

HYPERTENSION IN MONGOLIA: AN OVERVIEW

Objectives: Although hypertension is the primary cause of morbidity and mortality from cardiovascular diseases in Mongolia, reviews about hypertension in this country have not been reported, to our knowledge. Information on the overview of this disease may be useful to establish measures and policy to prevent hypertension and its related complications. The aim of our article is to summarize the current situation vis-à-vis hypertension in Mongolia.

Methods: Population-based studies that provided relevant information on hypertension in Mongolia were searched through PubMed, abstract books of the Mongolian Medical University resources from cardiologists, epidemiological databases and reliable websites of national organizations. Available articles from 1970 to present were selected.

Results: A high prevalence of hypertension, which varied according to geographic location, exists among Mongolian people. The prevalence of hypertension may be influenced by nutritional factors, sedentary lifestyle, socioeconomic status and environmental factors in particular.

Conclusions: The high prevalence of hypertension among Mongolian people can be a serious health problem in this country. Defining ethnic features of hypertension and related conditions will be the initial step that may lead to prevention of this disease. Further research and positive efforts to prevent hypertension appear necessary for Mongolians. (*Ethn Dis.* 2013;23[3]:363–368)

Key Words: Ethnic Epidemiology, Mongolia, Blood Pressure, Hypertension, Cardiovascular Disease

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INTRODUCTION

Globally, nearly one billion people suffer from high blood pressure or hypertension; of those, two thirds reside in developing countries.^{1,2} Hypertension is one of the most notable causes of premature death and by 2025, an estimated 1.56 billion adults may suffer from the disease.^{1,2} Persistent hypertension is one of the risk factors for myocardial infarction, heart failure, stroke, arterial aneurysm and chronic kidney failure.³

Located in the northern part of central Asia, Mongolia is a landlocked country bordered by Russia to the north and China to the south. With a total area of 1.57 million square kilometers and a population of 2.78 million in 2010 (1.5 inhabitants per km²), Mongolia is the 19th largest and the most sparsely populated country in the world.⁴ It is also the world's second-largest landlocked country (Kazakstan, with 2,72 million square kilometers, ranks number one). The country contains very little arable land, as much of it is covered by steppes, with mountains to the north and west and the Gobi Desert to the south. Approximately 30% of the population is nomadic or semi-nomadic.^{5,6} The country is subject to occasional harsh climatic conditions. Ulaanbaatar has the lowest annual average temperature, -2.4°C (27.7°F) of any national capital in the world. Mongolia is high, cold, and windy^{5,6}; the lifestyle of its people, in relation to behavioral and socioeconomic status, differs by regions. By tradition, Mongolians prefer a diet of meat and dairy products and are known as the greatest consumers of

red meat in Asia.⁷ The Western region has a lower socioeconomic status than the rest of the country according to the World Bank.⁸ According to the 2011 Household Social Economic Survey, rates of poverty by region are: Western, 51.1%; Khangai, 38.7%; Central, 34.4%; Eastern, 34.5%; and, in Ulaanbaatar city, 23.5%.⁸ Mongolia was previously part of a socialist system; with the system's collapse, Mongolia has experienced changes in its political, economic, social, and demographic structures, such as internal migration and urbanization.^{7,8} However, the residents in the rural areas still suffer from a lack of health care services.^{9–11}

Administratively, Mongolia is divided into rural aimags (provinces) and the capital city, Ulaanbaatar (Figure 1). Aimags are further subdivided into rural soums, then into rural bags. The country has 21 aimags, 329 soums, and 1,568 bags. The aimag centre is the administrative seat of local government, and the home of the aimag's legal bodies, theatres, hospitals, businesses, schools and industry. Most of the aimag populations work in light industry, services and small business enterprises. Bag populations tend to work in agricultural and animal husbandry and lead mainly a nomadic life, migrating with their herds depending on the change in season and weather conditions.^{4,11}

The capital city is divided into districts, then into khorooos. The capital city, Ulaanbaatar, has 9 districts and 132 khorooos.^{4,11} By the end of 2010, of the total population, 63.3% resided in cities, and the remaining 36.7% in rural areas. The population of Ulaanbaatar is

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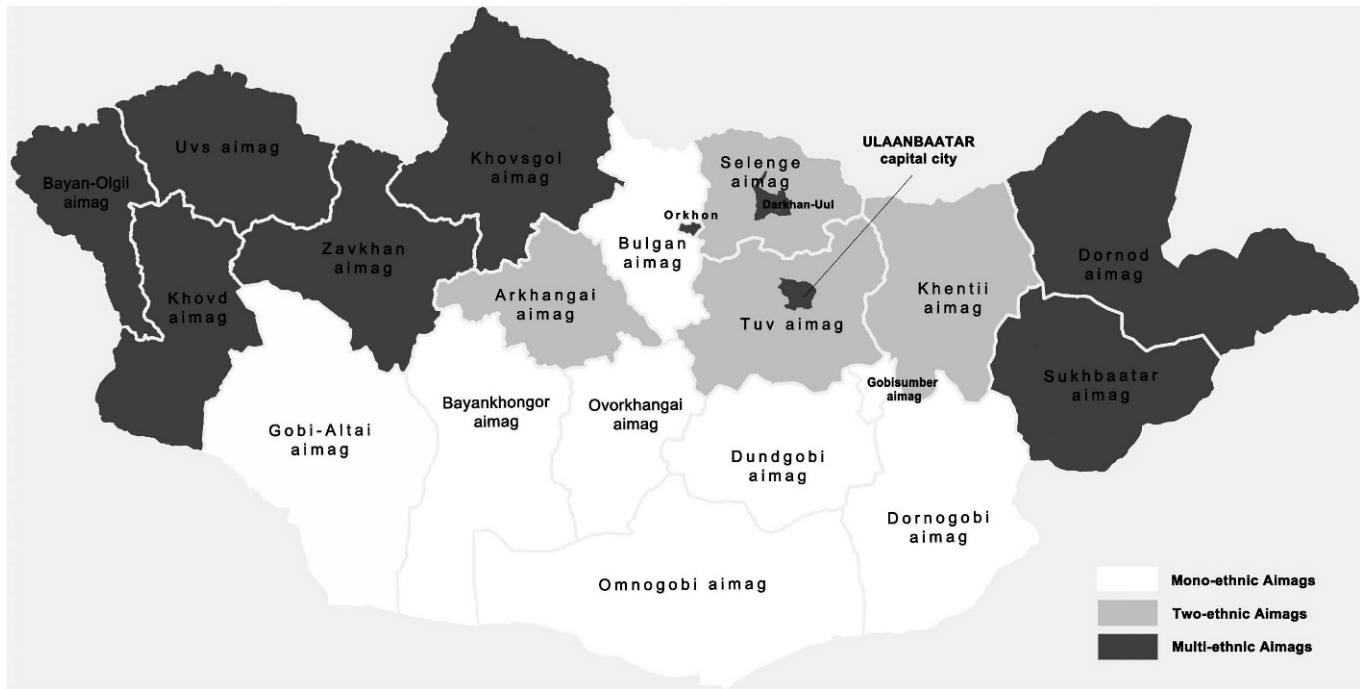


Fig 1. Map of Mongolia by aimags and ethnicity

1,151,400, or 41.4% of the total Mongolian population.¹¹ Male residents make up 48.6% of the total population and, the majority of the population (67%) are between 15 and 65 years.¹¹

The primary Mongolian ethnicity is Khalkh (about 80%) with the remainder of the population spread among the Kazakh, Durvud, Bayad, Buriad, Dariganga and other ethnicities.^{11,12} The second most populous ethnic group, Kazakh, has its own language, known as Kazakhs' and uses Mongolian as its second language. Other ethnic groups use the Mongolian language, but with unique intonations. All ethnic groups have their own traditions, culture, clothes, and diets.¹² Ten aimags are mono-ethnic (Khalkh), four are occupied by two ethnic groups (Khalkh-Buriad and Khalkh-Uuld), and seven are multi-ethnic (Figure 1).^{4,12}

According to the World Health Organization (WHO), the average life expectancy in Mongolia is 68.0 years, which is much shorter than in other Asian countries such as South Korea (78.8 years) or Japan (82.2 years).⁹

According to the official statistics from Mongolia's Ministry of Health, 46% of the population aged >15 years die before the age of 60, a life expectancy that is one of the shortest in the world.¹³ Not only is overall life expectancy short, but healthy life expectancy in Mongolia is short as well. In 2010, the WHO estimated that the healthy life expectancy for males was 55 years (full life expectancy, 65.5 years) and 62 years for females (life expectancy, 70.5 years). Thus, many Mongolians not only die during their productive years, they are unable to work effectively for as much as 14% of their lives.^{9,13} The sociomedical consideration of highly prevalent diseases, such as hypertension, is absolutely primary in Mongolia. The leading causes of death among the Mongolian people are diseases related to cardiovascular diseases (CVD), cancer, injuries, poisoning, and diseases of the digestive and respiratory systems. Hypertension is the leading cause of CVD morbidity and the third leading cause of CVD mortality in Mongolia.^{10,11}

To improve health, various initiatives for the prevention and control of

non-communicable diseases (NCD) were adopted in Mongolia over the past two decades. The country has implemented a comprehensive plan of action and a surveillance system for NCDs and their risk factors. A guideline for hypertension was issued in 2003 based on the 1999 WHO / International Society of Hypertension (ISH) Guidelines for the Management of Hypertension.¹⁴ In 2005, a national program on the prevention and control of NCDs was adopted and its implementation was planned for two stages (2006–2009 and 2010–2013).¹⁵ Most of the indicators listed in this national program

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failed to reach the planned levels, while some (ie, blood pressure and blood glucose levels) were reduced below the reference values.¹⁵ From 2009, the National Strategy for the Promotion of Healthy Nutrition and Physical Activity was issued and according to the strategy, the information, education and communication materials on healthy nutrition were distributed throughout the Mongolian regions.¹⁶ In 2010, the Millennium Challenge Account Mongolia started a health project for NCDs. From January 2011 until June 2013, the Millennium Challenge Account Mongolia implemented 15 campaigns for CVDs, diabetes, cervical and breast cancers, disease prevention, healthy diets, and physical activities. Since 2011, every Mongolian receives a complete annual health check-up as a new action plan of the government.¹⁷

METHODOLOGY

In order to effectively prevent and control CVDs, it is important to understand the status of hypertension in Mongolia. However, to our knowledge, meta-analyses and comprehensive literature reviews about hypertension do not exist for this country. Yet, several geographic studies on hypertension in Mongolia have been conducted to compare ethnic differences with other Asian populations.^{16–22} Therefore, the aim of our article is to summarize the current knowledge about hypertension in Mongolia. For this purpose, we conducted a search of studies in Mongolian and Russian languages in PubMed and the Mongolian Medical University Library. In the most optimally sensitive search in PubMed, we used the search terms: “blood pressure,” “prevention and control,” and “geographical area.” Furthermore, we consulted two experts in the field on the present situation of hypertension in Mongolia and conducted 17 manual searches of books and doctoral theses.

We included epidemiological studies on hypertension. On the other hand, clinical studies on hypertension were excluded because these studies did not always demonstrate the national status of this disease. For each of the studies selected, the following information was extracted: authors and years of publication (since 1970), years of completion of studies, study settings, sample size, and demographic characteristics (eg, age and sex). Only appropriate articles were summarized. After confirming content, we selected eight papers^{16–22,29} via PubMed and nine studies^{23–31} from the Mongolian Medical University Library.

POPULATION MORBIDITY AND MORTALITY IN MONGOLIA

According to WHO, by 2020, the NCDs will account for 60% of the global burden of disease and 73% of all deaths.¹ During the last few decades, Mongolia has experienced a gradual epidemiological transition from a preponderance of infectious diseases to NCDs and degenerative diseases.^{4,11} This transition is due to a sharp decrease in mortality from infectious and parasitic diseases and a sudden increase in diseases such as CVDs and malignancies. Hypertension and ischemic heart diseases are the main types of CVDs in Mongolia, which accounted for more than 60% of CVD-related morbidity.⁵

HYPERTENSION MORBIDITY AND MORTALITY IN MONGOLIA

In 2010, hypertension accounted for 36.6% of inpatient morbidity and 10.3% of outpatient morbidity from CVDs.⁵ Among the cause-specific CVD mortality rates per 10,000 population, hypertension was 1.38 in 2009 and 1.61 in 2010.⁵ As for age- and sex- specific

mortality from hypertension, it was 3.68 in males aged 45–65 years and 2.15 in females of the corresponding age group.⁵ The overall mortality from hypertension in Mongolia is 40.9 and ranks 47th in the world, higher than other Western Pacific region countries such as China (15.8 and 139th place) or Japan (1.6 and 191st place).⁴

RESEARCH ON HYPERTENSION

Several studies about hypertension have been conducted in Mongolia. During 1972–1980, the WHO conducted a prospective study on the treatment and long-term outcomes of treatment for hypertension in 13 countries, including Mongolia. The main objective of the project was to assess whether an organized intervention to control hypertension in a community could result in an appreciable reduction in blood pressure in the population. As a result, there was a modest increase in awareness among the intervention group of Mongolian people. Although a small increase was noted in the rate of anti-hypertensive treatment sought, the rate did not differ between the males of the intervention and reference communities. However, females in the intervention community (vs females in reference communities) were more likely to seek treatment. This study showed that, in Mongolia, the disability and mortality due to hypertension, as well as the target organ damage, can be reduced by early detection, active treatment and follow-up.²²

The relationship between the prevalence of hypertension and geographical features was studied among 3,264 people aged 20–69 (1,708 men and 1,556 women) by the Research Health Institute during 1985–1990.²⁴ This study compared blood pressure levels in four different geographical areas (Dornod steppe, Khentii mountain, Gobi-Altai mountain, and Khangai

mountain regions). The study results suggested that the prevalence of hypertension could show a geographical difference; that is, the prevalence was lower in eastern (Dornod and Khentii) aimags and higher in the Mongol-Altai mountainous areas.²³

In 1999, a study was conducted on the prevalence of hypertension, glucose intolerance/diabetes and obesity in six population samples (2,996 participants aged ≥ 35 years) in Mongolia.²⁰ The prevalence of hypertension was 50.5% and the combination of hypertension and central obesity was 17% while isolated hypertension was observed in 17%.²⁰ The Mongolian STEP's survey (on the prevalence of NCD risk factors) was carried out in 2005 and 2009.^{24,25} The first survey included 3,411 people selected from 20 soums of 18 aimags and 6 districts of Ulaanbaatar, Darkhan and Erdenet cities. The second survey included 5,638 randomly selected residents, aged 15–64 years, of both sexes from 36 soums of 2 aimags and 6 districts of Ulaanbaatar. The prevalence of hypertension was 28.1% in 2005 and 27.3% in 2009.^{24,25} In comparison to WHO data,² these results suggested a high prevalence of hypertension in Mongolia.

In general, the morbidity and mortality rates from hypertension differ among ethnic groups, which may be due to differences in diets, smoking habits, alcohol consumption, extent of physical activity, genetic background, psychological stress, socioeconomic components and environmental factors (eg, altitude and climate).^{5–7} Although limited, some investigations have been conducted in Mongolia to explore these contributory factors to hypertension.

The most reliable study on the effects of diet, specifically salt consumption in relation to hypertension, was conducted in Mongolia in 1978²⁸ and included 2,117 people, aged ≥ 20 years (1,531 from the Western region and 586 from the Eastern region). For people of the Western aimags where salty tea is

consumed frequently, the Na/K coefficient was 4.99 (vs recommend level is 3.1) and systolic blood pressure (SBP) was $\geq 143.2 \pm 3.5$ mm Hg and diastolic blood pressure (DBP) was $\geq 87.8 \pm 1.1$ mm Hg. In comparison, the Na/K coefficient of people from the Eastern aimags, where there is no habit of drinking salty tea, was 2.17 Na/K, and SBP and DBP were $\geq 122.6 \pm 1.5$ and $\geq 74.7 \pm 1.5$ mm Hg, respectively. The researchers noted that the population who drank salty tea had a higher mean blood pressure, and that the prevalence of hypertension was twice as high.²⁶

The National Survey of Maternal and Child Nutrition of Mongolia studied the diets of Mongolians in 1992, 1999, 2004, and 2010.²⁷ The 2010 survey included 1,151 men and 1,448 women of reproductive age (15–49 years old).²⁸ The survey revealed that salt intake was 15.6 grams in men and 14.2 grams in women (the WHO recommendation is < 5 grams per person per day for CVD prevention³). Thirty percent of women in the survey suffered from vitamin D deficiency.²⁸ In 1999, the the average values for salt intake for males and females were 14.6 grams ($n=571$) and 12.6 grams ($n=598$), respectively.²⁹ A 2009 national estimate on salt intake showed a daily consumption per person of about 7.3 grams per day in Mongolia.²⁵

Two nationwide surveys have shown that the prevalence of smoking by Mongolian people, aged ≥ 15 years, was 24.2% in 2005 and 24.3% in 2009;^{24,25} and it was 24.0% for those aged ≥ 40 years in 2009.²⁵ Although 27.9% of Mongolian adults abstain from the consumption of alcohol, the proportion of excessive drinking and dependence is high: an estimated 13.6% of the entire adult population are alcohol dependent, with prevalence 3 to 5 times greater in males than in females.³⁰ According to studies on the patterns of physical activity in Mongolia, between 2005 and 2009, the

segment of the population who did not engage in vigorous activities increased from 34.1% to 48.5%.^{24,25}

With respect to the other hypertension-induced and/or hypertension-linked disorders, incidences of overweight and obesity based on body mass index (BMI) are increasing annually in Mongolia. Nationally representative surveys, conducted repeatedly since 2005, have shown a substantial increase in the prevalence of excessive weight (overweight rates were 32.4% and 40.7%; obesity rates were 10.2% and 12.9% in 2005 and 2009, respectively).²⁵ This increase differs by age and sex, as well as socioeconomic status.²⁵

In addition, hospital-based studies for Mongolian and Japanese outpatients, which compared study results between ethnic groups, provide valuable information on the status of hypertension in Mongolia. A few comparative studies involved Mongolian and Japanese people and found a greater burden of risk for CVDs in Mongolia compared to other Asian populations.^{16,18,21} For example, one study reported that Mongolian patients with hypertension and diabetes might be at a higher risk for CVDs than Japanese patients. Mongolian patients were reported to have higher levels CVD risk factors, including: serum C-reactive protein (as a low-grade inflammatory parameter), cardio-ankle vascular index (as an arterial stiffness parameter), higher percentage of current smoking, and higher BMIs, heart rate, blood pressure and insulin level.¹⁶

Some risk factors for CVDs (eg, glomerular filtration rate, presence of proteinuria, hypertension, diabetes and obesity) were highest among the Mongolians when compared to Chinese or Nepalese.¹⁷ The prevalence of metabolic syndrome, which includes increased blood pressure as a one of the criteria, was higher in the Mongolian people than in the Japanese or Koreans.¹⁸ Hypertension among Mongolians was reported to be influenced by body

weight, high salt intake, smoking and high serum cholesterol levels.¹⁹

Furthermore, socioeconomic changes, in addition to aging of the population, can lead to an increase in the prevalence of hypertension, with low control rates due to scarce health resources and insufficient public health infrastructure.⁵⁻⁷ The prevalence of hypertension can also be influenced by climate and geographical location, although these factors are not always modifiable.³¹ A high altitude, with an increased migration rate and extended cold weather, can increase the prevalence of hypertension.^{23,31} A recent study reported that hypertension prevailed in Khangai, Western, Central regions and the capital city of Ulaanbaatar³¹ and suggested that ecological factors, such as average atmospheric temperature, atmospheric pressure, precipitation and mineralization of rivers, might have statistically significant effects on the morbidity of hypertension.³¹

CONCLUSIONS

Although limited studies have been conducted, our review indicates a high prevalence of hypertension among Mongolian people. The prevalence of hypertension in this country may be influenced by several contributors, such as nutritional factors, sedentary lifestyle, socioeconomic status, and environmental factors. Defining the effects of ethnicity on hypertension and related conditions will be one step that could assist in preventing hypertension and cardiovascular disease. Although some health strategies to prevent hypertension are ongoing, our review will be useful for targeting additional strategies and pointing to further research that appears necessary to explore health conditions and outcomes within Mongolia.

REFERENCES

1. World Health Organization. *Global Status Report on NCD 2010*. Geneva: WHO Press, 2011;9-28.
2. World Health Organization Key Fact on Cardiovascular Diseases. [www.who.int/mediacentre/](http://www.who.int/mediacentre/factsheets/fs317/en/index.html)

3. World Health Organization. *Preventing Chronic Diseases: A Vital Investment*. Geneva: WHO Press, 2005;34-45.
4. National Statistical Office of Mongolia. *Mongolian statistical yearbook 2009*. Ulaanbaatar, Mongolia, 2010;43-64.
5. Mocellin J, Foggin P. Health status and geographic mobility among semi-nomadic pastoralists in Mongolia. *Health Peace*. 2008;14:228-242.
6. Foggin PM, Farkas O, Shiirev-Adiya S, Chinbat B. Health status and risk factors of seminomadic pastoralists in Mongolia: a geographical approach. *Soc Sci Med*. 1997;44:1623-1647.
7. Manaseki S. Mongolia: a health system in transition. *BMJ*. 1993;307:1609-1611.
8. The World Bank. worldbank.org/en/news/2012/04/17/poverty-level-at-nearly-30-percent-in-mongolia. Accessed March 25, 2013.
9. World Health Organization. *Western Pacific Country Health Information Profiles: 2010 Revision*. Geneva: WHO press, 2010;250-260.
10. Implementing Agency of the Government, Department of Health, Mongolia and Public Health Institute (PHI) of Mongolia. *Projection of Mortality of CVD and Their Regional Specificity in Mongolia*. Ulaanbaatar, 2009;8-29.
11. Implementing Agency of the Government, Department of Health, Mongolia. *Health Indicators 2008-2010*. Ulaanbaatar, 2011;43-51.
12. The National Centre for Non-formal Distance Education of Mongolia. *Study Reports of Needs for Minority*. Ulaanbaatar, 2010;16-17.
13. World Health Ranking 2009. www.worldlifeexpectancy.com/country-health-profile/mongolia. Accessed March 25, 2013.
14. The State of Great Hural Resolution of Mongolia N 35. Resolution on Approval of the Action Plan of the Government for 2008-2012. Ulaanbaatar, 2008;1-15.
15. Millennium Challenge Account Mongolia. www.mca.mn/en/index.htm. Accessed March 25, 2013.
16. Uurtuya S, Kotani K, Taniguchi N, et al. Comparative study of atherosclerotic parameters in Mongolian and Japanese patients with hypertension and diabetes mellitus. *J Atheroscler Thromb*. 2010;17:181-188.
17. Sharma SK, Zou H, Togtokh A, et al. Burden of CKD, proteinuria, and cardiovascular risk among Chinese, Mongolian, and Nepalese participants in the International Society of Nephrology screening programs. *Am J Kidney Dis*. 2010;56:915-927.
18. Shiwaku K, Nogi A, Kitajima K, et al. Prevalence of the metabolic syndrome using the modified ATP III definitions for workers in Japan, Korea and Mongolia. *J Occup Health*. 2005;47:126-135.
19. Komatsu F, Hasegawa K, Watanabe S, et al. Comparison of electrocardiogram findings and lifestyles between urbanized people and geriatric people in Ulaanbaatar, Mongolia. *Atherosclerosis*. 2004;175:101-108.
20. Suvd J, Gerel B, Otgooloi H, et al. Glucose intolerance and associated factors in Mongolia: results of a national survey. *Diabet Med*. 2002;19:502-508.
21. Uurtuya S, Kotani K, Taniguchi N, Yoshioka H, Yamada T, Taniguchi N. Determinants of carotid atherosclerosis in the general Mongolian population. *Ethn Dis*. 2010;20:257-260.
22. Ambrosio GB, Strasser T, Dowd JE, et al. Effects of interventions on community awareness and treatment of hypertension: results of a WHO study. *Bull World Health Organ*. 1988;66:107-113.
23. Olziikhutag A. Adaptation of aboriginal inhabitants and regional pathology in condition of Mongolian median altitude. Ulaanbaatar, 2000;56-192.
24. Ministry of Health of Mongolia, Public Health Institute of Mongolia, Western Pacific Region of World Health Organization. *Mongolian STEPS Survey on the Prevalence of Non-communicable Disease Risk Factors -2006*. Ulaanbaatar, 2006;24-71.
25. Ministry of Health of Mongolia, Western Pacific Region of World Health Organization, Millennium Challenge Account - Mongolia, Public Health Institute of Mongolia. *Mongolian STEPS Survey on the Prevalence of Non-communicable Disease and Injury Risk Factors-2009*. Ulaanbaatar, 2010;36-98.
26. Dondog Ya, Amgalan J, Oyundelger Ts, Bayartogtoh Sh, Ariunaa A. The study of hypertension among people of Ubs, Dornod aimags. *Mongolian Medical Journal*. 1989;72:12-16.
27. Public Health Institute of Mongolia, Ministry of Health of Mongolia, UNICEF. *3rd National Survey of Nutritional status of Mongolian Children and Women*. Ulaanbaatar, 2004;100-106.
28. Public Health Institute of Mongolia, Ministry of Health of Mongolia, UNICEF, World Health Organization. *4th National Survey of Nutritional status of Mongolian Children and Women*. Ulaanbaatar, 2010;117-160.
29. Yamada C, Oyunbileg D, Erdenebat A, et al. Estimation of salt intake and recommendation for iodine content in iodized salt in Mongolia. *Asia Pac J Public Health*. 2000;12:27-31.
30. Ministry of Health of Mongolia, World Health Organization, Center of Mental Health and Narcology of Mongolia. *Epidemiological Study on Prevalence of Alcohol Consumption, Alcohol Drinking Patterns and Alcohol Related Harms in Mongolia*. Ulaanbaatar, 2006;10-41.
31. Tuul M, Baasanjav N, Purevsuren D. Result of the research study on influence factors for

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mortality and morbidity rate of CVD. *Mongolian Medical Journal*. 2011;2:70-77.

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