to health during heat wave.[12] A large body of research shows that people (particularly when asked about risks outside their area of expertise) apply a complex understanding of risk when making personal judgments about risks and their acceptability. It has also been identified in the existing literature that there remains a significant gap between the general public's perception of risk and the objective risks as identified by expert groups. One reason for such as gap, is that "arguably the most important difference is that scientists usually define risk in terms of effects on populations, while the lay audience is concerned with effects on individuals.[13] It is therefore necessary to investigate the extent and nature of the public's perceptions of heat wave hazards and their associated risks in order to address the existing problems in risk communication and public mitigation and response behavior.

AIMS AND OBJECTIVES

The objectives of this research are three fold :

(1) To discuss the extent and nature of the scientists' perceptions of climate change induced heat wave events;

(2) To examine the extent and nature of the public's perceptions of climate change induced heat wave events; and

(3) to identify the gaps and overlaps in understanding and knowledge between experts and community people concerning the hazard.

The aim of this research is to assist the best possible practices in risk communication by incorporating public views into risk analysis in an attempt to decrease mortality rate during heat wave. The failure to effectively inform the public about existing and potential risk and mitigation options is a reflection of the lack of systematic procedures for finding out what people know and need to know, and for confirming empirically that a communication has been ineffective.[14] In order to address these issues, this research employs an iterative, process oriented, and a multi-layered survey based "Knowledge Model" framework.[15]

METHODOLOGY

The first step in Knowledge Model application involves construction of an 'expert knowledge model' by creating an influence diagram that captures the pooled beliefs of technical specialists about the heat wave phenomena. The model is created through the use of a focus group of experts from various yet related disciplines. In this research a team of experts representing 12 different stakeholders, who met on 16 October, 2006 in Winnipeg, Canada, provided their inputs into framing an influence diagram on risks to heat wave relating to climate change. In the second step, 25 respondents (N_1 = 25) were interviewed with an 'open-ended' instruments within the local community (namely, the North Kildonan Ward in the City of Winnipeg) as a case of a Canadian urban community. The purpose of the open-ended interviews was to capture elicited community people's beliefs about heat wave in their own terms. As indicated in the existing literature, the elderly and low income groups are mostly vulnerable in a heat wave period; this required a stratified sampling. Hence, among the 25 direct interviewees, 10 were chosen from the elderly (age > = 65) population and five were from financially challenged groups (annual income < = 35,000). The remaining 10 were selected from the common people within the community. As to fulfill the third step of the knowledge model process, a quantitative confirmatory questionnaire was created and distributed among a large sample of the overall community of North Kildonan (N_2 = 300) to estimate the population prevalence of these beliefs and to substantiate the initial findings. The response rate was 38% (N_3 = 114).

Finally, the results, both qualitative and quantitative, were analyzed to determine which incorrect beliefs need intervention for improvement and which knowledge gaps require attention for convergence.

RESULTS AND DISCUSSION

Expert knowledge of an area of study like climate change induced heat waves, involves complex variables, with factors influencing each other in direct and indirect ways. It is possible to identify certain factors and relationships that exist between these variables as well as to determine the areas that require lucid communication. From our initial model, some major relationships have been identified which warrant thorough consideration. The Knowledge Model developed under the present study indicates that the three most important factors contributing to the physical risk of extreme heat are :

(1) rise in mean temperature,
(2) changes in atmospheric moisture, and
(3) changes to surface moisture.

In the existence of physical presence of a heat wave, the risk would exist only if individuals are exposed to sunlight for a long time, have a lack of access to water and/or are exposed to inadequate ventilation in housing/building structures. If this continues for too long, the advanced effects of a heat wave detrimentally affect :

(1) the infrastructure,
(2) the environment, and
(3) human health.

Many physiological and psychological conditions may be aggravated by these effects. The Knowledge Model developed by the participant experts is exhibited, along with their influence indicators, in **Fig. 1.**

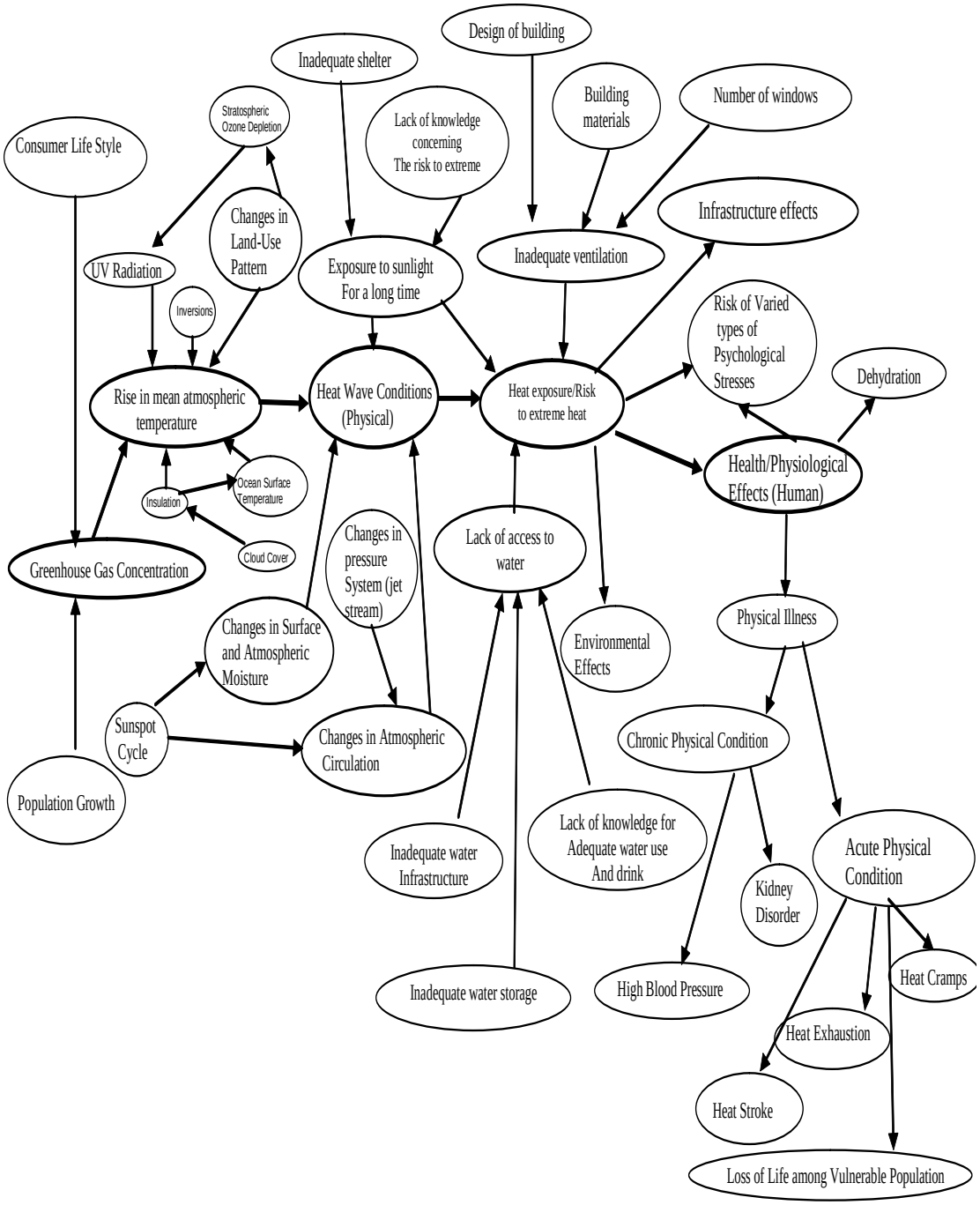

Fig. 1 : Expert Knowledge Model of heat wave and its associated risks

Hypotheses were examined in the present study in three key areas, these include: (1) Greenhouse gas (GHGs) emissions lead to an increase of heat waves, (2) heat wave causes significant health risk including high mortality rate, (3) heat exposure risk could be minimised by taking precautionary measures. A five-point Likert-type instrument was used to generate quantifiable information that can reveal the degree of agreement or disagreement. The first hypothesis tested asserts that "a rise in mean temperature is correlated with an increase in atmospheric greenhouse gas concentration."[16] In terms of the stated hypothesis, all (100%) low income respondents and elderly respondents believe that (i.e., agreed and strongly agreed) increased GHGs concentration indirectly influence occurrences of heat waves, particularly by causing rising earth's mean temperature. Among the overall community respondents, only 50% recognize such a pattern and correlation. The cross-sectional survey results (N_3 = 114) have revealed that 90% of the respondents either strongly agree or agree to the assertion that GHGs cause earth's mean temperature to rise and thereby helps indirectly in occurring heat wave.

The second hypothesis examined concedes that "heat wave causes significant health risk including high mortality rate."[17] In this regard, all low income and elderly respondents unanimously "agreed" and "strongly agreed" that climate change induced heat wave causes significant health risk including high mortality. But at the broader community level, only about 20% of the respondents either do not know or are not aware of such relationships. Cross-sectional data reaffirm the pattern that 88% of the sample agreed to the notion that heat wave posses significant mortality threats.

The third hypothesis of this research argues that "heat exposure risk could be minimised by taking appropriate precautionary measures."[18] Mixed results appeared with regard to this notion. Notably, 60% of the elderly respondents do not recognize that heat wave related disasters can be avoided by proactive measures whereas about 20% of the low income group and larger community members fall in this category. Thus, a large variation exists between elderly and low income respondents, this may be indicative of the passive nature of the elderly population and their heavy reliance on external supports such as, institutional assistance. The passive nature of the elderly population is also attributed to their limited physical capability to undertake proactive measures to reduce risk. The cross-sectional survey data have revealed a contrary perspective than the face-to-face interview data with regard to the possibility of reducing heat wave impact by interventions. The face-to-face survey results exhibited that 50% of the respondents (N_1= 25) believe that human interventions can minimize heat wave hazard impact whereas only 20% of the cross-sectional survey sample agree or strongly agree to the same notion. Also, 23% of the cross-sectional survey sample reported that they did not have enough information to make comments on this.

The above responses illustrate a common misconception and misunderstanding about the role of precautionary measures prior and during heat wave period. In order to obtain further insights, an analysis of some selected explanatory variables was attempted. These included age and income. **Table 1** shows the pattern in the responses by age groups.

From the **Table 1**, it is apparent that most elderly population (86%) strongly disagree with the notion that precautionary measures are effective to reduce risk and impact, reflecting their passive or incapable nature to undertake proactive measures. A cross-table between respondents and income groups has reveal that the low income groups are passive in taking risk-reduction measures **(Table 2)**.

Table 1 : Relationships between responses concerning hypothesis 3 and age of the respondents (N_3 = 114)

Age	Response (%)				
	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
25-45 years	20	12	34	28	6
46-65 years	28	33	21	16	2
66-85 years	86	0	14	0	0
Total	37	20	23	17	3

Table 2: Relationship between responses concerning hypothesis 3 and income of the respondents (N_3 = 114)

Income/Year	Response (%)				
	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
$10,000-$35,000	55	8	18	19	0
$36,000-$65,000	36	19	31	14	0
>= $65,000	23	33	21	15	8
Total	38	20	23	16	3

CONCLUSION

Community members' knowledge and perception of climate change related hazards are nearer to 'experts' understanding of the phenomena. However, significant variation exists between the 'scientific/technological' model and the first responders in the area of heat-wave mitigation and coping measures. Paradoxically, the most knowledgeable socio-demographic groups (such as, the elderly) are either least capable or intended to take proactive heat-wave risk mitigation measures. Most vulnerable groups, such as low-income groups also face limiting factors to take proactive measures. Risk communication strategies therefore should take into account the prevailing socio-economic, demographic, ethno-cultural and other human dimensions. Finally, conventional risk communication strategies (which usually follow a one-way process) should be re-designed in a participatory way where first responders and local community perspectives would be reflected.

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