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The Social and Ecological Problems of Urbanized Areas in Mongolia

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Abstract

This paper presents the results of studies on the formation of urbanized territories and metropolitan areas in Mongolia, and the influences of the industrial complex on the pollution level in urban landscapes, as well as on population health. The capital city, Ulaanbaatar, is one of the most highly polluted cities in the Central Asian region. The data on spatial distribution and the contents of toxic elements in the soils, snow cover, plants and human hair are given, according to the main ecological zones of the city. The statistical data on the dynamics of birthrate, rates of sickness and death of the population by the main groups of diseases are analyzed in accordance with the classification of the World Health Organization.

Key words; social and ecological problems, urbanization, pollution, dwelling-zone, gastrointestinal disease, Mongolia

Introduction

According to Danilova (2005) more than 20 remainders of the Hunnu town culture, over 10 Uigur towns, more than 20 Kidani towns and more than 30 small towns from the period of the Mongolian empire are known in Central Asia. Central-Asiatic settlements were nearly always small and were not populous. In the Yani epoch the function of metropolitan empires was executed in Da-du (Hanbalgasun) near Beijng. Significantly, after the collapse of Mongolian rule in Karakorum, in 1380 it was destroyed by Chinese troops and forfeited its status of state centre.

The capital city of Mongolia, Ulaanbaatar, which was previously called Ikh-Khure, Da-Khuree, Niislel –Khuree, came into being in the middle of XVII century, in the valley of river Tuul, near the monastery Ikh-Khuree. However, in Russian documents from the middle of the XIX century it was named Urga. A trade complex and town administration formed around the monastery, so the stationary settlement became a national religious center, but also gained an administrative function and became an area Mongolians returned to and stayed. In the early XX century, the city already had governmental institutions, foreign consulates, a central post office, telegraph and Chinese theatre. Therefore, from this time began the process of shaping a town from the many components of functionally different zones into united areas. In this time, there was a developmemt of urban infrastructure: administrative complex, industrial zone, religious buildings, dwellings and trade quarters.

Between 1921 and 1990 the public authorities of Mongolia took measures to settle nomads, with some success. After the political and economic reforms in 1990 settled inhabitants returned to a nomadic lifestyle leaving villages deserted, breaking the former infrastructure and physical destruction of the population of the country. During this period the capital city of Mongolia developed, but this has caused deterioration of the ecological conditions.

Urbanization is accompanied by the development of industrial production, which for a long time was comparatively low. Besides manual labor there were small sized enterprises (approximately 480) belonging to Russian and Chinese, which animal skin, made footwear and clothes, jewellery products, woven carpets etc. There were only 300 Mongolian workers in 1928, but 140,000 in 1940. The intensive industrialization of the country started around the end of 1940s, and the main growth of the Mongolian industry occurred between 1975 and 1990. At the end of 1980s there were 35 power stations, 20 coal mines, 20 metal processing and repairing factories, 43 producing building material, 55 lumber-mills and

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wood processing enterprises, 12 textile, 18 shoe factories, 45 large and middle-sized factories, and 28 printing and other industrial organizations. (Namjim, 2000).

By the end of 1980s, because of the influence of industrialization and urbanization, the representatives of different ethnic groups occupying the traditional life style and their economical activities (nomadic and semi nomadic life stock-breeding) fell to 26-45% (Graivoronsky,1997). During 30 years (between 1961 and 1990) approximately 600,000 rural inhabitants migrated to Ulaanbaatar (Yaskina, 1998).

The cities in Mongolia grew intensively in the second half of the XX century, particularly after the 1960s. Large established industrial centers such as Darkhan, Erdenet and others were restored as urban areas and the town population quickly increased.

In the urban planning of Mongolia, there have been the same problems that occurred in other parts of the world: disappearance of natural soil cover and native vegetation, waste contamination of the environments, increasing water consumption, etc. The cities became the main center of attraction for cattle breeders and nomadic herders because of the simplicity of marketing their products. As a consequence of the concentration of a large number of livestock on a relatively small area there has been degradation of pasture and some places are already in the process of desertification.

The Ulaanbaatar area covers 4704000 hectares and contains light and food industry, construction, woodworking, metal repair, motor repair, printing enterprises and filling stations.

Methods

Methods of geochemical and medico-biological survey

In order to reveal the general trends of the development, and to assess the urban environmental condition, we used an eco-geochemical concept of environmental assessment of the migration and concentration of a number of chemical elements and their compounds, primarily pollutants and toxicants, and also dust deposited in natural media including snow, soil and plants (for the soils (Pb), tin (Sn), copper (Cu), zinc (Zn), nickel (Ni), cobalt (Co), chromium (Cr), vanadium (V), molybdenum (Mo), arsenic (As) and boron (B); for plants (family Panacea): lead, copper, zinc, nickel, cobalt, chromium, manganese and cadmium (Cd); for snow: copper, arsenic, zinc, lead, mercury (Hg), strontium (Sr); for the dust contained in snow ("snow dust"), in addition to the above, rubidium (Rb) and zirconium (Zr). We also looked at the concentration of the same chemical elements and their compounds in some human protective organs (i.e. hair) as an index of pollution and urban environmental transformation (Kasimov *et al*., 1995). In the late 1980s and early 1990s the geochemists of Moscow University performed an integrated investigation of the soil, vegetation, and snow cover and assessed the geochemical situation of the city Ulaanbaatar. The results of this assessment is widely used in the present research.

The technogenic geochemical anomalies formed in different depository media are characterized by the combination of different pollutant elements, different spatial configuration and different contractiveness. This is determined by the pattern of the environmental impact and landscape-geochemical conditions, which account for the differentiation of that impact. The spatial distributions of element anomalies are also manifested in the health condition of members of different social groups and particular individuals, whose hair was subjected to the chemical test.

Domestic waste also concentrates chemical pollutants and toxicants, including nitrogen, to a considerable extent. The issue of domestic waste utilization is extremely important for Ulaanbaatar, with its domestic garbage dumps which occur randomly, and waste scattered by the wind and burned. Industrial and domestic wastes are accumulated in surface and underground collectors (shower sewerage). They are treated by the natural dilution method and settling is directed out of town via the sewerage system.

The general assessment of Ulaanbaatar city in the early 1990s, (Eco-geochemistry of Urban Landscapes 1997) provides data on the distribution of a number of pollutants in some depository media, particularly soils, since they reflect some long-term trends of the pollutant accumulation. In terms of soil concentration of the pollutants under study, a total pollution index was estimated in conventional units (Zc) which makes it possible to compare the levels of pollutants in the city soils to those in the background chestnut and sod alluvial soils. From this we can obtain the Coefficient of Technogenic Concentration or accumulation, by which we can demonstrate that the concentration of the element in urban soils is higher than that in the background (baseline) soils (Table 1).

Plant Cover analysis

The sampling of dominant plants was performed in September, 1999, based on the method of sheet soil tests, corrected by presence in the plant cover of some particular families. Some species of Poacea had a ubiquitous distribution. The total number of samples was 78.

The plants of the family Poacea are characterized by low concentrations but their ubiquitous distribution allowed us to obtain a fairly representative picture of pollution in natural objects during the warm season. Identification of microelements in the plants was performed by the atomic absorption method, and the results are presented in Table 2.

Snow Cover Analysis

A detailed examination of the snow cover was performed in January-February 2000. As noted above, the high level of sub-inversion smog plays an essential role in snow cover pollution. In total, 89 snow samples were analyzed using the Perking-Elmcr-503 atomic absorption spectrophotometer with a graphite furnace HGA 74, and atomic absorption spectrophotometer AA6 Varian (flame version). Discrimination of the snow dust composition was performed using X-ray-fluorescent analysis. In addition, we used data of air pollution of the city area using sulfurous anhydride compounds, nitrogen dioxide and organic compounds of polycyclic aromatic hydrocarbons (PAH), including carcinogenic 3, 4-benzopyrene obtained from previous studies of Ulaanbaatar snow cover in 1992-1995. Special attention was given to those chemical pollutants

Table1. Concentrations of chemical elements in the soils of Ulaanbaatar and baseline areas basing on spectral analysis

Values	Chemical elements, mg/kg												
	Cd	Pb	Mn	Cr	Fe	Mo	Sn	V	Cu	Zn	NI	Co	
I. **Baseline soils**													
I.A) In all horizons of baseline soils, n=10													
X_{min}-X_{max}	17-29	35-45	340-560	33-140	2300-3200	1-3	2-3	80-150	12-36	30-80	15-52	6-15	4-15
X_{mid}.	24	40	447	59	2790	2	3		26	54	25	9,7	6,8
V%	15	11	16	54	13	29	18	19	32	30	40	28	
CC	2	2.6	0.45	0.71	0.62	2	1,2	1,3	0,55	0,65	0,43	0,54	
CP			2.2	1.4	1.6				1.8	1.5	2,3	1,9	
I.B) In Humus horizon (Al) of baseline soils, n=3													
X_{min}-X_{max}	17-25	35-45	500-560	54-140	3000-3200	2-3	2-3	12-130	25-38	50-70	22-52	9-15	4-9
X_{mid}.	21	39	527	84	3130	2,7	**2,5**	100	30	60	33	11	6,2
CC	1,8	254	1,9	1	**1.4**	**2,5**	1,2	1,4	1,6	1,4	1,8	1,6	1,5
II. Soils of the City													
II. A) In all horizons of city soils, n=333													
X_{min}-X_{max}	8-96	12-500	80-1200	7-530	1000-53000	0-23	1-120	10-270	8-180	30-440	2-82	3-58	3-200
X_{mid}.	24	54	359	41	3050	2,2	5,5	119	38	82	15	9,9	11
V%	39,4	78,4	49,3	91,2	20,2	75	13	35	4554	54,5	63,9	47,4	186
CCn	1,5	2.3	2	0.71	0,5	1,4	2,3	1,4	2	2,1	0,9	1,3	1,8
CCn max	3,2	21			1	14	43	3,1	9	11	1,8	7,4	32
II. B) In Humus horizons (Al) of city soils, n=66													
X_{min}-X_{max}	13-45	25-280	80-780	16-86	1600-5200	1-4	3-8	64270	11-57	30-440	6-82	3-20	6-140
X_{mid}.	25	63	365	43	3010	2	3,4	163	33	71	22	9,9	
V%	25	73	38	37	28	40	30	50	33	83	68	41	32

CC- Concentration Coefficient (Coal/Ash)

Table 2. Concentration of heavy metals in the plant species, *Leymus chinensis*

Value	Chemical elements (content: mg/kg)						
	Pb	Zn	Fe	Mn	Ni	Cr	Cd
Average (Xn)	0,17	26,5	875,5	78,5	1,5	1,9	0,8
Minimum (X nun)	0	6,9	I0	21,0	0,2	0	0
Maximum (X mns)	26	845	123	195	5,1	5,1	1,4
R-mesn-btiuaic deflection (G n-1)	2.2	14,8	1313	32,1	1,3	2,1	1,8

that are particularly hazardous for human health. These are primarily Cd, Pb, Sr, As,Cu and, Zn (Table 3).

Also, we intended to define the content of mercury. However, in snow waters mercury was absent. The concentration of arsenic in snow waters exceeded the Admissible concentration limit (according to the Russian standards).

Analysis of chemical elements in the hair of metropolitan residents

We made an attempt to establish the impact of unfavorable ecological conditions on the health of citizens of Ulaanbaatar using the analysis of the concentration of some chemical elements in the hair of adults and children in three ecological zones of the city: industrial-residential, administrative-residential and traditional dwelling.

Being enzyme activity elements, zinc and copper show higher concentration indices in adult hair. Cadmium and lead show a fairly high range of concentration and are associated with the ecological situation in the subject's areas of residence and their professional activities (Table 4).

Neither strontium or mercury were found in the hair of subjects. Variations of iron and manganese concentrations reflect the intensity of the living processes of each individual, serving as diagnostic indices in assessing inflammatory processes, but no direct relationship with ecological processes has been revealed so far. It should be noted however, that the very high levels of manganese content determined in the hair of some individuals exceeded the average level by a factor of 1.5-2.

In fact, elevated concentrations of lead have been revealed in the hair of professional drivers or subjects who often use private cars. The cadmium concentration in the hair of traditional dwelling (ger) district residents was higher than that in residents of other districts. In two cases, the difference was 400-fold. Chemical tests demonstrate the reliability of the determinations that we made. Presumably, there is a relationship between the cadmium content in the human hair, and coal utilization for heating.

Thus, the ecological strain, undoubtedly present in the Ulaanbaatar city area under study, was confirmed by disease incidence statistics. The concentration of pollutants in depository media is associated with natural and other factors, such as the depressed situation of the land area, anticyclone weather in winter, industrial heat-energy specialization, and wide use of coal for heating individual homes in the districts of traditional tent dwelling.

The social dimension of the problem, including congestion of one third of the total population

Table 3. Contents of the chemical elements in snow cover of Ulaanbaatar city

Value	Cu (*n*=78)	Pb (*n*=78)	Cd (*n*=78)	As (*n*=78)	Zn (*n*=14)	Sr (*n*=15)
Average µg/ml	0.0138	0.0009	4.8E-05	0.0039	0.018	0.214
Dispersion	0.0003	1.3E-06	1.7E-09	1.1E-05	0.000	0.008
Mode	0.0100	0.0001	0.0001	0.0003	0.005	0.120
Mediane	0.0100	0.0005	3.0E-05	0.0029	0.014	0.200
MIN	0.0002	0.0001	0.0E+00	1.0E-05	0.005	0.100
MAX	0.1100	0.0050	0.0002	0.0170	0.050	0.400
Statistical Dispersion	0.0173	0.0011	4.1E-05	0.0033	0.014	0.094

Table 4. Content of chemical elements in the hair of metropolitan region residents.
(chemical elements, μg/ml)

	Mn	Zn	Cu	Pb	Cd	Fe
School 75 - The Industrial Zone (*n*=49)						
Average	6.2	179.9	20.0	8.7	0.28	
Dispersion of samples	94.1	9,895.5	598.0	75.3	0.05	
Dispersion of main massif	92.2	9,689.4	585.5	73.7	0.05	
Mode	0.0		14.0	4.4	0.05	
Median	0.0	170.8	13.0	5.8	0.20	
MIN	0.0	26.4	4.6	03.I	0.04	
MAX	57.9	478.0	163.0	42.4	0.84	
School 2 - Administrative -Living Zone (*n*=42)						
Average	5.0	124.1	23.0	9.1	0.23	70.5
Dispersion of Samples	194.5	11,039.4	190.7	79.2	0.06	6,122.6
Dispersion of Main massif	190.2	10,799.5	186.4	77.4	0.06	5,442.3
Mode	0.0	127.8	10.2	1.2	0.06	
Median	0.0	91.1	18.9	6.7	0.12	62.9
MIN	0.0	22.7	4.2	1.1	0.04	3.0
MAX	70.6	711.3	55.3	40.3	0.98	245.7
School 17- Ger Zone (*n*=65)						
Average	10.7	124.6	23.1	10.1	0.34	88.0
Dispersion of Samples	3,066.2	5,490.0	310.3	152.2	0.36	26,847.1
Dispersion of Samples	3,009.4	5,388.4	304.5	149.4	0.36	24,162.4
Mode	0.0	164.4	13.0	1.0	0.04	
Median	0.0	102.1	19.9	5.1	0.16	23.4
MIN	0.0	43.2	6.9	1.0	0.04	4.1
MAX	397.8	465.5	120.6	50.0	3.80	539.2

of the country in a relatively small area, less than 1% of the country territory, exerts further detrimental effects on the health of residents in urban areas.

RESULTS AND DISCUSSION

Contamination analysis of metropolitan environments

Soil Pollution

The soils of the Urgiin Depression under natural conditions are relatively rich in boron, arsenium and molybdenum (CC:1.5 -2.5), and has typical pH levels (6.5 – 7.0). However, the background soils show low concentrations of Ni, Cr, Xn, Cu (CC: 2.1-3.4), due to a wide distribution of acid soils within the Khentei Mountain Province. The urban soils are rich in As, Pb, Cr, Mo, and Sn. These elements are characterized both by higher variability of concentration in the urban soils, and in contrastive soil-geochemical anomalies. A particular focus was directed on the soils of the central part of the city (administrative - residential), and in northern and eastern edges (traditional tent dwelling zones). A contrast between the above two ranges is 3-7 fold. A cinch anomaly was revealed in the central part of the city (CCn: 3 - 5).

What appears to be associated with the long-term effect of numerous domestic pollution sources? Analysis of the elements in the ammonium-acetate extraction (water-soluble and carbonate forms) shows an increase of Ca for Pb - about 30 times for the central part of the city, whereas in the relatively clean districts (modern residential zone) the concentrations of the stable and mobile forms of the elements are relatively low.

In addition, the soils show anomalies of As, Mo, Cr associated with ash and slag spoils of the thermoelectric plants (CCn of arsenic is 32, that of chromium and molybdenum is 14-16), and also weakly contrastive anomalies of Zn and Co in the traditional dwelling zone.

Pollution of the Plant Cover

The investigation of concentrations of heavy metals and other pollutants in plants is important to assess pollution of the urban area during the warm season, characterized by active water migration of pollutants from the polluted soils entering the plants. In plants of Poaceae, Compositae, Rosacae and Chenopodiacae families iron, manganese, copper, zinc, lead, nickel, cobalt, chromium, and cadmium were revealed (in extractions obtained by the method of wet decomposition with 10% HNO_3). These plants are most commonly represented in the plant cover of the city and its surrounding areas. Particularly great concentrations of the pollutants are in the plant cover of the traditional tent dwelling area, which is characterized by biogeochemical anomalies of Cd (Cb:l0), Pb (Cb:10), Co and Zn (Cb:3). The industrial zone also shows anomalies of Pb and Cr (Cb : 3).

The administrative-residential (central) zone shows some weakly contrastive lead-nickel anomaly of the plant cover (Cb :3-5).

Pollution of the Snow Cover

Usually the snow cover forms in late October and keeps until early March in the Ulaanbaatar area. The cold season is formed by the development of temperature inversions and weak circulation of a subinversive layer of atmospheric air, which leads to the concentration of pollutants in the near-ground layer. This is what creates the "ecological strain" of the cold season, and is the biggest hazard to human health. Snow has a high absorption capacity absorbing elements from the atmosphere. However, the anticyclone regime of the weather makes the snow cover discontinuous. The thickness of the snow cover within the city area varies widely, the indices differing 2-3-fold (in the year 2000 snow thickness ranged from 2.3 cm to 8.5 cm). Beyond the city boundaries, at the location of background monitoring in the Terelj region, the snow cover thickness was 8.5 - 10 cm in February, 2000.

Dust Content

In the city, the snow is characterized by high dust content values (Table 4). At the points of background control, dust content per 1 m of snow was 0.5- 0.6 g, wheresas the mean values for the city were 30-40 g with maximum values of 300 -800 g. The dust content in the urban snow cover is characterized by the presence of several concentration foci, territorially connected with relief features, location of technogenic sources of pollution and large sod-free areas not covered by snow. The higher values of dust concentrations were recorded in the industrial zone, and in the traditional dwelling zone in the northern and eastern parts of the city. The high dust concentration around power stations creates preconditions for accumulation in the snow cover and, subsequently, the plants and soils; a similar process is observed in traditional dwelling districts.

Concentration of Heavy Metals

Analysis of the distribution of pollutants in the snow cover revealed anomalous concentrations of cadmium, lead, arsenic in the snow cover of Ulaanbaatar, which is definitely associated with the composition of coal and coal ash used as fuel by the big thermoelectric stations, boiler facilities, and individual heating sources in the traditional dwelling districts. Comparison of the concentrations of a number of pollutants (lead, arsenic, cadmium, copper) in the snow water of urban samples and baseline snow sample scollected in Terelj demonstrate excess concentrations of arsenic at least by one order, that of cadmium by 1.5 to 10 times, that of lead by 50 times, and copper by 5 to 30 times. It is well differentiated throughout the city area, generally coinciding with the distinguished functional zones.

The concentration of metals in the snow dust and in the ash of ash and slag spoils of thermoelectric stations are fairly similar. A comparison of the elemental composition of the dust and the upper horizons of city soils does not appear to be correct, since the elemental composition of the upper horizon is also formed under the effect of aero- technogenic fall.

Medical and biological issues of the metropolitan environment

This part addresses the relationship between the health status of the population in general and in particular categories (children, teenagers, able adult population, and elderly people), and the ecological situation in the process of adaptation of the nomadic community to urban life over the last 50 years (from 1951 to 1999) in terms of health of the human society. In addition, the territory and age aspects of morbidity and mortality are examined with special reference to typological units on the environmental zoning map, and to the present borders of city regions.

As reference material for this research we used the medical statistics data from 1966 to 1999 provided by the Ulaanbaatar Department of Health, and the city archive data of mortality according to the records of the civil status (from 1951 to 1985). These materials have been generalized using the World Health Organization International Classification for Diseases, Trauma, and Causes of Mortality, recommended by the World Health Organization and approved by the World Health Assembly. It should be noted that the structure of data provided by the Mongolian organizations differs occasionally from the WHO approved classification. Therefore, in our study the medical statistics data are generalized on the level of a three-digit heading, and in some cases more detailed four-digit sub-rubrics were used *(World Classification of Diseases,* 1989).

Despite its relativity and possible errors, the reference of the medical statistics data presented by the Ulan-Ude Health Department were suitable for the environmental assessment in terms of its impact on the health status of residents over a protracted period. In further considerations we relied upon the absolute indices of morbidity and mortality within the six units, three-digit groups, the indices obtained in relation to ten thousand people and the relative percentage indices of morbidity in the following groups of diseases:

Infectious and Parasitic Diseases (IPD) including measles, whooping cough, rubella, jaundice (according to Mongolian medical statistics);

Neoplastic Diseases (ND), tumors including breast cancer;

Blood Circulation Diseases (BCD) including hypertension, heart ischemia, infarction, stroke;

A detailed description of the occurrence of some diseases is presented for the period from 1973 to 1978 and also from 1995 to 1999:

Respiratory Diseases (RD), including pneumonia;

Gastrointestinal Diseases (GID), including ulcers and colic;

Trauma, Poisoning and Accidents (TPA).

It is obvious, that together with urban development the structure of morbidity and mortality was subject to change. In fact in the mid 1950s, during the so-called "pre-industrial period", mortality was mostly caused by infectious and gastrointestinal diseases, whereas during the "industrial period" of totalitarian socialist regime (1960s through the 1970s) the main causes of mortality were respiratory diseases. In contrast, the early 1990s, characterized by economy collapse and transition to the market relations, brought some typically urban diseases, such as infarction and stroke, as well as trauma and accidents (Figure 1).

Environmental impact (eco-geochemical conditions) on health and biology

The environment is a dynamic medium, but despite its potential for self-purification, it has been gradually deteriorating in terms of ecological and geochemical indices. Continuous exposure to a low concentration of pollutants is characteristic for the Ulaanbaatar atmosphere. The air is polluted with sulfur oxide, nitrogen dioxide and polycyclic hydrocarbons, and with a high concentration of dust particles. According to the State Agency for Hydrometeorology of Mongolia, the dynamics for pollutant concentration in the air shows a tendency to deterioration.

Although this is a general tendency for all large cities, it primarily applies to cities with thermal energy production such as Ulaanbaatar. In addition, the social and economic processes in the city's development and formation of a specific urban environment have essentially contributed to its numerous problems regarding the present sanitary-hygiene situation. The formation of the Ulaanbaatar architectural visage was undoubtedly ahead of the rate of development of the urban community. The nomadic people have been changing their traditional lifestyle and migrating to the urban area, and this process is still underway.

The staple foods of Mongols basically remain meat and dairy products, cereals (mainly rice), tea (green tea and milk) (Maiskiy, 1950), but recently the diet has been somewhat modified by increased consumption of fish, vegetables, fruit, soft drinks, beer, bread and biscuits. Thus, the shortage of the direct consumption of vitamins and carbohydrate is compensated by meat and dairy food, which are rich in protein and fat. However, there is a predisposition of gastrointestinal diseases among Mongols.

The retained tradition of big family-clans promotes the transmission of infectious and virus caused diseases.

General structure of morbidity for the Ulaanbaatar population (1966-1999)

The general structure of morbidity of the Ulaanbaatar population is presented in Table

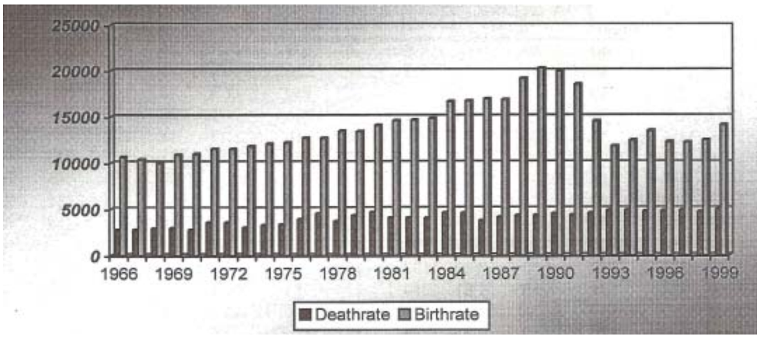

Figure l. Dynamics of death rate and birth rate of Ulaanbaatar citizens

6. The total adult morbidity (referral rate for medical assistance) shows a rising tendency from the mid 1960s to early 1990s: the referral rate has increased five times from 1966 to 1992. This increase was accounted for by the deterioration of the urban environment and the progress in sanitary education, with an expanded network of medical facilities and large-scale prophylactic medical examination for the personnel of state-owned enterprises.

The time intervals selected to assess the general situation of morbidity made it possible to accurately trace patterns of structural change of morbidity due to the enlarged urban area, complicated housing structure, expansion of the industrial zones, etc. In the 1960s the main causes for referrals were gastrointestinal diseases (ulcers, colitis, and enteritis). By the end of the 1960s the highest ranking disease was respiratory illness, and its proportion in the total structure of referrals increased. This may be attributed to the increased impact of the thermal energy complex on the urban environment, along with unfavorable climate features, including anticyclone weather during wintertime. During this period the people residing in the traditional dwellings are likely to use more coal to heat their houses, instead of wood and dry dung.

The WHO specialists attribute up to 20 % of health impairment in the population to the state of the environment (Prokhorov, 1996), and in the case of urbanized systems of Central Asia up to 40%. The highest morbidity was recorded in the early 1990s, which may be accounted for by the drastic change in social and economic conditions and a corresponding response of the urban population. As the morbidity was mostly blood circulation diseases (hypertension, infarction, and stroke) a psychological-emotional factor should be considered. The data on mortality caused by the ischemia diseases have not been distinguished from the overall body of data on blood circulation diseases, but were similar to the situation in other countries with a post-communist regime. There are grounds to believe that able men (30-59 years) were affected to the greatest extent. Similar to other countries with political and economic transition, over 70 percent of the Mongolian population live in a state of long-term emotional and social stress, which leads to depression, severe neurosis, psychological disturbances, and alcoholism etc.

The relative increase in the ontological group of blood circulation diseases may also be explained by these causes. Compared to the 1960s and 1970s, it increased 3-5 times. This is also supported by the increased rate of trauma, accidents and poisoning by the end of the 1990s. The relative increase is 3-4 times compared to the 1960s.

Table 5. Morbidity per groups of diseases (per ten thousand persons)

Horologic Forms	**1966**	**1976**	**1986**	**1992**	**1999**
Total	1678.1	3851.1	4989.1	8803.1	1708.5
Including: Infectious parasite diseases (IPD)	148.6	220.1	127.1	53.6	54.6
Oncology tumors (ND)	22	57.1	32.4	48.5	57.8
Blood circulation diseases (BCD)	114.4	81.4	100.3	1192.5	256.3
Respiratory diseases (RD)	348.2	2302.9	2665.1	4517.7	410.8
Gastrointestinal diseases (GID)	886.9	945.3	1708.1	2450.2	464.4
Trauma, poisoning, accidents (TPA)	178	275	384.5	572.9	484.6

It should be noted that the total number of diseases has diminished. But most likely, this is not due to improved health, but is rather an indication of the reduced rate of referrals due to the aggravated social and economic status of the patient, as well as to the introduction of paid medicine in Mongolia. The increase in trauma rate is attributed to street trauma, when medical aid comes on call.

All six groups of diseases are evenly distributed in the elderly age class, with blood circulation diseases (infarction, stroke, hypertension) accounting for 25-30%; accidents, trauma, poisoning for 20-25%, and the gastrointestinal and respiratory diseases by 15-20%. Compared to the other age class groups this class shows a higher incidence of oncology diseases (5-10%).

Due to the complicated environmental situation in winter, respiratory diseases mostly affect infants and toddlers. However, the older age classes are also adversely affected, although as they do not ask for medical aid they may not show up as respiratory disease cases. According to the medical statistics the diseases of the elderly people of Ulaanbaatar (over 55 years) are manifested earlier than usual, and their structure is typical of the elderly age diseases, with blood circulation diseases prevailing. Thus, the impact of social and ecological factors on morbidity is found in almost all the age class groups.

The sanitary-hygiene situation is largely influenced by the social and economic processes, which are characterized by a transition from the traditional nomadic lifestyle to the developing urban lifestyle, changes in behavior motivations, changes in nutrition, and also morbidity structure over the last 50 years. The predominant types of diseases from 1951 to 1999 show a pattern: from infectious and gastrointestinal diseases in the 1950s and 1960s to the respiratory diseases in the 1970s and 1980s, and blood circulation, accidents, trauma and poisoning at the present time. The determining factors in this case are thermal energy specialization of the city industry, large expansion of traditional housing in the residential zone, the changed diet pattern, and changes in the economic system over the last ten years. The age-sex aspects in the morbidity structure are characterized by a high rate of infant mortality, increased incidence and high rate of mortality among the men of 30-50 years of age caused by blood circulation diseases (infarction, stroke), and the oncology statistics show a predominance of breast cancer in women. The territorial aspects reflect the degree of comfort, including the impact of congested living, the development of central heating, running water supply, sewage service, telephone, the development of public motor vehicle transport, and the establishment of green plantations.

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Хураангуй

Энэхүү өгүүлэлд Монгол улсын хүн ам төвлөрсөн суурин газар болон нийслэл хотын бүрэлдэж буй болсон байдал, үйлдвэрлэлийн

зүгээс хот суурин орчмын ландшафтын бохирдол болон хүн амын эрүүл мэндэд үзүүлэх нөлөөллийг судалсан судалгааны дүнг тусгасан болно. Тус улсын нийслэл Улаанбаатар хот нь Төв Азийн бүс нутагт орших хамгийн их бохирдолтой хотуудын нэг юм. Тус хотын хөрс, цасан бүрхүүл, ургамал болон хүний үсний дээжинд агуулагдах хортой элементүүдийн хэмжээ болон тархацыг хотын экологийн бүс бүрээр харьцуулан тодорхойлов. Дэлхийн Эрүүл Мэндийн Байгууллагын ангиллыг үндэслэн хотын хүн амын төрөлт, өвчлөлийн зэрэг болон нас баралтын хэмжээг өвчний төрөл бүрээр харьцуулж гаргав.

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