# Impact of environmental factors on the demographic characteristics in Tomsk Oblast (Russia, 1980-2015)

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**Abstract.** The research represents the analysis of essential demographic indexes in Tomsk Oblast (Russia): birth-rate, death-rate, natural increase (1980-2015), migration increase (1997-2014), and child mortality (1990-2015). Environmental factors were determined as influencing the health and as a consequence, having the impact on the demographic characteristics of the studied region.

## 1. Introduction

Tomsk Oblast is situated in the southeast of the Western Siberian lowland in the Middle Ob River. It takes the territory of 314,400 square km (1.9% of the Russian Federation) [1]. The climate in Tomsk Oblast is continental due to its geographic location in the temperate latitude: 55-56° N. Average-year air temperature ranges from -0.5° C in Tomsk to -3.5° C in the northeast of the region.

On January 1st, 2016 the constant population base accounted 1076,800 people; the density of population was 3.43 people per 1 square km [2]. The region includes 6 cities, 1 urban-type settlement, and 694 villages. Distribution of the population in the region territory is irregular. The essential part of the population lives in the southeast of the region because remote places have undeveloped traffic system and weak economical-geographical characteristics. By the ratio of urban and village population Tomsk Oblast relates to the highly urbanized territories with 71.6% of urban population. The industrial production is predominately concentrated in two cities – Tomsk and Seversk. The northern areas of the region are the places of the location of large oil-producing facilities.

## 2. Results and discussion

The analysis of the indexes of natural population migration in Tomsk Oblast over the last 35 years allowed detecting the following essential attributes of the demographic situation.

1. The birth-rate index constantly decreased from 1983 to 1995, at the same time the mortality increased (figure 1) [2-4]. The natural increase of the population from 1980 to 1993 was positive. The maximum value of the natural increase index was marked in 1983 (11.4 for 1000 people).

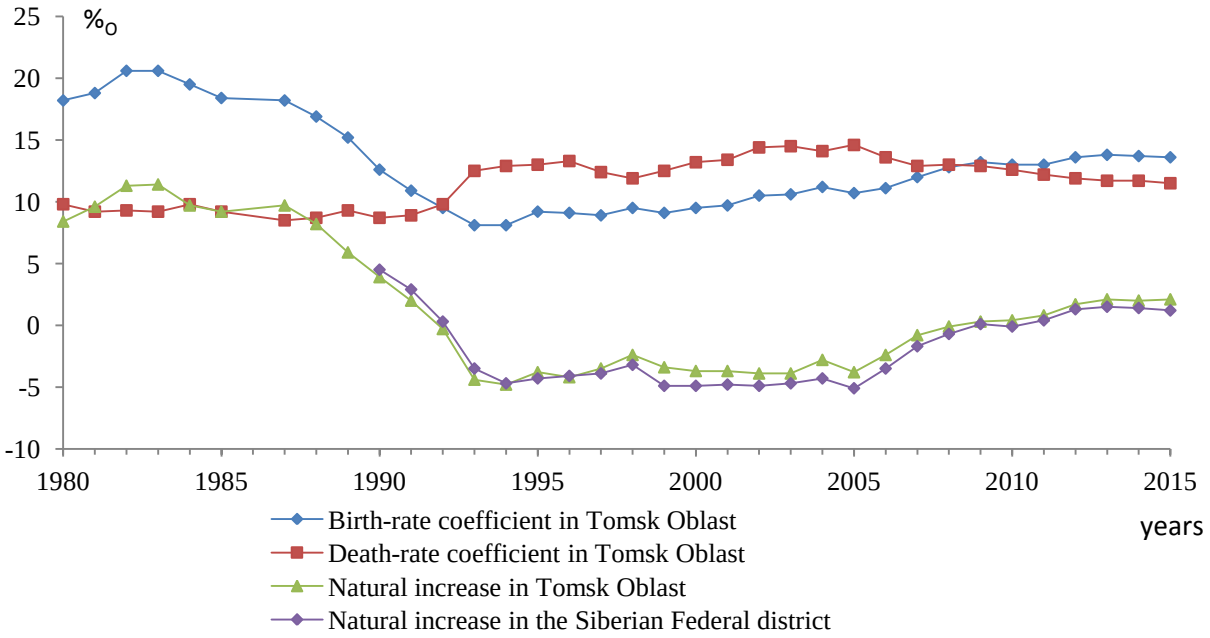


**Figure 1.** Dynamic of the indexes of natural population change (per 1000 people) from 1980 to 2015. The graphs were made using the data from [2-4].

In 1992 the increase of the population in Tomsk Oblast sharply stopped, as well as in the whole Russia, the birth-rate index corresponded to the death-rate. This situation was named "Russian cross". In the graphs of the natural movement of the population the death curve crosses the birth cross. After 1992 the dead amount gradually began to exceed the birth number. In the opinion of demographers, this situation was formed after the collapse of the USSR. Due to the incompleteness of the modernization processes a challenging social-economic situation has formed.

Since 2006 the death-rate in Tomsk Oblast began to decrease and in 2009 the index of natural increase was positive. In 2009 the situation of the "Russian cross" repeated. Since 2010 the birth-rate gradually began to exceed the death-rate. In 2015 the birth-rate was 13.6 births per 1000 people, the death-rate was 11.5, that was 15% lower than the birth-rate. Such a trend in the natural population increase from 1994 to 2015 was also observed for the Siberian Federal District (SFD) [2, 5]. At the same time the whole Central Russia and many regions of the Russian Federation had natural decrease of the population in 2014.

Such an index of demographic well-being as child mortality for the last 24 years has approximately corresponded to the data of the SFD with the tendency to decrease (figure 2). The main reasons of the child death under 1 year are often perinatal condition (54.4%), congenital anomalies (17.8%), indeterminate diagnosis (11.9%), accidents and poisoning (8.9) [5, 6]. The period from 2007 to 2015 in the Tomsk Oblast has been notable as the most indicative in the child mortality decrease. In the beginning of 2016 the region had first place in the SFD (the lowest level of the mortality – 4.7 per 1000 of living born children) and fifth place in Russia.

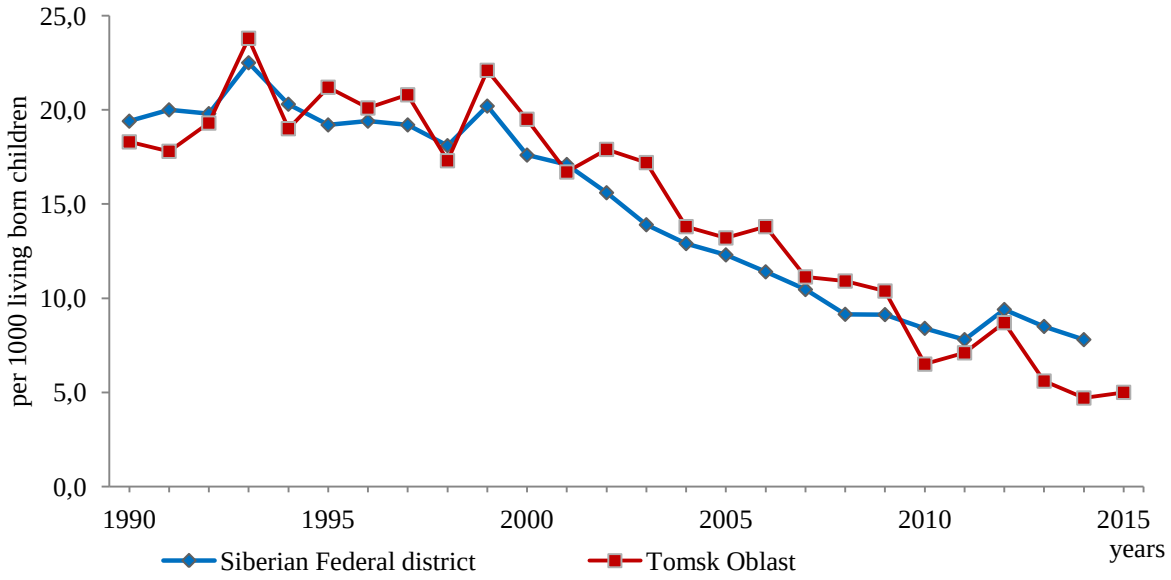


**Figure 2**. Child mortality from 1990 to 2015 (per 1000 living born children). The graphs were made using the data from [6].

One of the determining factors influencing the demographic indexes is people health. In the dynamic of the morbidity index a growth tendency of the first-diagnosed diseases has been found (figure 3).

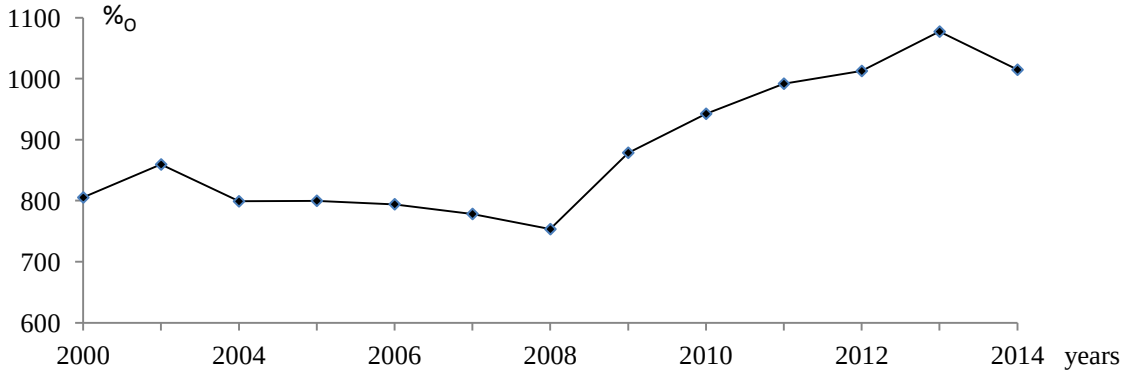


**Figure 3.** Morbidity of the population (registered with the first-diagnosed diseases, per 1000 people). The graphs were made using the data from [4].

The primary diseases incidence from 2000 to 2013 increased from 805.3 to 1014.7‰ with the first-diagnosed diseases [4]. In the structure of the primary morbidity of the population of the Tomsk Oblast the largest part is due to respiratory diseases, accidents and poisonings, diseases of the genitourinary system, infectious and parasitic diseases, and eye and it's appendages diseases.

For the last 10 years among the reasons of the population death the diseases of circulation organs, neoplasms, diseases of the digestive system, respiratory diseases, and infectious and parasitic diseases have had the leading place (table).

**Table**. Death-rate by the main classes of the death reasons (number of the dead per 100,000 people) [4].

| **Death reasons** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
|---|---|---|---|---|---|---|---|---|---|---|
| neoplasms | 204.8 | 213 | 216.5 | 222.7 | 219.4 | 214.3 | 219.9 | 212.4 | 205.7 | 205.1 |
| diseases of circulation organs | 677.4 | 615.1 | 596.2 | 617.5 | 619.7 | 612.7 | 573.9 | 528.5 | 519.6 | 515.5 |
| respiratory diseases | 70.1 | 60 | 57.1 | 53 | 57.9 | 45.5 | 57.4 | 54.9 | 64.8 | 67 |
| diseases of the digestive system | 74.1 | 73 | 65.2 | 66 | 66.6 | 66.1 | 58.7 | 67 | 62.5 | 79.5 |
| infectious and parasitic diseases | 23.4 | 18 | 17 | 16.1 | 17.6 | 14 | 13.1 | 13.7 | 15.3 | 19.1 |

In the structure of the mortality of employable population of the region the leading places have the same death reasons. But the first place is accidents and poisonings (29.5%), second one – diseases of circulation organs (28.9%), third place – neoplasms (16%).

One more important demographic index is the migration processes of the population (figure 4).

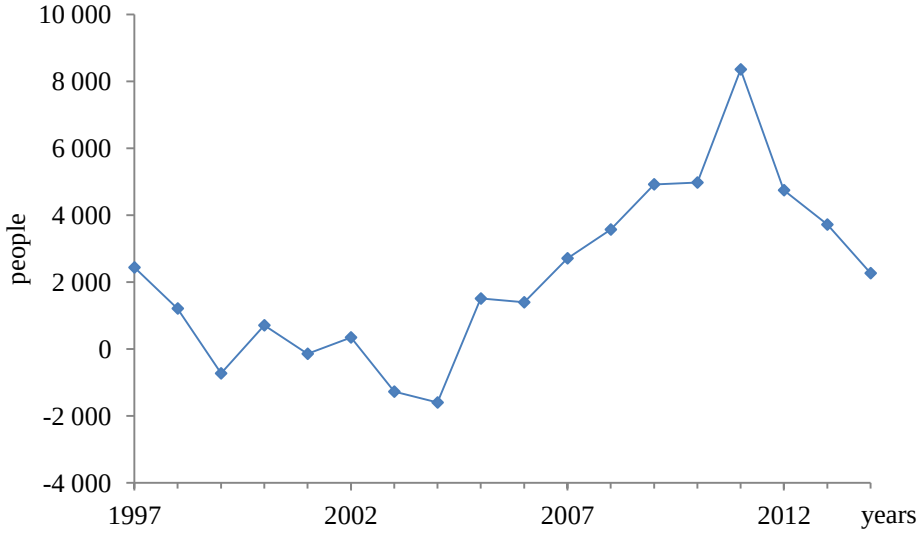


**Figure 4.** Migration increase of the population of Tomsk Oblast from 1997 to 2014. The graph was made using the data from [3, 4, 6]

From 2005 to 2011 an influx of foreign and Russian immigrants has grown in Tomsk Oblast in comparison with the period from 1997 to 2004. This fact was probably caused by the increase of the status value of Tomsk universities and student arrival, and by the attractiveness of the essential social-economic situation in the region [7].

2. Demographic characteristics are first of all determined by the condition of the population heath, which is defined by environmental factors in a greater extent.

Since 2011 a steady reduction of emissions in the atmosphere has been observed in Tomsk Oblast [1]. This tendency is connected with the decrease in the oil and gas extraction and with the realization of programs on the utilization of oil-associated gas. Since 2010 the provision of the population by safe

water has been about 60-65%. But along with this situation, in 2014 524 water pipes were used for the domestic water consumption, and 81.3% from them did not satisfied sanitary requirements due to the absence of the protective sanitary zones and necessary complex of water-treatment equipment [4]. In 2014 367.20 billions $m^3$ of sewage water were discharged in water ponds, which is 3.71 billions $m^3$ less than in 2013. Since 2005 this indicator decreased by 170.6 billions $m^3$.

The radiation situation in Tomsk Oblast was generally formed due to the atmospheric deposition of radionuclides caused by the former nuclear tests in polygons of other regions of Russia, and by the radionuclide pollution because of the Siberian Chemical Combine (SCC) functioning, radioactive waste storage, and accidents [1, 8]. For the last 15 years the radiation doze rate in the settlements of Tomsk Oblast was within the limits of the natural radiation background – from 6 to 13 $\mu R \cdot hour^{-1}$ with the mean values of 7-10 $\mu R \cdot hour^{-1}$. The radiation situation connected with the trace of the accident in 1993 in SCC now is normalized. The radionuclide concentration in food, drinking water, soil, and atmospheric air is within the standards.

All types of waste cause negative environmental impact in different extent. From 1990 to 2001 the volume of waste has been about 1,500 000 tons a year, from 2002 to 2009 it is decreased to 641,000 tons a year. In 2014 771,000 tons of wastes were formed from industry and 330,400 tons were domestic wastes.

By the condition of the atmosphere, surface and ground water the region is determined as a zone of high environmental hazard. Environmental factors can have indirect impact on some diseases, first of all on child pathologies, child mortality, and also on respiratory system, circulation and digestion system, which take a leading place in the structure of the main population diseases.

Natural-environmental factors of Tomsk region determine sanitary-epidemiological situation by the tick-borne encephalitis and opisthorchiasis diseases [9, 10]. Since 2001 a constant tendency in the decreasing amount of patients with the tick-borne encephalitis has been observed. In 2001 504 people were revealed, in 2007 – 307 people, in 2008 – 263 people, in 2012 – 131 people, in 2013 – 143 people. Due to the location of Tomsk Oblast in the water area of Ob-Irtysh basin and due to the active consumption of river fish by the population, one of the most socially important problems for the region is the opisthorchiasis disease. The accounted 400-600 cases per 100,000 people for the last 10 years.

In the structure of the death reasons from infectious and parasitic diseases for the last 10 years the death-rate coefficient has been declining, with the negligible rise in 2013 and 2014 (Table).

3. Social regional programs, maintained by the country, are directed to the heath protection, healthcare delivery, and, as a consequence, to the demographic indexes. For example, from January 1st, 2007 the program “mother (family) capital” began functioning [11]. The main objective of the program is the stimulation of the birth rate and the improvement of the demographic situation in the country. The opening of the “Regional Perinatal Center” in 2010 contributed to the decline of the child deaths (under 1 year). The Center is equipped by unique medical facilities satisfied to modern requirements [12]. Since 2012 the program “Population health survey” has contributed to the preventive examination and early definition of diseases of the adult population; the application of additional reproductive technologies (extracorporal fertilization) has been provided under the base program of the compulsory health insurance. The system of the specialized medical help includes the application of new complicated and (or) unique methods of therapy, and also resource-intensive methods of therapy with the proved effectiveness, including cell technologies, robotic technics, information technologies and genetic engineering, developed on the basis of medical advances and related fields of science and technology. Arrangements on the development of high-technology medical help were taken as a basis for the state program “The development of the heath care protection of Tomsk Oblast” for years 2015-2020.

The strategic objectives of the social-economic development of the region supposes the decrease of the morbidity and mortality, increase of longevity of the population, improvement of the quality of medical services with the maintaining free medical service in the region [13].

## 3. Conclusion

Thus, the main demographic characteristics of Tomsk Oblast since 90-s and until 2008 have reflected pronounced features of the demographic crisis. After 2008 a negligible, but stable excess of the natural increase has been fixed. Since 2000 the child mortality declined. These tendencies have been determined to a large extent by the regional social-economic reasons, but they have been aggravated by the local natural and environmental conditions. Taking into account the large territory of Tomsk Oblast and different social-environmental-economic situation in every municipal-administrative unit, the further analysis of demographic characteristics is necessary to carry out on the basis of indexes of ranking and zoning.

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