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Health status and geographic mobility among semi-nomadic pastoralists in Mongolia

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Abstract

This paper sets out to examine the impact on health of a key aspect of the semi-nomadic lifestyle, namely geographic mobility. The relevant literature suggests that seasonal migrations of pastoralists tend to increase the risk of a poor health. Highlighted in this paper is an inverse association between spatial mobility and health status among the herders of rural Mongolia. Two types of mobility are involved in this process. For households, seasonal migration has a significant influence on health. At the level of individuals, however, there is another kind of mobility: that of travelling to meet personal needs. At both of these levels, statistically significant impacts on health were observed.
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Keyword: Mongolia; Health status; Health geography; Spatial mobility; Nomads; Pastoralism

Introduction

The main goal of this article is to elucidate the impact on health of a central component of the lifestyle of semi-nomadic pastoralists[2], namely their geographic mobility. To achieve this, we have first of all enumerated the various constraints faced by these pastoralists taking into account the various internal changes within the context of a rapidly changing Mongolia. The second part of this paper describes the method used to demonstrate these links. The third and last section discusses the results obtained and potential explanations of how geographic mobility may impact upon the health status of semi-nomadic herders.

Although there has been increasing interest in the study of the relationships between health and lifestyle among the populations of the developing world, the determinants of health in pastoral nomadic societies remain poorly explored. Furthermore, studies concerning this type of community have generally been conducted within African ecosystems, notwithstanding the existence of some inquiries in Central Asia and Israel. Pastoral nomadic peoples tend in general to be highly vulnerable since they are mainly located at the extreme functional, cultural, spatial and environmental margins of the Third World nations

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[2]Semi-nomadic pastoralism implies extensive pastoralism based on periodic changes of pastures during the course of the entire or the greater part of the year. Although pastoralism remains the prevailing activity, there is agriculture as a secondary and supplementary activity (Khazanov, 1994).

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(Meir, 1987, p, 115). The conclusions usually drawn from the few surveys devoted to the health status of such populations often raise debate among scholars, in particular with regard to the effects of geographic isolation and spatial mobility on its well-being.

Some argue that nomads have better health status than their sedentarized agricultural counterparts while others point out differences due to social or geographical isolation (Meir, 1987; Roboff, 1977; Nathan et al., 1996; Loutan, 1989; Foggin et al., 1997; Imperato, 1975; Chabasse et al., 1983). For instance, some studies have shown that some nomadic communities are less affected by intestinal parasites or demonstrate a lower susceptibility to waterborne diseases such as cholera and hepatitis (Nathan et al., 1996; Hill, 1985; Little et al., 1988; Ilardi et al., 1987). In contrast, other inquiries have indicated the propensity of pastoralist populations to suffer from specific kinds of morbidity such as higher rates of treponemal infections, as well as from higher rates of infant/child mortality than those of settled agriculturalists. These trends are usually attributed to differences, between nomadic pastoralists and crop farmers, of nutritional status, maternal diet, child care practices (Chabasse et al., 1983; Brainard, 1986). Regardless of the various patterns of morbidity, the literature reveals a broad range of illnesses in nomadic populations including brucellosis (and other zoonoses), measles, respiratory disease and diarrhoeal problems. In addition, they also suffer from higher rates of infant and child mortality (Foggin et al., 2000; Nathan et al., 1996; Imperato, 1975; Schelling et al., 2005; Little, 2002; Loutan, 1989).

The dual perspective about risks to the health status of nomads mentioned above can be explained to a large degree by the effects of geographic mobility. On the one hand, it has been observed that regular pastoral migrations, population dispersion and low human density may protect nomadic populations from epidemics while they may also introduce some diseases to non-contaminated areas (Loutan, 1989, p. 232). On the other hand, however, one of the side effects attributed to spatial dispersion which is widely recognized as deleterious is the consequence of geographic barriers to the effective use of the health care system (Swift et al., 1990; Meir, 1987; Hampshire, 2002; Brainard, 1986). Other factors that threaten health within pastoral nomadic societies, and also prevalent among Mongolian pastoralists, have been identified by Swift et al. (1990): (i) proximity to animals, (ii) a diet highly rich in milk, (iii) the socio-economic and cultural contexts, and (iv) hazardous physical environments (Schelling et al., 2005; Harragin, 1994). In this paper we seek to shed some light on the health effects of spatial mobility defined here on the basis of seasonal migratory patterns including spatial movements which are culturally embedded.

Health and health care landscapes in Mongolia: the context of social change

Over the past decade Mongolia has been undergoing a process of rapid political and economic change. Despite the occurrence of structural change, however, pastoral nomadic life is still one of the main pillars of the national economy providing employment for nearly 50% of the labour force (World Bank Group, 1996; Griffin, 2003a). For example, in 1994 just over 150,000 households were actively engaged in animal husbandry while their number reached approximately 192,000 in 2000 (UNDP, 1994; National Statistical Office of Mongolia, 2001). If anything, the accompanying socio-economic upheaval seems to have increased health inequalities within Mongolia's pastoral semi-nomadic society (UNDP, 2000; Ministry of Health, 2002; Foggin et al., 1997, 2000; Smith and Lannert, 1995). Notwithstanding these economic changes, and in spite of the remarkable achievements of the socialist era in improving and universalising accessibility to health care, rates of maternal and infant mortality (IMR) have remained high despite a decline since the 1990s (Foggin et al., 1997). IMRs had fallen from 63.4 deaths per thousand births in 1990 to 31.2 per 1000 births in 2000 (Ministry of Health, 2002). In addition, the epidemiological transition that has been taking place in Mongolia since the 1970s has witnessed the most predominant health problems and causes of mortality affecting Mongolia's people shifting from mainly infectious and parasitic illness to chronic and degenerative diseases (Ministry of Health, 2002; WHO, 1999). The sudden disengagement of the Mongolian state fostered the resurgence of infectious morbidity, which still remained a major public health concern in the 1990s. An example of this is the relatively high prevalence of tuberculosis whose diffusion seems to be related to the regular migrations characteristic of Mongolia's semi-nomadic rural population (Foggin et al., 2000; Swift et al., 1990; Imperato, 1975; Ministry of Health, 2002; Foggin et al., 1997; Ebright et al., 2003).

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The transition from a socialist system to a market economy caused a significant recession and this greatly damaged the organisation of the health care system and consequently threatened in many ways the well-being of the semi-nomadic population (Medvedeva, 1996). Whereas the new Mongolian constitution enacted in 1992 guaranteed health for all Mongolian citizens, it dropped the principle of cost-free health care. This situation has been exacerbated by the appearance of poverty and by the rapid rise of inflation, which have prevented pastoral households from having full access to health care. The privatization process has also resulted in the obsolescence of medical infrastructures and with poorly qualified health workers, two features which have endangered the sustainability of the health care system. Similarly, the dissolution of the *negdels*, entailed the decline and the deterioration of veterinary services in Mongolia, leading veterinarians to move away from rural parts of the country to settle in urban areas, a process which heightened the risk of disease incidence encountered by herders (Rossabi, 2005). In addition, the poorer herders had difficulty coping with the additional financial burden due to having to pay for this service themselves (Griffin, 2003b).

From a spatial point of view, pastoral families, who usually had located close to the negdel[3] centres during the collectivization period, saw their physical access to health facilities greatly decrease since the state ceased to provide them with motorized transportation. They now have to rely mostly on animals for any kind of travel and this puts them at risk in terms of health care accessibility. At the outset of privatization the Mongolian health care system failed in its attempt to provide universal access to health services especially at the primary level that is encountered in rural settings.

Geographic mobility in Mongolia in the transition period

In the Mongolian context, two types of movement can be observed, one related to time and the other to space. The first has to do with the temporal character of migrations and the second, the distances traversed by semi-nomadic households. At the outset, a distinction has to be made between short distance within-season movements and seasonal migrations involving a higher level of spatial mobility over greater distances. The short distance category is typified by relatively short trips to district (*sum*) and sub-district (*bag*) centres, and in rare instances to the provincial (*aimag*) capital itself. This form of mobility is usually limited to a certain type of individual found in approximately 65% of the households sampled, usually male and head of the *khot ail* (the typical small clusters of *ger*, or yurts). Such trips are made in response to needs vital to the survival (i.e., the sustainability) of pastoral households and involve, for example, the sale of products derived from animal herding (e.g. wool, the highly prized and slightly alcoholic drink called *airag* and other saleable animal products) but can also involve visiting family members who live in administrative centres, or when health needs (due to illness or pregnancies) require reaching health services that are only available in these centres.

The second kind of movement is seasonal and is undertaken with a view to fattening animals and, implicitly, to preserve the viability of pasture lands. This form of geographic mobility, although taking place in a seemingly random fashion, nonetheless follows certain rules and practices that have come down over the centuries (Bold, 1997; Fernandez-Gimenez, 2001). The occupation of isolated areas by pastoral populations on the basis of continuous mobility has made it possible for semi-nomadic families to enjoy a relatively high level of security (Cloudsley-Thompson, 1977). Many factors are involved in the migration of domesticated animals; for example, forage availability, saline soils, sufficient water supply, coordinating the use of pastoral ecosystems by different households and different types of group organization (Bold, 1997; Mearns, 1993). Consequently, as Fernandez-Gimenez (1999) points out, a generalization of land use patterns cannot be made for the whole of Mongolia. Beyond the factors just mentioned, the level of spatial mobility can be viewed in itself as a resource that needs to be organized and used in an optimal fashion. It allows the pastoral community to take full advantage of the potential of pastoral areas that are available in the midst of extreme ecological conditions, and thus minimizes the competition between groups of herders in their quest for a scarce resource, namely edible vegetation (Campi, 1996; Crawford and Leonard, 2002; Casimir and

[3]Negdels were the herding collective 'farms' under the previous governments (pre-1990s).

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Rao, 1992; Galaty and Johnston, 1990). In fact, what happens is that each type of pasture is characterized by a specific vegetation complex, which is particularly well-suited for certain herds. This has been shown in the case of cattle and horses that thrive in different types of pastoral environments (Tumurjav, 2003).

Finally, the use of pastoral areas in Mongolia and the resulting migratory patterns are based on a vertical (altitude) and cyclical (seasons) logic and involves a minimum of four seasonal migrations. These movements, involving entire households vary both in distance and, of course, in direction. As a rule the winter season corresponds to the period where the pastoral households settle for a time in the heart of high altitude areas that have a topography that produces a certain protection from the extremely cold wind conditions experienced elsewhere. However, in the summer, households generally settle for the season on the plains which are perceived to be the most appropriate ecosystem for animal husbandry at that time of the year (Bold, 1997; Erdenebaatar, 1996). The distances covered usually vary in relation to the ecological characteristics of the region (Tumurjav, 2003; Sneath, 1999). Those provinces located in the west of the country are characterized by longer migrations and this is, at least partially, due to the nature of the mountain ecosystem. Elsewhere, pastoral herders in the north of the country have adopted a different kind of migratory behaviour which is referred to as the 'Hangai-type' of migration, involving six to eight moves per year covering distances in the neighbourhood of 20 km. The third migratory pattern (called steppe migration) is similar to the Hangai-type, except that moves are by far the longest seasonal migrations made by any of the groups of semi-nomadic pastoral households. The fourth migration type originates in the Gobi ecological area where, as a result of the dry and harsh environment, herders have to be much more mobile, varying between 10 and 15 moves per year; however, these are over shorter distances than in the Hangai type of migration (Tumurjav, 2003). Regardless of the type of migration adopted by various households, the mobility of sheep and cattle (including, of course, yak) is a vital part of the adaptive response to the harsh environment that covers most of central Asia (Bold, 2001; Tumurjav, 2003; Fernandez-Gimenez, 2001). It is also a means of adapting to varying socio-economic circumstances (Bruun and Odgaard, 1996).

Conceptual model and methods

The health status of a population is influenced by at least three major predictor categories (Foggin et al., 2006; Oths, 1998; Lalonde, 1974). Consequently, our conceptual model is based on the description and measurement of (1) the lifestyle of a given population, (2) the social and physical environments (Gesler et al., 1997), and (3) the health care system as it is perceived and used by a given population (Phillips, 1990; Mohan, 1998). This conceptual framework (Fig. 1) provides a basis for understanding the relationship between key risk factors and the health status of a community. These three dimensions are known to interact with each other and at the same time to affect the health status of pastoralists. The concept of lifestyle covers a broad range of variables including attitudes, beliefs and the resulting set of behaviours shared within a homogeneous cultural community (Backett and Davison, 1995; Picheral, 2001). To be relevant and meaningful, however, this model should to include the political and environmental influences impacting on the daily lives of semi-nomadic pastoralists. Beyond these concepts lie other basic factors which are also likely to have an impact on the health status of such populations, for example, the quality and accessibility of health care (Swift et al., 1990; Swift and Mearns, 1993; Spicer, 1999).

Within this framework, a socio-medical questionnaire covering various variables related to health was also used to obtain the basic socio-demographic information needed as well as a range of relevant environmental and behavioural characteristics of the pastoralists included in the sample design. All the questionnaires were administered in (Khalha) Mongolian and the answers were translated as necessary into English for their analysis. The data thus obtained were based on the (questionnaire) interviews within each *ger* (yurt) that was visited. The respondent had to be an adult, most often the wife of the head of the household in order to minimize bias due to a lack of knowledge of the various members of the households. Given her central position in nomadic society owing to the tasks she carries out on a daily basis (caring for the children, looking after the yurt, etc.), the wife of the head of the household is certainly the most well-informed person for reporting on issues such family illnesses and other detailed information about any member living within the same *ger*. To be more specific, this qualitative measuring tool can be

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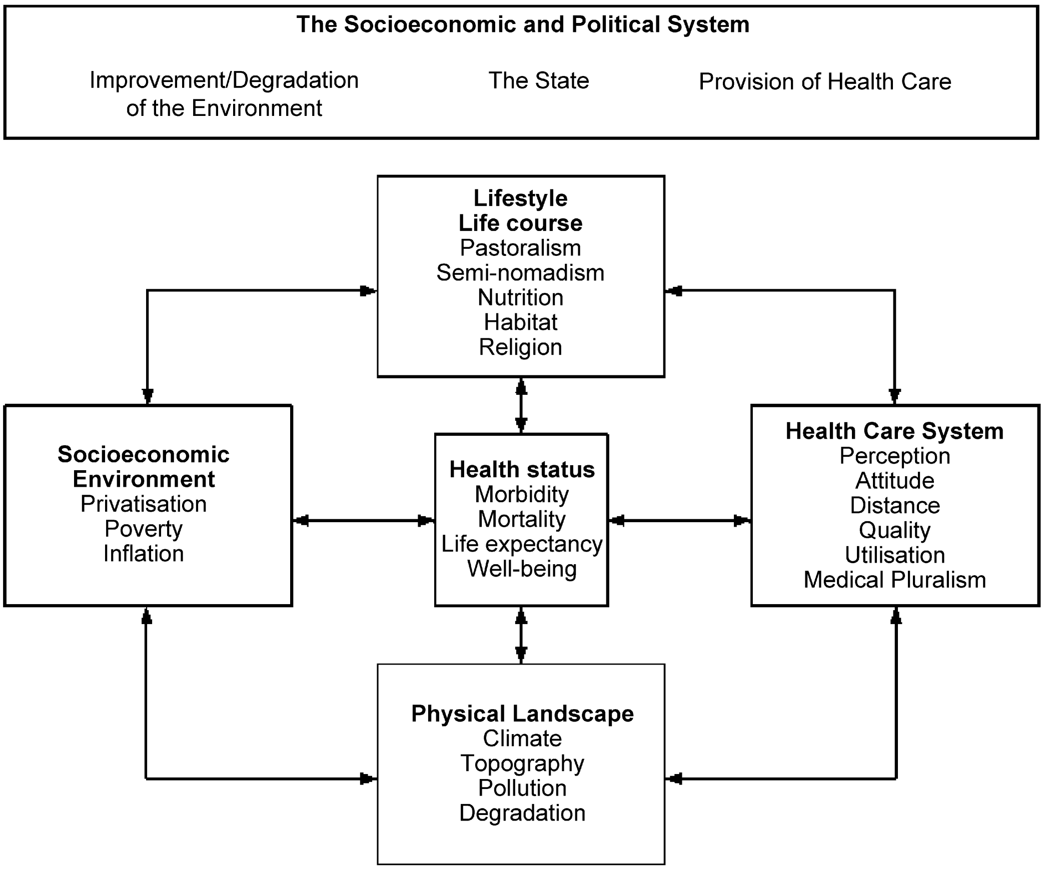

Fig. 1. The study's conceptual model. Adapted from Smith (1982, p. 4).

broken down into categories of information. The first had to do with epidemiological questions such as indicators of self-assessed morbidity (i.e., reported illnesses or symptoms) (see Foggin et al., 1997; McLennan, 1992). In spite of the limitations and biases inherent in this form of data collection, the method used is robust and has produced valuable information for this research. The questionnaire used had been validated through previous research in the north of Québec (among the Inuit and Cree of that region) before being revised to take into account the specificity of the Mongolian cultural and economic contexts.

A primary question used to elicit the required health information was: 'Have you or any member of this household been sick (ill) during the previous 4 weeks?' The answer was invariably a yes–no type of response, which in the affirmative, was followed by the question 'Who in the household had been ill?', and what was the nature of the observed symptoms. Lastly, it should be noted that the reported health problems were not, nor could they be, indicated by the respondent in terms of the disease's or symptom's severity.

In order to have a sufficiently diversified sample as well as for basic logistical reasons, the data in this study were collected over a 3-year period (1992–1994) during similar seasons (June–July period) in three different, non-contiguous provinces (*aimag*) of Mongolia (Övörhangay, Hovsgol and Hovd), which reflect the environmental, ethnic and economic diversity of the country (Fig. 2). The choice of the three provinces (out of 18 at the time) was dictated by the need for representing the broad ecological zones of Mongolia. Thus, the first province (aïmag), Övörhangay, lies in the central part of Mongolia and is divided into 18 districts (*sum*) from which three were selected for their varying geographic characteristics, and a fourth was added in order to integrate a parallel study[4]. This *aimag* corresponds more or less to an environmental microcosm of the regions that exist at a national scale. In fact, Övörhangay's territory covers the wooded mountain steppe (Uyanga-Jargalant and Bat-Olzii), the drier steppe (Bayan-Teeg) and the desert, or Gobi (Baruun-Bayan-Ulaan). Its

[4]For more information see Foggin et al. (2000).

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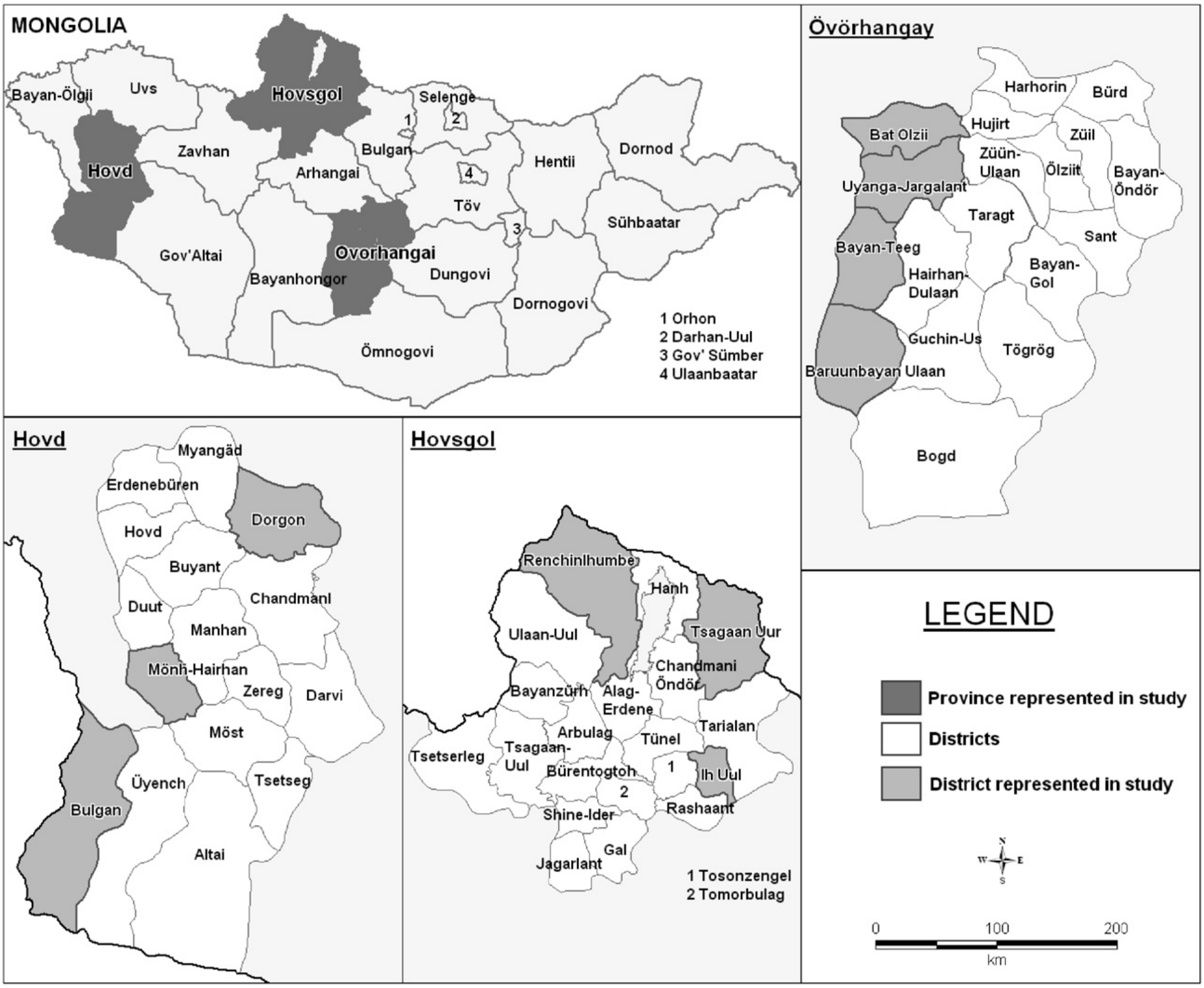

Fig. 2. The study areas map: Jérôme Mocellin and Marc Girard.

population at the beginning in the early 1990s was slightly more than 100,000 inhabitants, almost all of whom belong to Mongolia's Khalkha majority ethnic group.

The second province chosen was Hovsgol in the north of the country (Fig. 2), mainly because of its ethnic and environmental characteristics, which make it unlike any other province. Situated on the Russian border, its population of approximately 106,900 people is made up of various ethnic groups (Khalkha, Urianhai, Dahrat, Buriat and Tuva-Tsataan) scattered around the province's famous lake bearing the same name. The three selected districts here also cover a range of ecological types, including wooded alpine steppe (Renchinlhumbe *sum*), semi-dry steppe (Ihl-Uul *sum*) and forested steppe (Tsagaan-Uur *sum*). The third and last province was Hovd, situated in the west of Mongolia (see Fig. 2), introduced two other ecological dimensions: that of mountains (the Altai) and the desert. The districts (*sum*) selected within Hovd were Bulgan and Monh-Hairhan in the mountainous region and Dörgön, to the north of the province being basically a desert area. The population of Hovd in 1994 when the survey took place was approximately 81,000, including a large minority of Kazakh people.

In the case of Övörhangay, roughly 55% of the sample households migrate 4 times in the year, whereas the comparable figure for Hovsgol was 70% and for Hovd was 38%. The most remarkable feature in Hovd, however, is the high frequency of moves made by the pastoralists of that western province. These moves take them along the Altai

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Mountains. Here pastoralists that make more than 9 moves in a year make up 14.8% of the households, compared with 8.2% in Övörhangay and 3.1% in Hovsgol.

After identifying the above areas for our study, the next stage was that of developing a suitable sampling design. This involved deciding the number of households to interview in each of the three provinces. The basic sampling unit was the household defined as all those living in *ger* (yurt) at the time of the survey (Berry, 1968; Foggin et al., 1997; Sneath, 1999). In order to do this it was necessary to locate *all* of the pastoral households in selected districts (*sum*), and to lay out this information on district maps at the scales of 1:100,000 or 1:200,000, whichever type of map was available for given districts (*sum*). These household sites were ordered numerically and between 60 and 70 households were selected randomly from each of the 10 districts (*sum*). When the whole process was finished our sample population came to a total of 615 households (3167 individuals).

To test the relationships between geographic mobility and the health status of the semi-nomadic pastoralists interviewed in this study requires an understanding of the spatial migratory patterns of this population. Consequently, the categorical data from this survey were analysed by means of two non-parametric techniques using SPSS 10.0; more specifically, chi-square contingency tables and logistic binary regression. The former was a preliminary test carried out in order to grasp the statistically significant associations between hypothesized dependent (health status) variables and a broad array of potentially explanatory variables, whereas the second technique was used to evaluate the relationships.

To do this, a dependent variable corresponding to the morbidity of the individuals in the sample households ($N = 615$), as well as for use at the level of individuals in these same households ($N = 3167$), was constructed. All the symptom/illness response categories taken together give an indication of general morbidity. Individually, these response categories cover a wide range of specific symptoms and illnesses common to Mongolian pastoralists (such as brucellosis, symptoms of heart disease, tuberculosis, problems of the digestive system, pneumonia, fever, cold, headaches, accidents). The second dependent variable corresponds only to the presence or absence of symptoms of upper respiratory illnesses (URI) without integrating others types of morbidity. Since URI frequency was high within households (10.1%) compared to other kinds of morbidity and, in particular, due to its possible link with spatial movements in such a hazardous physical environment, we chose to look at the statistical relationship between geographic seasonal mobility and the prevalence of URI's symptoms.

The selected independent variables were recoded as categorical variates in which one value of the variable serves as a reference category (see Table 1). Those measured at the level of individuals cover a broad range of information on the social and demographic status of herders including, of course, data reflecting general mobility. The decision to treat short distance mobility at the level of individuals (rather than for households taken as a whole) is justified by the fact that this type of mobility is essentially an individually driven characteristic, since short movements characterize individuals more than whole households (which tend to move together over longer seasonal migrations).

At that level (i.e., households), explanatory variables (Table 1) designate various types of geographic mobility such as seasonal distances. They also elucidate the frequency of migrations and the use of alternative dwellings. Also included are control variables, namely age, sex, household size and an indicator of poverty, the latter given the fact that socio-economic status (SES) influences the migratory patterns of nomadic households, if only in terms of the kinds of transportation available to move their belongings. The most prosperous pastoralists are able to afford motorized transportation, whereas others cannot (Morris and Bruun, 2005).

The results of our logistic regression analyses are interpreted by observing the odds ratios (OR) which can be understood as a relative measurement of risk. The OR indicates the probability individuals exposed to a given factor will develop a specified form of morbidity (in this case) compared to individuals who have not been exposed to this same factor (Crichton, 2001). In order to control for confounding influences, the independent variables, which show strong correlations among themselves, were excluded from the logistic regression analysis. The independent variables that are included correspond to three hypotheses: (1) geographic mobility increases the risk of general and specific morbidity (i.e., URI) at the individual and at the household levels; (2) increase in risk results not only from geographic movements but also from the type of

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Table 1
Variables in the analysis[a]

Individual variables	Household variables
Socio-demographic status	*Seasonal distances*
Age: AGEGP	Spring: SPRGKM
Gender: SEX	Summer: SUMKM
Ethnicity: ETHNCGP	Autumn: AUTKM
	Winter: WINTKM
Main occupation	*Short-distance pattern*
Young child before school age: YNGCHLD	Household's member who has a regular contact with the bag or sum centres: CONTACT
Nomadic pastoralist: NOMADISM	Households members are absent of the *khot ail*: TRAVPRES
Student: STUDENT	Households whose people are moving frequently from their village (khot ail): TRAVFREQ
Trader, merchant, business shop: BUSINESS	
Task usually carried out by women: HOMETASK	
Geographic mobility	*Means of transportation*
Person who goes in sum or bag centres for whatever reason: WHO	Horse: HORSETR
Person who has a regular contact with sum or bag centre: CONTACT	Camels or cattle: ANIMALTR
People are moving frequently from their village (khot ail): TRAVFREQ	Motorcycle: MOTOCYCL
	Cart used to move herders' dwelling: DWELCART
Geographic location	*Use of alternative dwelling during migration*
Province (*aimag*): PROVINCE	Tent: TENT
	Ötorin ger or a formal Mongolian yurt of a small size: OTORIGER
	A built habitat outside the 'village': BUILDOUT
	A built habitat inside the 'village': BUILDINV
	Controlling variables
	Size of the household: PERSONB
	Poverty line: POVERTYLINE[b]

[a]All independent variables are constructed on a binary pattern (0 = no; yes = 1) including a reference category labelled (ref.), except for the geographic location (Province: ref. Hovd = 1; Hovsgol = 2 and Övörhangay = 3) and the age groups (Agegp: ref. 0–14 = 1; 15–59 = 2; 60 and more = 3) variables. The two categories of the seasonal mobility variables at household level are (ref.) 0–8 km = 0; 9 km and more = 1. Computer acronyms are given in order to facilitate the understanding of Tables 4 and 5.

[b]The poverty line was determined on the basis of annually per capita income for each household following the different thresholds provided by the Ministry of Population Policy and Labour for each year corresponding to the time of the study (1992-1994) and also including annual revaluation of the Tugrik. The poverty threshold is the same for households originating from a similar province (*aimag*).

migration and the way the migrations take place; and finally (3) the type of transportation used also contributes to the level of risk to semi-nomadic pastoralists' health status.

Results

To understand the relationship between geographic mobility and health status requires first of all the description of the health levels of the households selected in this study. A quick overview reveals that general morbidity seems to be significantly high. In fact, 54% of the sample households indicated that there was a health problem with someone in the household over the 4 weeks preceding the questionnaire interview. Breaking this figure down (Table 2) shows that this general morbidity is mainly composed of (1) symptoms suggesting heart problems, (2) symptoms related to the digestive tract, (3) upper respiratory infections (URIs) symptoms, and (4) brucellosis and other animal-related illness (zoonoses). The major health problems highlighted in Table 2 are typically found within other nomadic societies, although some variations may exist between and within nomadic groups. For instance, in some nomadic pastoralists' communities of Chad, the prevalence of digestive tract disorders was 26% for the 0–4 years age group but reached 31.9% for those 46 years and over (Schelling et al., 2005). On the other hand, some

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Table 2
Spatial distribution of general and specific morbidity indicators (%)

	General morbidity	Heart problem	Digestive tract symptoms	URI symptoms	Brucellosis and other zoonosis
Övörhangay	62.4	15.4	18.4	7.3	8.5
Hovsgol	55.7	15.6	13	19.3	10.4
Hovd	43	7.9	7.9	4.2	3.2
3 provinces	54	13	13.5	10.1	7.5

researches have shown that 4% of the Fulani nomadic community were affected by brucellosis (Schelling et al., 2003). When we looked at the spatial distribution of the prevalence of all these symptoms (the general and specific morbidity indicators), we found that Övörhangay and Hovsgol had the highest levels of morbidity, while Hovd showing comparatively lower prevalence levels.

It must be emphasized that the results reported below reveal only statistical associations between the dependent and the independent variables. Consequently, no attempt was made to establish links of causality since there is frequently no clear causal pathway to the morbidity indicators used in our analysis (assuming that the dependent variable corresponds to a limited diagnosis based on self-reported morbidity problems). Table 3 displays the frequency distribution of explanatory variables, which were also cross-tabulated (chi-square test) showing the presence or absence of statistical association with their corresponding response variates. We should note that despite the lack of statistically significant correlations between some explicative variables and our health indicators, we decided to include all the variates in our logistic regression analysis.

Regarding the relationship between geographic mobility and the health status of the semi-nomadic pastoralists, a binary logistic regression analysis was carried out at the level of individuals ($N = 3165$) in order to determine the impact of short-distance moves on health (Table 4). The results of this analysis show that age is a very significant ($p = 0.000$) predictor of general morbidity. This is particularly true for herders who are over 60 years of age (Table 4; OR = 7.2). Alongside this observation, we found that geographic location was also a very significant factor ($p = 0.000$), the higher risk to health being registering as OR = 2.76 for Hovsgol, and OR = 2.54 for Övörhangay, in comparison with Hovd which was chosen as the reference category. This confirms the role of residential location as that of a risk factor, and may be understood as resulting from various deleterious environmental factors (that vary across geographic space).

The following results concern the impact of the social positioning of the households in the sample as well as the gender status. First, our logistical regression model reveals the advantageous status of Mongolian men within the semi-nomadic pastoral community. They are at lower levels of risk of illness (Table 4: OR = 0.674) than their female counterparts. This tendency is emphasized by the weakened health status of women who carried out the regular tasks within households (HOMETASK). As a result, the OR related to the variable associated to this category of herders indicates that their risk of morbidity is 1.75 times that of other semi-nomadic pastoralists whose function differs within household, according to the traditional division of labour, mostly based on gender in the Mongolian pastoral society. Women in developing countries are more highly exposed to health risks than their male counterparts, particularly those who live and work in transition economies such as Mongolia's. In fact, Mongolia's recent liberalization has resulted in increases of the demands made upon women, while at the same time diminishing the level of social support that they had enjoyed during the period of collectivization (Skapa and et Benwell, 1996). Finally, an examination of the OR associated with the variable targeting student status (Table 4: OR = 0.508) reveals the advantageous state of those semi-nomadic herders who attend school, compared to those who do not.

With regard to geographic mobility (see Table 1), the logistic regression model retained two variables which translate, first, the negative impact on health levels experienced by pastoralists who have regular contacts with the administrative centres of their district (*sum*) or subdistrict (*bag*), most of the time for social or personal reasons according the results of our survey. Thus, people who often go to these

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Table 3
Frequency distribution of independent variables (%) and chi-square test[a]

Individual level ($N = 3167$)		Household's level ($N = 615$)	
Variables	*p*	Variables	*p*
GPETHNIC: Total: 100% (3167) Khalkha (ref): 53.3% (1688) Other ethnic groups: 46.7% (1479)	0.000	POVERTYLINE: Total: 75.9% (467) Below 19.3% (119) Above (ref): 56.6% (348)	0.173
WHO: Total: 100% (3167) No (ref): 79.4% (2515) Yes: 20.6% (652)	0.253	SPRGKM: Total: 93% (572) 0–8 km (ref): 46.5% (286) 9 km and more: 46.5% (286)	0.119
STUDENT: Total: 99.9% (3165) No (ref): 86.5% (2741) Yes: 13.4% (424)	0.000	SUMKM: Total: 92.7% (570) 0–8 km (ref): 43.3% (266) 9 km and more: 49.4% (304)	0.970
SEX: Total: 100% (3167) No (ref): 50.5% (1598) Yes: 49.5% (1569)	0.000	AUTKM: Total: 92.7% (570) 0–8 km (ref): 46.8% (288) 9 km and more: 45.9% (282)	0.446
HOMETASK: Total: 99.9% (3165) No (ref): 75% (2376) Yes: 24.9% (789)	0.000	WINTKM: Total: 92.5% (569) 0–8 km (ref): 42.1% (259) 9 km and more: 50.4% (310)	0.010
BUSINESS: Total: 99.9% (3165) No (ref): 99.7% (3158) Yes: 0.2% (7)	0.220	PERSONNB: Total: 100% (615) 0–5 (ref): 57.7% (355) 6 and more: 42.3% (260)	0.000
CONTACT: Total: 100% (3167) No (ref): 92.3% (2923) Yes: 7.7% (244)	0.000	OTORIGER: Total: 100% (615) No (ref): 78.7% (484) Yes: 21.3% (131)	0.795
TRAVFREQ: Total: 100% (3167) No (ref): 99.1% (3139) Yes: 0.9% (28)	0.012	TENT: Total: 100% (615) No (ref): 95.1% (585) Yes: 4.9% (30)	0.998
NOMADISM: Total: 99.9% (3167) No (ref): 66.8% (2114) Yes: 33.2% (1051)	0.157	BUILDOUT: Total: 100% (615) No (ref): 83.1% (511) Yes: 16.9% (104)	0.001
YNGCHILD: Total: 100% (3167) No (ref): 74.4% (2356) Yes: 25.6% (811)	0.000	BUILDINV: Total: 100% (615) No (ref): 99.2% (610) Yes: 0.8% (5)	0.460
PROVINCE : Total: 100% (3167) Hovd (ref) : 30.8% (977) Hovsgol : 31.2% (988) Övörhangay: 38% (1202)	0.000	CONTACT: Total: 100% (615) No (ref): 34.8% (214) Yes: 65.2% (401)	0.469
AGEGP: Total: 100% (3167) 0–14 (ref): 41.5% (1313) 15–59: 52.4% (1658) 60 and more: 6.2% (196)	0.000	MOTOCYCL: Total: 100% (615) No (ref): 83.7% (515) Yes: 16.3% (100)	0.739
		ANIMALTR: Total: 100% (615) No (ref): 99% (609) Yes: 1% (6)	0.410
		HORSETR: Total: 100% (615) No (ref): 61.8% (380) Yes: 38.2% (235)	0.235
		TRAVFREQ: Total: 100% (615) No (ref): 95.8% (589) Yes: 4.2% (26)	0.801

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Table 3 (*continued*)

Individual level ($N = 3167$)		Household's level ($N = 615$)	
Variables	p	Variables	p
		TRAVPRES Total: 99.8% (614) No (ref): 87.2% (536) Yes: 12.7% (78)	0.209
		DWELCART: Total: 100% (615) No (ref): 59.2% (364) Yes: 40.8% (251)	0.004

[a]Using Pearson χ^2-test ($p \leqslant 0.005$).

Table 4
Multiple (stepwise) logistic regression analysis of the impact of mobility on levels of general morbidity ($N = 3165$ individuals)

Dependent variable = general morbidity	Estimated coefficient	Signif.	Odds ratio (OR) Exp(B)	95.0% CI for EXP(B)	
				Lower	Upper
PROVINCE (ref: Hovd)		0.000			
PROVINCE (Hovsgol)	1.019	0.000	2.769	2.104	3.644
PROVINCE (Övörhangay)	0.934	0.000	2.545	1.940	3.340
AGEGP (ref: 0-14)		0.000			
AGEGP (15–59)	0.380	0.008	1.463	1.107	1.933
AGEGP (60 and more)	1.985	0.000	7.279	4.968	10.666
SEX (ref: Female)	−0.395	0.004	0.674	0.516	0.880
HOMETASK (ref: No)	0.561	0.000	1.753	1.291	2.381
CONTACT (ref: No)	0.501	0.005	1.650	1.167	2.332
STUDENT (ref : no)	−0.678	0.002	0.508	0.334	0.772
TRAVFREQ (ref : no)	1.087	0.011	2.967	1.280	6.875
Constant	−2.672	0.000	0.069		

Dependent variable: General morbidity indicator (presence or absence of illness at the individual level).
Variables excluded: gpethnic, yngchld, who, business.
Overall our predictions were correct 2607 out of 3165 times, for an overall success rate of 82.4%.

centres, experience an increased risk of general morbidity that is 1.65 times that of semi-nomadic herders who do not have this kind of spatial contact (Table 4: OR = 1.65). This underscores the existence of risk to the health of these pastoralists that arises from any contact with more densely populated areas. One of the possible reasons for this finding is that illnesses (particularly contagious diseases, such as respiratory ailments) are often more prevalent in places where population is concentrated. Furthermore, there is more likelihood (Table 4: OR = 2.96) that semi-nomadic herders who are moving frequently from their encampments will have been affected by a morbidity problem in the recent past.

Having looked at the effects of short-distance mobility at the individual level, the second model (Table 5) analyses the effects of spatial mobility (short and long distance) on an indicator of one kind of morbidity that is associated with URIs. To do this the analysis had to be carried out at the household level, since long-distance mobility is primarily a seasonal movement conducted by the entire household together. To this end, we had to include all of our independent explanatory variables at the level of household-based data. Table 5 gives a synthesis of the results obtained and indicates the relationships between health status and the impact of family migrations on health. Exposure to the risk of URIs (viral or otherwise) is very widespread in the pastoralist population, partly due no doubt to severe climatic conditions in which these migrations take place. The choice of this type of morbidity for analysis was based on its relatively high prevalence

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Table 5
Multiple (stepwise) logistic regression analysis of the impact of mobility on levels of mild respiratory diseases ($N = 442$ households)

Dependent variable = upper respiratory infections (URI)	Estimated coefficient	Signif.	Odds ratio (OR) Exp(*B*)	95.0% CI for EXP(*B*)	
				Lower	Upper
PERSONNB (Ref. 0–5 members)	1.395	0.000	4.037	1.986	8.202
WINTKM (ref : 0–8 km)	0.822	0.022	2.276	1.125	4.607
TRAVPRES (Ref. No)	0.885	0.041	2.423	1.038	5.652
DWELCART (Ref. No)	1.229	0.001	3.419	1.666	7.014
BUILDOUT (Ref. No)	0.882	0.029	2.416	1.093	5.343
POVERTYLINE (Ref. Above)	1.051	0.005	2.861	1.368	5.982
Constant	−4.681	0.000	0.009		

Dependent variable: Upper respiratory infection morbidity indicator (absence or presence of upper respiratory infections at the household level).
Variables excluded: tent, otoriger, buildinv, contact, travfreq, sumkm, sprgkm, autkm, horsetr, animaltr, motocycl.
Overall our predictions were correct 378 out of 442 times, for an overall success rate of 90%.

in the nomadic population (10.1%) compared to the more serious (lower) respiratory illnesses (5%). In a sense the following analysis aims to shed light on the impact of geographic mobility on URI, a dependent variable that groups together influenza, colds and fever.

The control variables need, first of all, to be elucidated, starting with household size. Logically, this variate is connected to the risk of infectious respiratory illnesses, especially since the average size of households is more than five people in the quite confined space of the pastoralist *ger* (yurt), the relative proximity and promiscuity providing increased risk of contagion. The following results (Table 5) also evoke the links that exist between SES (or 'poverty line', see Table 1 and note 5) and health, whereby households having a very low socio-economic level are at greater risk of URI (OR = 2.86; $p = 0.005$) than those at the higher end of the SES scale. This result corroborates the general trend noted in many studies linking SES with levels of health. Furthermore, it was observed that more prosperous households had a greater margin of choice in terms of the means of transportation used. Here it can be seen that the type of vehicle used has a strong link with risk levels (Table 5: 'DWELCART'; OR = 3.41; $p = 0.001$). Thus, those families using the traditional yak-drawn cart are at greater risk of mild respiratory infection than those who are able to call upon a more modern means of transport such as a truck.

Also in keeping with expectations, the OR associated with migrations of encampments (*khot ail,* or small groups of *ger*) and the increasing distance between the autumn and the winter encampments is quite specifically a risk factor (WINTKM; OR = 2.27). Furthermore, this analysis based on household-level data shows the negative impact on respiratory health of short spatial movements and short time periods in the migratory process (TRAVPRES, OR = 2.42). The use of an alternate dwelling instead of the traditional *ger* (for whatever reason) happens quite frequently during the seasonal migrations and also has an impact on this indicator of health (URI).

More specifically still, households that reside in wooden dwellings (frequently the case in parts of the province (aimag) of Hovsgol) experience twice the risk when compared to those dwelling in the traditional *ger* (yurt) (Table 5: OR = 2.4), but as can be seen the statistical significance of this link is not as reassuring (BUILDOUT; OR = 2.4; $p = 0.029$).

Discussion

The fact that long-distance migrations have been characteristic of semi-nomadic pastoralists for centuries does not mean that this social behaviour is ideal in terms of its impact on health. In fact, there may be considerable links between migratory processes and health, particularly in the long term. Firstly, as already indicated, studies have shown the high degree of difficulty experienced by nomad populations in their quest for access and use of health care infrastructures (Imperato, 1975; Stock, 1983). In addition, the deterioration or even the absence of roads in remote parts of rural Mongolia simply adds to the level of risk to the health of pastoralists, particularly when they need to use

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various means of transportation to obtain professional help. Furthermore, the risk of the spread of contagious disease increases with contact between nomadic and sedentary populations in the administrative centres where people go for care (Gatrell, 2002). However, taking stock of other aspects of seasonal mobility such as the switching from the traditional 'housing' of nomadic populations in Mongolia (in their *ger* or traditional yurts) to other kinds of more functional, if temporary, forms of shelter (tent or *ötörin ger*) will be important as we seek to understand the impact of the various facets of seasonal mobility on health. These characteristics moves take place in severe climatic conditions amidst a dearth of resources—all of this threatening the physical integrity and health of semi-nomadic families. These are the factors that have stimulated us to focus upon the impact of two types of geographic mobility on health: short-term mobility and seasonal moves that by definition are considerably longer.

The results flowing from these binary logistic regression analyses demonstrate how important geographic mobility (whether over short or over long distances) is to people's health at the time of seasonal migrations. First of all, the analysis confirms our hypothesis that travel, whether over short or long distances, may worsen herders' health status, particularly during the economic and political transition era in Mongolia. In addition, health problems are often exacerbated by the decline of provision of adequate health care for nomadic groups living in remote areas (Hampshire, 2002). Indeed, mobility in the Mongolian context does not automatically ensure a better access to health care services, since an altitudinal migratory scheme and a harsh environment often prevent pastoralists from reaching better health care facilities typically located in areas with higher concentrations of population. In fact, it appears that the overall patterns of geographic mobility within the pastoral communities of Mongolia tend to be a risk to health status within this population. However, since there are different kinds of mobility, it is very important to distinguish the geographic scales of analysis that are involved. While seasonal migrations involving longer movements in space may contribute to developing epidemic conditions (Loutan, 1989), short distance movements (such as from the *khot ail* to the district (*sum*) centres) appear to expose the pastoralists surveyed to greater risk generated no doubt by increased contact with basically sedentary populations in these centres. Nevertheless, seasonal (i.e., longer) migrations are not without risk. They expose the migratory households to a series of risk factors that are relatively independent of geographic space, namely those related to the pastoralist lifestyle. One of the key confounding factors has to do with the severe climatic conditions under which these moves take place. During winter migrations the temperatures oscillate between $-10\,^{\circ}\mathrm{C}$ and $-30\,^{\circ}\mathrm{C}$, and often there is considerable snowfall. Apart from such environmental variables, the lack of reliable means of transport during the period of economic transition, together with scarce means of communication, combine to create particular risks to health, especially in terms of the need for ready emerging access to health care facilities.

Conclusion

Geographic mobility in rural Mongolia can be viewed from several angles: (1) migratory movements take place over short and long distances, depending on the seasons and on the carrying capacity of the land; (2) there are varying lifestyles among Mongolian pastoralists of different regions; and (3) the absence of a well-functioning, well-supplied health care system only exacerbates these (environmental and lifestyle) trends among Mongolia's rural population which is mainly composed of semi-nomadic pastoralists. Finally, the geographic mobility of pastoralists, often seen as an expression of their adaptation to the vast ecosystems of central Asia (with all their resources), paradoxically, can contribute to making the health of pastoralist populations more fragile. It is to be hoped that geographic mobility will once again become more of a positive adaptive process, a contributing factor to the health status of the populations of rural Mongolia.

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