Long-Term Effects of Livestock Loss Caused by Dust Storm on Mongolian Inhabitants: A Survey 1 Year after the Dust Storm

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ABSTRACT

Background Every spring, windblown dust storms damage human health and cause many domestic animal deaths in Mongolia. In particular, mass livestock death results in severe, direct economic loss to inhabitants. However, there is little empirical evidence to demonstrate the long-term effects of dust storm, especially in terms of health-related quality of life (HRQoL) secondary to livestock loss. We evaluated the long-term effects of livestock loss on Mongolian inhabitants.

Methods We performed a cross-sectional survey of HRQoL using 36-item short-form health survey (SF-36, an index of the health condition) 1 year after a dust storm. The study subjects were 64 inhabitants of stricken areas of Mongolia. The data collection method was a face-to-face interview with a questionnaire.

Results A total of 64 subjects were interviewed, 81% in the victims group and 19% in the non-victims group. The mean number of livestock victims was 83.3, s = 128.3. The SF-36 subscale scores were lower among people who lost livestock than among those who did not. Multiple regression analysis displayed a significant association between livestock loss and HRQoL (general health: $\beta = -0.476$, $P = 0.021$; vitality: $\beta = -0.359$, $P = 0.013$).

Conclusion Our results provide preliminary evidence that livestock loss has long-term effects on HRQoL. Thus, it is necessary to conduct epidemiologic surveys on disorders associated with dust storms and devise countermeasures for the future.

Key words dust storm; livestock loss; long-term effect

In recent years, rapid climate changes have escalated the severity of dust storms and have made them a more serious hazard than ever before in Mongolia.[1] In fact, recent dust storms have damaged electricity and telephone lines, road networks, pasturage and agricultural products, human and animal health, and so on. The costs for recovery have become increasingly enormous. In particular, mass livestock deaths have caused severe direct economic loss to the inhabitants.[2]

Dust storms have recently attracted more attention in terms of causing not only social and environmental problems but also health problems including their influence on humans. We previously reported that dust storms can cause eye damage (deterioration of subjective symptoms).[3] However, the above-described impacts on health occur immediately after the dust storms (i.e., short-term effects). There is little empirical evidence to demonstrate the long-term effects of dust storms, especially in terms of the effect of mass livestock death on the health-related quality of life (HRQoL).

HRQoL is considered to be a subset concept of quality of life (QoL). QoL has been defined as "a person's subjective sense of well-being, derived from current experience of life as a whole". However, there is no clear agreement on the definition of HRQoL.[4] In general, HRQoL is accepted as a multidimensional concept that encompasses physical, psychological, social, spiritual and role-functioning concepts as well as general well-being. Therefore, HRQoL is used to evaluate health status.[5]

An intense dust storm occurred on May 26 and 27, 2008 in eastern Mongolia. The newsletter of the United Nations in Mongolia reported that during the storm, the air temperature dropped nearly to 0 ˚C and the wind speed was believed to have reached > 40 m/s. Fifty-two people were killed, out of which 14 were children, and more than 278,000 livestock died. Also, many thousands of livestock went missing.[1] According to Government of Mongolia and UNDP (2008), this storm may have caused the greatest amount of damage since 1980.[2] For this study, we focused specifically on this dust storm. To evaluate the association between livestock loss and HRQoL of stricken-area inhabitants, we performed an HRQoL survey among these inhabitants 1 year later.

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Abbreviations: HRQoL, health-related quality of life; GH, general health; MH, mental health; QoL, quality of life; RP, role physical; SF-36, 36-item short-form health survey; VT, vitality

SUBJETS AND METHODS

Study subjects

We performed a cross-sectional survey on HRQoL and the livestock loss in Khentii Province, east of the capital city of Ulaanbaatar in May 2009 (1 year after the dust storm). The province covers an area of 80,311 km^2 and has a population of 67,770. The occupation of most inhabitants is nomadism with herding of domestic animals. We chose Khentii Province as our study area because it is one of the typical nomadic areas that represents the overall population of the Mongolia desert (in terms of socio-economic status and demographic character) and where the highest number of human and livestock deaths was recorded in that dust storm (30 people; 100,776 livestock). We visited 34 nomad gers (households) from door-to-door along the main road for 3 days. The study subjects were the heads of households and their spouses in each household. Of all households that were visited, there were no occurrences of death in any families. The data collection method used in this survey was a face-to-face interview with a questionnaire. The investigators first informed the participants of the purpose of the survey and then obtained a statement of voluntary participation from each person being interviewed.

HRQoL

HRQoL was assessed with a 36-item short-form health survey (SF-36). The original questionnaire has 36 items comprising 8 subscales. To simplify the questionnaire for this study, only 4 subscales were investigated: general health (GH), vitality (VT), mental health (MH) and role-physical (RP). The scoring of each subscale was performed according to a scoring protocol.[6] Raw scores were converted into numerical scores ranging from 0 to 100. The higher the value, the better the outcome.

Livestock loss

Information on livestock loss was obtained from the following 2 items: state of livestock victims (victims group or non-victims group) and number of livestock victims.

Statistical analyses

To examine the relationship between HRQoL and livestock loss, the scores of SF-36 subscales (GH, VT, MH and RP) between the victims group and non-victims group were compared using Student's *t*-test. Furthermore, two multiple regression analysis were conducted to adjust the other variables (gender and age), using SF-36 subscales as the dependent variables, and using the state of livestock victims and the number of livestock victims each as the independent variables. A *P*-value of 0.05 was accepted as statistically significant. In addition, by means of the hypothesis test, quantitative data of SF-36 subscales scores (0–100) have the normal distribution, meet the conditions of multiple regression analysis. Statistical analysis was carried out using SPSS version 18.0 (IBM SPSS, Chicago, IL).

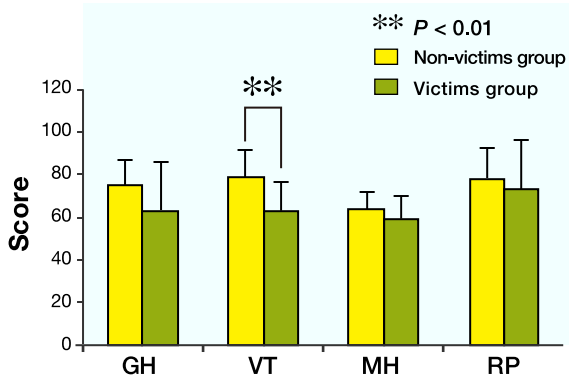

Fig. 1. Comparison of SF-36 subscale scores between victims and non-victims groups. GH, general health; MH, mental health; RP, role physical; VT, vitality.

RESULTS

Characteristics of study subjects

A total of 64 subjects (33 males and 31 females, mean age was 42.1 years, s = 12.9 years) were interviewed in this study. In terms of the state of livestock victims, 81% of total study subjects were in the victims group and 19% were in the non-victims group. The mean of livestock victims was 83.3, s = 128.3.

Relationship between livestock loss and HRQoL

Figure 1 shows the results of comparison of SF-36 subscale scores between the victims and non-victims groups. The scores of SF-36 subscales for the victims group were lower than those for the non-victims group,

Table 1. Results of multiple regression analysis of each SF-36 subscale and the state of livestock victims

Dependent variable	State of livestock victims†		
	β	*R*	*P*-value
GH	–0.148	0.354	0.326
VT	–0.359	0.488	0.013
MH	–0.151	0.185	0.337
RP	–0.077	0.187	0.626

† Non-victims = 0; victims = 1.
Adjustment factors: gender and age.
GH, general health; MH, mental health; RP, role physical; VT, vitality.
β, standardized partial regression coefficient; *R*, multiple correlation coefficient.

Table 2. Results of multiple regression analysis of each SF-36 subscale and the number of livestock victims

Dependent variable	Number of livestock victims		
	β	*R*	*P*-value
GH	–0.476	0.494	0.021
VT	–0.393	0.499	0.055
MH	–0.142	0.076	0.510
RP	–0.319	0.404	0.128

Adjustment factors: gender and age.
GH, general health; MH, mental health; RP, role physical; VT, vitality.
β, standardized partial regression coefficient; *R*, multiple correlation coefficient.

and VT displayed a statistically significant association with livestock victims ($P = 0.007$). Table 1 shows the results of multiple regression analysis in which the state of livestock victims was the independent variable and each SF-36 subscale was a dependent variable. There was a statistically significant correlation between the state of livestock victims and VT ($\beta = -0.359$, $P = 0.013$). Table 2 shows the results of multiple regression analysis in which the number of livestock victims was the independent variable and each SF-36 subscale was a dependent variable. There was a statistically significant correlation between the number of livestock victims and GH ($\beta = -0.476$, $P = 0.021$).

DISCUSSION

HRQoL is an evaluation index of the health condition. A large number of HRQoL evaluation methods have been developed over the past 3 decades. The SF-36 was designed for use in clinical practice and research, health policy evaluation and general population surveys.[7] The SF-36 is one of the most frequently used generic measurements of HRQoL.[8] In this study, we assessed HRQoL of inhabitants in Mongolia using the SF-36. HRQoL was assessed using a 4-subscale survey that evaluated GH, VT, MH and RP.

The SF-36 subscale scores were lower among the people in the livestock victims group than among those in the non-livestock victim group. HRQoL displayed a significant association with livestock loss; in particular, there was a significant correlation between livestock loss and GH or VT. GH is a subscale that reflects both "QoL of physical health" and "QoL of spiritual health". VT contributes to the spiritual function, which means the decline of spiritual health status.[6] The stock-raising industry is a key industry in Mongolia, and an economic loss occurs if there is a high loss of livestock. This may lead to a decline in the QoL of people (particularly the spiritual health status). Up to now, there is little research to demonstrate QoL decline in conjunction with the economic loss, but some studies reported it to be significantly correlated with economic income level.[4,9] The key steps in promoting QoL include the improvement of people's income.[10,11] We suggest economic support or the construction of a compensation insurance system to improve the QoL level of inhabitants.

Many studies have explored the acute health effects associated with short-term exposure to dust storms in some countries and regions. Substantial evidence shows that short-term exposure is linked to a variety of adverse effects on mortality, hospital admissions, outpatients, asthma attacks, etc.[12–15] However, these studies show only short-term effects. Our study provides preliminary evidence of the long-term effects of livestock loss for the first time. Therefore, saving lives, animal husbandry and medical health support after disasters (e.g., medical care patrols, psychological consultations, etc.) are necessary. At the same time, developing an early warning system to ameliorate damage is also need.[16] Thus, it is necessary to conduct epidemiologic surveys on disorders associated with dust storms and devise countermeasures for the future.

Our study has some limitations. The obtained data were based on self-reports, the sample size was small, and certain conditions were not ruled out because of the lack of past medical histories. Therefore, future studies should consider these parameters. Our study used a cross-sectional design, which does not establish cause-and-effect relationships and which may result in bias. We believe, however, that this study provides sufficient information to establish a hypothesis for a follow-up study.

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