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## **Epidemiological situation of human plague in Mongolia**

Key words: human plague, cases, outbreak, mortality, source, Mongolia, *Marmota sibirica*

### **Introduction**

The research works was conducted to prepare an overview of epidemiological situation of human plague in Mongolia for the last ten years and determine characteristics based on the data collected. Between 1999 and 2008, 38 human plague foci were reported and 47 human plague cases were registered. In comparison with the figures of previous decade (1989 to 1998) human plague foci decreased by 33.3 % from 57 and human plague cases declined by 44.7 % from 85. Case fatality rate decreased by almost 10 % from 44.7 % to 34.0 %.

Decrease rate of human plague cases is speeding up, in the last 5 years period (2004 to 2008), human plague cases decreased 4.9 times compared to the number of previous 5 years period (1999 to 2003), from 39 to 8. The most possible reasons of the decrease to be the followings:

- Positive outcomes of prevention measures taken among people
- Decrease in population of the main reservoir-marmots
- Decrease in intensiveness of epizooty
- Prohibition of marmot hunting for the last five years

In accordance with WHO report, Mongolia is one of the 8 countries of human plague cases

were reported nearly every year. The research of outlining the feature of epidemiology is important for defining effective prevention measures. The purpose is set to prepare an overview of epidemiological situation of human plague for the last ten years in comparison with the previous decade.

### **Materials and methods**

Official reports of human plague foci occurred in Mongolia between 1999 and 2008 were used for the work. The report figures were analyzed in comparison with numbers of previous decade from 1989 to 1998 and retrospectively analyzed with the numbers of the period between 1931 and 1985.

### **Results and discussion**

According to the research work conducted by SUMIYABAZAR (2007) at Burkhanbuudai and Gichgene Mountains of Gobi-Altai province, where outbreaks were registered every year until 2005, the number of *Marmota sibirica*, the main reservoir, decreased dramatically and was 0.93 in year 2004, 0.7 in 2005 and 0.4 in 2006 per hectare area (Fig. 1).

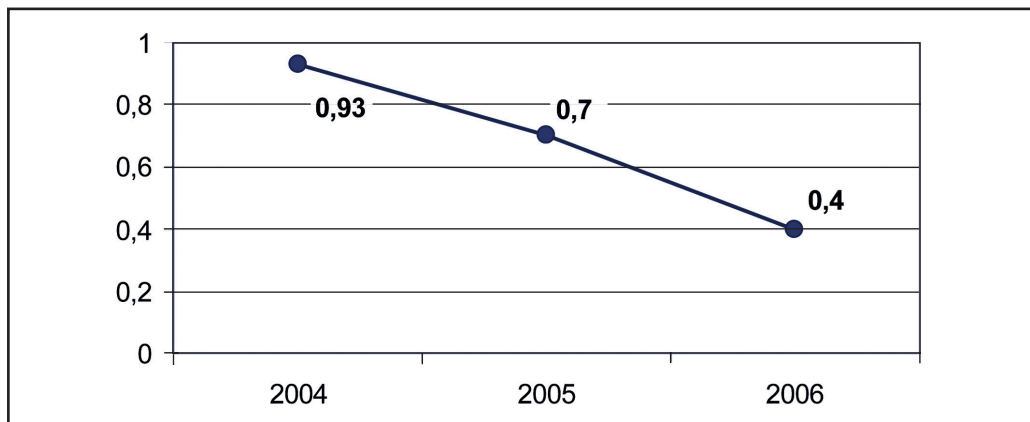


Fig. 1 Density of marmots per hectare in Gichgene and Burkhan Buudai mountains

The field research results revealed the decrease of epizooty regions; infectious agent was isolated from the 37 soums (the lowest level of administrative unit) between 2004 and 2008 in comparison with the number of previous five years (1999–2003) it was decreased from 70 by 47.2 %.

According to the WHO report, average mortality of human plague was 10.2 for the period between 1998 and 2003. During the same period average mortality was 3.7 times higher reaching 38.5 in Mongolia. One of the reasons of the high level of mortality could probably be the higher virulence of *Yersinia pestis* circulating in natural foci of marmot reservoir in Mongolia. In areas of natural foci of marmot reservoir the mortality of human plague was 33.3–49.4 between 1988–1997 (in Mongolia mortality was 34.0–44.7 % for last 20 years) while in foci of rat reservoir the mortality was 0.77 % in China (Li HONGWEI et al. 2000).

In the period between 1989 and 1998, 11 outbreaks were registered with 2 to 9 cases each and 39 cases in total. In the period between 1999 and 2008, 4 outbreaks were registered with 2 to 4 cases and in total 12 cases, which shows that the number of cases were decreased by 3 times. The main reasons of outbreaks are: the first patient infected from animal to have primary pneumonic plague, the misdiagnosis, and belated approach to medical treatment (ADIYASUREN 1999). For the period of 1931–1985, 1986–1995 and 1996–2005 the percentage of

the first patients infected from animals those had primary pneumonic plague were 9.7, 6.9, 3.6 respectively (Fig. 2), and the percentage of outbreaks were 35.1, 9.8, 5.3 ( $r = 0.909$ ).

For the last 10 years, marmot was the only infectious source of plague for those who were first infected from animals and 44.7 % of the first patients were infected from dead marmots or marmots hunted by bare-hand hunting (8 times from dead marmots, 5 times from marmots caught by dogs, 5 times from marmots hunted by rod or trap, 3 times from marmots hunted by stone or club). As per survey conducted by DOLGOR et al. (1987), the number of the first patients infected from dead marmots or marmots hunted by bare-hand hunting was 64.3 % of all cases (Fig. 3).

For the last ten years 76.3 % of infection was from direct contact, 21.0 % from fleas, and 2.7 % from raw tissue or undercooked meat of animal. In the period between 1989 and 1998, 80.7 % of infection was from direct contact, 17.5 % from fleas, and 1.8 % from raw tissue or undercooked meat of animal.

First patient infected by bite of flea was 2.7 % of total for the period of 1931–1985, was 10.3 % for 1986–1995, and was 26.8 % for 1996–2005. Primary bubonic plague cases was increasing from 76.7 % to 82.7 %, and to 92.2 % for the respective period (ADIYASUREN et al. 2006) (Fig. 4).

As per survey conducted by DOLGOR et al. (1987) 73.7 % of the infectious source was

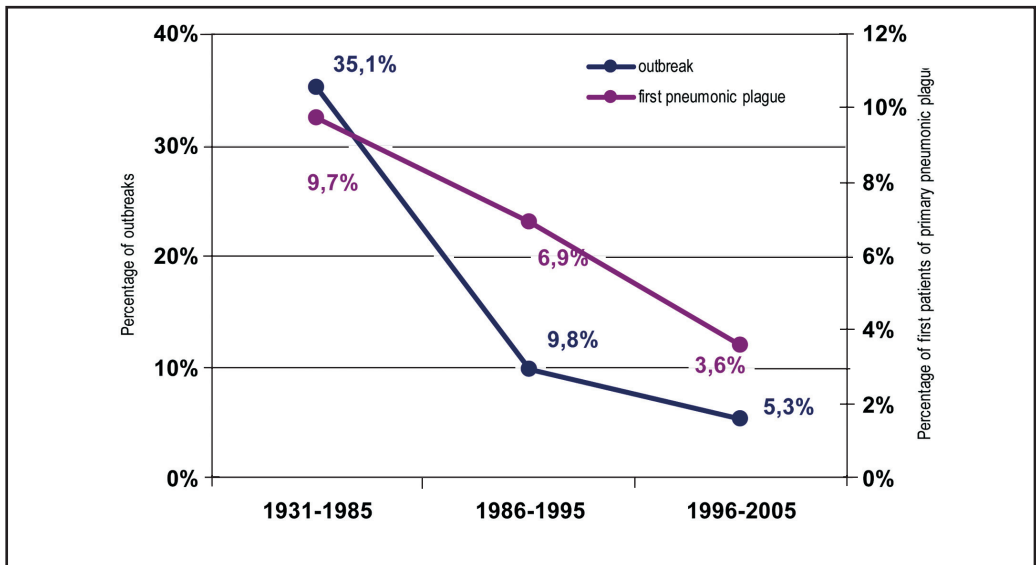


Fig. 2 Correlation between percentage of outbreaks and the percentage of the first patients of primary pneumonic plague

marmot and 5.9 % was ground squirrel of all cases. 10.5 % of the cases were infected by flea bite. For the last 10 years, no occurrence were registered the ground squirrel to be the infectious source. The reason could be the significant reduction of ground squirrel hunting.

Human plague occurred between June and October and seasonal peak of the first patient infection was in August and September. Between 1999 and 2008, 39.5 % of cases was registered in August and 47.4 % in September. Between 1989 and 1998, 49.1 % of cases was registered in August and 28.1 % in September (Fig. 5).

The recent seasonality figures overlap with the results of survey conducted by DOLGOR et al. in 1987, as 10.5 % of the human plague cases was in July, 68.4 % – in August, 5.3 % – in September and 15.8 % – in October. The reason of such high percentage of cases in August could be opening of marmot hunting season. For the period from 1931 to 2000 the first patient of human plague occurred between April and October and the peak of first patient of human plague registered in August (39.8 %) and September (34.6 %) (ADIYASUREN et al. 2002).

Between 1989 and 1998, 77.2 % of the first patients infected from natural foci were men and between 1999 and 2008, 71.0 % was men. The reason of such sex pattern in the first patients

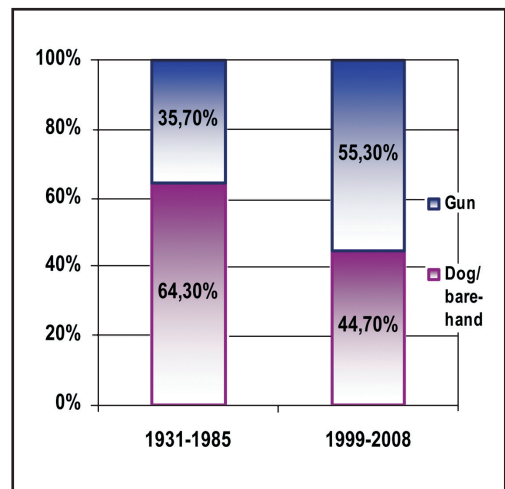


Fig. 3 Change in methods and techniques for hunting marmots (animals) that first patients uses for the period of 1931–1985 and 1999–2008

infected from natural foci is related to the hunting custom and remains the same (Fig. 6).

Between 1989 and 1998, 59.9 % of the first patients infected from natural foci were teens and adolescents aged up to 20 years (including aged 20 years) and between 1999 and 2008, 55.3 % was youngster, which possibly relates with lack of skill and experience of hunting (Fig. 7).

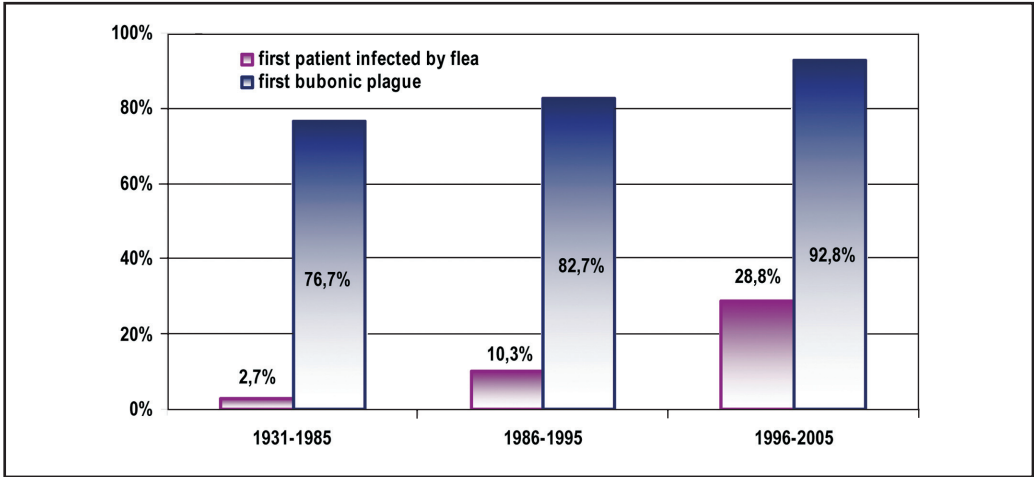


Fig. 4 Relation between first patient infected by flea and first bubonic plague

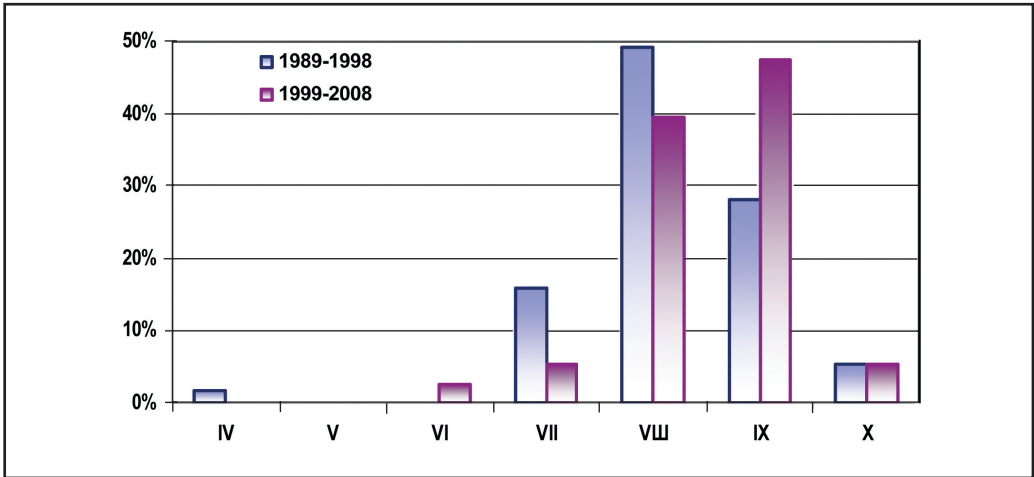


Fig. 5 Seasonality for the period of 1989–1998 and 1999–2008 (by first patient)

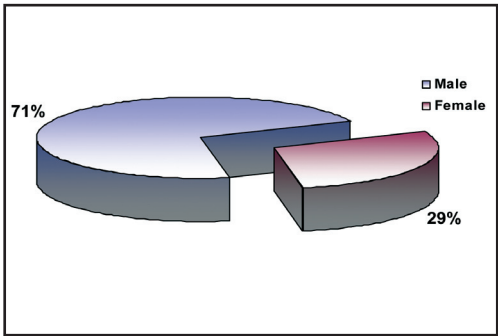


Fig. 6 Sex of first patients infected from animals for the period of 1999–2008

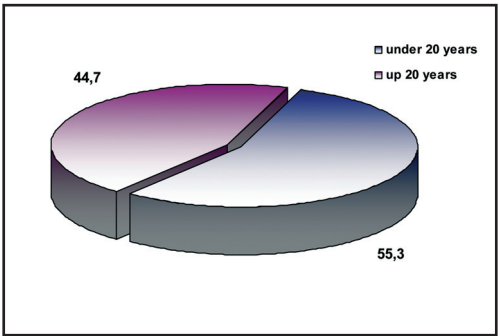


Fig. 7 Risk group by age

Statistics show that 5 to 19 years old children accounted for 35.1 % of the total population of Mongolia in 2004, which is by 20.2–24.8 % higher than the world average. This age group could be regarded as risky and infection-prone higher risk-group.

## Conclusion

Decrease of human plague cases and mortality could possibly be the result of decrease in population of the main reservoir-marmots, decrease in intensiveness of epizooty and prohibition of marmot hunting for the last five years between 2004 and 2008. Marmot is still the major infectious source and infection transmission by flea is increasing. The peak of infection occurs in August and September. The most of the first patients infected from natural foci were men. The risk group remains youngsters who possibly hunt potential sick animals.

## Zusammenfassung

### Epidemiologische Situation der Pestausbrüche in der Mongolei

Die Abnahme der Pesterkrankungen von Menschen hängt in der Mongolei möglicherweise mit dem Rückgang der Murmeltierpopulation und dem Verbot der Jagd auf Murmeltiere von 2004 bis 2008 zusammen. *Marmota sibirica* ist mit seiner Flohfauna die Hauptinfektionsquelle. Pesterkrankungen werden hauptsächlich im August und September registriert. Männliche Personen (Murmeltierjäger) sind im Falle des Krankheitsausbruchs meistens die Erstinfizierten.

Unerfahrene Jugendliche, die potentiell kranke Tiere jagen, sind stärker gefährdet als ältere Personen.

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