A. A. Ivanova, L. A. Aprosimov, A. F. Potapov, L. F. Timofeev

Working-Age Population Mortality in the Republic of Sakha (Yakutia): Regional Characteristics

ABSTRACT

The purpose of this study is to examine the regional characteristics of the working-age population mortality in the Republic of Sakha (Yakutia). With the use of the continuous statistical method and the method of mathematical analysis, there was done a retrospective analysis of the official data from mortality reports by the Territorial Office of the Federal State Statistics Service (FSSS) and demographic yearbooks of the Republic of Sakha (Yakutia) for the period of 1990-2014. It was found out that the distinguishing feature of the mortality in the republic is a high level of human losses in the younger age groups from preventable causes. As of 2013 data, the mortality rate of the working-age population exceeded the Russian Federation average by 5%, in particular, cardiovascular diseases – by 10.3%, external causes – by 26.7%. At the same time, Yakutia demonstrates a decreasing trend of the working - age population mortality from all the major classes of the causes, which determined the 2014 decrease in crude mortality rate in this age group by 5.1% (down to 5.7 per 1,000 population of the corresponding age). In the structure of causes of death in working-age population of the Russian Federation as a whole, the ranking places were successively occupied by cardiovascular diseases (170.3 per 100 thousand people of working age), external causes (158.3), and neoplasms (81.9). In Yakutia, the leading position went to external causes (216.1), followed by cardiovascular diseases (189.9), and neoplasms (67.1).

The study of the level, structure and trends of the working-age population mortality in the republic in the context of different health-economic groups of regions (Arctic, industrial, rural) reveals significant intra-regional variations in the data. In the period 1990-2014, all the groups of regions showed significant increase in the working-age population mortality rate. It should be noted that the rural group rate was remaining relatively stable, as there was no increase in the mortality of working-age women; still, it was higher than the average republic's indicator by 7.0%. Since 2000, the Arctic regions showed the highest mortality rates in the working-age group in the republic, with the excess being observed in both men and women. Over the entire study period, the group of industrial regions demonstrated a relatively prosperous situation, despite a growing trend.

Differences were also identified in the structure of the main causes of mortality of the working-age people in different groups of regions. The Arctic group experienced the highest numbers of deaths from cardiovascular diseases (345.7 per 100 thousand people of working age), digestive diseases (56.4), external causes (404.5), whereas the industrial group – from infectious diseases (20.0) and neoplasms (75.0). The rural group, with the average numbers for all the major causes, showed an upward trend in mortality from cardiovascular diseases and external causes.

Premature mortality of working-age people in the republic results in economic cost for the society, which annually makes the average of 0.4% of the gross regional product.

Keywords: population mortality, working age, economic cost.

BACKGROUND

Mortality is one of the main indicators characterizing the level of socio-economic development and welfare of certain areas, public health, accessibility and quality of the services [5]. Regions of the Russian Federation, so different in various living conditions of people, differ in the rate of mortality, as well. [3] A distinctive feature of health in the Republic of Sakha (Yakutia) is the problem of premature mortality with a high birth rate and positive natural growth of the population. The high share of human losses in the younger age groups has a negative impact on the formation of human resources, as well as on the demographic situation in the area as a whole. [1] As of 2012 data, the mortality rate of the working-age population exceeded the Russian Federation average by 12.0% (649.4 and 575.7 per 100 thousand population, respectively). The year 2014 witnessed positive dynamics, and the analyzed parameter decreased to the national average – 5.7 ‰; still, it exceeds the 1990 figure by 14.0%.

The different groups of regions of the republic demonstrate significant differentiation of mortality parameters due to the socio-economic conditions in which people live, territorial differences in resources supply, and performance of the therapeutic and preventive care system.[2]

Aim: to study regional characteristics of the working-age population mortality in the Republic of Sakha (Yakutia).

MATERIAL AND METHODS

The main sources of information were the reports on the age and sex composition by regions of the Republic of Sakha (Yakutia), published by the Territorial Unit of the Federal State Statistics Service in 1994-2014; demographic yearbooks of the Republic of Sakha (Yakutia); reports on mortality in 2000-2014. The continuous method was used to characterize the level,

structure and trends of mortality in the working-age population in the republic as a whole, as well as in the context of different medical-economic groups: Arctic, industrial, and rural. The groups of regions were formed basing on the medical-economic zoning of administrative-territorial units of the Republic of Sakha (Yakutia) (L.F. Timofeev, V.G. Krivoshapkin, 2006). [4] The calculation of the economic cost caused by the working-age population mortality is made according to the methodology approved by orders of the Ministry of Economic Development of Russia No. 192, Russian Health Ministry No. 323н, Ministry of Finance of Russia No. 45н, and Federal State Statistics Service No. 113 of 10.04.2012 "On approving the methodology for calculating the economic cost of mortality, morbidity and disability of the population." Under the method of calculating, the economic cost of mortality was considered as losses associated with the underproduction of gross regional product (GRP) due to the disposal of an individual from labor activity because of death.

RESULTS

The annual loss of the working-age population in the republic make over 40% of all deaths: in 1990 – 44.2%, in 2010 – 46.9%, in 2013 – 40.2%. The dynamics of the index was characterized by undulating course and experienced two growth periods, the first of which fell on 1990-1995, when the mortality rate for both genders rose by 63.0%, with the mortality of working-age men increasing by 71.0% (from 7.5 to 12.8 ‰), which was four times higher than the figure for women; the increase in the mortality rate of women was 60%. Starting from 1996, there was a deceasing trend in the analyzed indicators, which was replaced by another rise in male mortality up to 12.0 ‰ in 1999-2004, which led to worse general indicators for both genders. Later, since 2010, there has been a tendency for reduced annual loss of life in the working-age population however; the 2014 level was still higher than that of 1990 by 12.5% for both genders.

Since 1996, the mortality rate of the working-age population in the republic consistently exceeds the Russian Federation average, and it amounted to 5.9‰ in 2013 (in the Russian Federation - 5.6). With the mortality rate of working-age people decreased by 32% in the Russian Federation in 2005-2013, Yakutia had a lower rate of reduction (16%). (Table 1)

Table 1

Dynamics of the working-age population mortality rate in the Republic of Sakha (Yakutia) (per 1,000 people of the relevant age)

Years	Republic of Sakha (Yakutia)			Russian Federation
	Both genders	Men	Women	Both genders
1990	4.9	7.5	2.0	4.9
1991	5.0	7.4	2.3	5.0
1992	6.2	9.5	2.5	5.8
1993	7.1	11.0	2.8	7.4
1994	8.0	12.3	3.1	8.4
1995	8.0	12.8	3.2	8.0
1996	7.4	11.2	3.2	7.1
1997	6.7	10.2	2.9	6.3
1998	6.6	9.9	3.0	6.1
1999	7.2	10.9	3.3	6.8
2000	7.3	11.3	3.2	7.3
2001	7.9	12.2	3.4	7.5
2002	7.8	12.1	3.5	6.8
2003	7.7	12.0	3.4	7.2
2004	7.7	12.0	3.4	7.2
2005	7.0	11.0	3.2	8.3
2006	7.2	11.1	3.3	7.5
2007	6.8	10.6	2.9	7.0
2008	7.2	11.2	3.1	6.9
2009	7.3	11.1	3.2	6.4
2010	7.2	11.2	3.1	6.3
2011	6.8	10.3	3.0	6.0
2012	6.5	10.0	2.7	5.7
2013	5.9	9.1	2.4	5.6

In the structure of causes of death of the working-age population during the study period, accidents, poisonings and injuries ranked first, followed by cardiovascular diseases and neoplasms, except the year 2010, when the mortality rate from cardiovascular diseases exceeded all other indicators. In respect of individual classes of causes, the period of 1990-2012 saw an

increase in deaths from certain infectious and parasitic diseases – by 35.6%, from cardiovascular diseases – by 2 times, respiratory diseases – by 53.3%, from digestive diseases – more than 2 times, and from external causes – 1.8%. In the following period of 2013-2014, because of large-scale measures to reduce mortality, there were marked positive changes in the medical and demographic situation of the area. Mortality indices went down significantly, including those for infectious diseases and cardiovascular diseases decreasing by 13.0%, respiratory diseases – 26.6%, digestive diseases – 23.9%, external causes – 8.9% (Table 2).

Table 2

Mortality indices for the working-age population by main and particular causes in the Republic of Sakha (Yakutia)

(per 100,000 of working-age people)

Cause of death	1990	1995	2000	2005	2010	2011	2012	2013	2014
All causes	487.5	818.3	737.9	773.6	725.5	679.0	649.4	590.6	559.0
Infectious and parasite diseases	11.8	20.9	18.6	17.5	12.5	16.9	16.0	13.2	13.9
Neoplasms	78.6	87.2	78.4	79.0	64.2	67.1	73.9	67.1	62.8
Cardiovascular diseases	108.4	206.0	193.2	264.2	260.3	231.0	218.9	189.9	190.0
Respiratory diseases	15.2	27.1	28.4	30.5	23.4	24.6	23.3	18.8	17.1
Digestive diseases	18.7	56.0	40.9	43.9	55.9	46.7	42.7	39.8	32.5
External causes, including:	221.3	350.1	324.2	291.7	252.9	240.1	225.2	216.1	205.1
- road accidents			24.0	28.6	19.6	26.3	23.8	28.2	21.2
- suicides			68.9	67.0	56.1	56.0	55.0	50.9	50.6
- homicides			74.8	70.5	47.7	39.7	40.0	37.2	30.3

The breakdown of the main causes of mortality of the working-age population in Yakutia in 2011-2014 was as follows: external causes – 36.0%, cardiovascular diseases –33.5%, neoplasms – 11.0%.

Ranking of the main causes in the Russian Federation was different during the entire study period, with the leading position going to cardiovascular diseases (170.3 per 100 thousand population), followed by external causes (158.3), and neoplasms (81.9).

The gender differences are so that the mortality rate among working-age men is 4 times higher than the mortality rate of women in the same age category. In 2014, men accounted for 79.8% of the total number of deaths in working age (four out of every five deaths). External causes led to the death of almost every second deceased man of working age (42.1%) and every third deceased woman (28.7%). To a large extent, this disadvantage stems from the spread of alcohol abuse and alcoholism, with a worse crime situation in the country as a whole, and the republic, as well.

In terms of specific causes of death, the proportion of working-age people is the dominant value. For example, among the dead from tuberculosis, working-age people accounted for 73%, mental disorders – 50%, accidents – 82.5%, suicides – 87.1%. (Table 3)

Table 3

Share of the working-age people dying of individual causes (in %)

Cause of death	Working-age population share
Tuberculosis	73.0
Mental disorders	50.0
Chronic alcoholism	62.5
Alcoholic liver diseases	70.6
Accidents and poisoning	82.5
Alcohol poisoning	77.4
Suicides	87.1

A retrospective analysis of mortality of the working-age population in the Arctic, rural and industrial groups of regions of the republic revealed significant variations of indicators. By 2012, the total mortality of the working-age population, against 1990, increased in all the compared groups: in the rural group – by 29.6%, industrial – by 18.4%, the Arctic – by 2.5 times.

Of particular note is a significant growth in the Arctic regions, where, since 2000, the level of human losses of working age is almost 1.5 times higher than that of the rural and industrial groups and the republic as a whole. The subsequent declines in 2013-2014 took place in the Arctic regions, where the rate of decline made 18.3%, in the industrial – 4.0%, whereas the rural group experienced certain stagnation. (Table 4)

Table 4

Working-age mortality rate in different groups of regions of the Republic of Sakha (Yakutia) (per 1,000 people of the relevant age and gender)

Groups of regions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2012	2013	2014
Rural	5.4	7.3	6.9	7.9	6.8	7.2	7.4	7.9	7.5	7.0	6.4	6.4
Arctic	4.0	8.3	**8.9**	**11.3**	**9.9**	**10.2**	**11.3**	**11.0**	**11.8**	**10.1**	**10.4**	**8.5**
Industrial	4.9	8.3	6.8	7.0	6.9	6.1	6.5	6.4	6.6	5.8	5.2	5.0
Sakha Republic (Yakutia)	4.9	8.0	7.3	7.8	7.2	6.8	7.2	7.3	7.2	6.5	5.9	5.6

It should be noted that the Arctic regions demonstrate the highest mortality rates in the republic for both men and women of working age (Table 5). As of 2012 data, the mortality rate of working-age men in the Arctic regions was 26.2% higher than in the rural group, and 37.9% than in the industrial one; the mortality rate of women was higher by 44.2 and 55.8%, respectively.

Table 5

Mortality indices of men and women of the working age in different groups of regions in 1990-2012 (per 1,000 people of the relevant gender and age)

Groups of regions	1990		1995		2000		2005		2010		2012	
	Men	Women	M	W	M	W	M	W	M	W	M	W
Rural	8.0	2.8	10.9	3.3	11.3	3.2	12.2	3.3	11.4	3.2	10.7	2.9
Arctic	7.0	2.4	12.3	3.7	12.6	4.4	17.1	4.8	17.2	5.7	14.5	5.2
Industrial	7.3	2.2	12.8	3.2	10.4	3.0	11.0	2.9	10.5	2.7	9.0	2.3
SR(Y)	7.4	2.3	12.2	3.3	10.4	3.2	12.2	3.2	11.2	3	10.0	2.7

In the beginning of the study, the rural group showed the highest mortality rate of working-age men (8.0 per 100 thousand population) among the three groups, but later, the figure did not change much, and in 2012 it became lower than the Arctic group figure by 35.5 % (10.7 and 14.5, respectively). The mortality rate of working-age women in 1990-2012 remained

virtually unchanged (2.8 and 2.9 per 100 thousand of the working population), but was higher than the republic's average by 6.9%.

Throughout the study period, the industrial group demonstrated the lowest mortality rates of the working-age population for both genders and a relatively slow growth rate (by 18.0%); since 2000, these regions enjoy the most prosperous situation with mortality of working-age men and women. The proportion of deaths in working age is 41.8%; (in rural - 42.8%, in the Arctic - 53.6%).

The analysis of the main causes of mortality of the working-age population in the compared groups also showed differences. For example, in the Arctic regions, the situation remains serious for cardiovascular diseases, digestive diseases, and external causes (Table 6). The mortality rate from cardiovascular diseases exceeds that of the rural and industrial groups by 1.6 times, from digestive diseases – by 1.5 and 1.3 times, external causes – by 1.4 and 2.3 times.

Table 6

Mortality indices of the working-age population of certain main causes in different groups of regions (per 100,000 people of the relevant gender and age)

Groups of regions	Infectious diseases	Neoplasms	Cardiovascular diseases	Respiratory diseases	Digestive diseases	External causes	All causes
Rural	10.0	70.3	216.0	20.6	37.7	284.0	696.5
Arctic	7.0	71.1	**345.7**	14.7	**56.4**	**404.5**	1012.6
Industrial	**20.0**	**75.0**	204.2	27.0	43.0	176.4	581.4
SR(Y)	16.0	73.9	218.9	23.3	42.7	225.2	649.4

Mortality rates of the working-age population in the rural group from the main causes are quite comparable with the republic's average, except for external causes, the figure for which is 20.7% higher than in the republic, and 37.9% than in the industrial regions. The industrial group has relatively high mortality rates from infectious diseases, neoplasms, and respiratory diseases.

In the structure of the economic cost, the greatest share of losses in all classes of diseases in the context of age groups was observed in the older working men aged 49-54 years, women in the age groups 49-56 and 58-59 years. Cardiovascular diseases (38.2%) and external causes of death (30.0%) make the largest contribution to the economic losses. The third place in the

structure of the economic cost goes to neoplasms (12.2%). The mortality rate of the working-age population of the three main causes accounts for 79.5% of the economic cost. They are followed by mortality from digestive (6.6%) and respiratory (3.4%) diseases.

In the cardiovascular diseases class, women account for more economic losses from mortality by 3.2% (40.5%), whereas in the class of injuries, poisoning and certain other external causes – men by 1.8 times (34.1 %). The economic cost for men is almost 3 times higher than the losses among women and average annually to 74% of all losses.

Overall, the economic cost of premature mortality in the Republic of Sakha (Yakutia) in the study period increased by 17.7%, and in 2012, it amounted to 2,166.7 million rubles, or 0.4% of the gross regional product of the republic.

CONCLUSION

Thus, the Republic of Sakha (Yakutia) still faces a problem of high mortality of the working-age population of both genders from preventable causes (external causes, cardiovascular, digestive, respiratory, and infectious diseases), which, given a growing trend in the proportion of retirement-age people and continuing migration loss of working-age people, has a negative impact on the formation of labor resources in the republic. The use of the zoning method revealed intra-regional differences in both the level and the structure of human losses. Understanding of mortality characteristics in certain regions is necessary to develop a set of measures to reduce premature mortality from specific causes.

REFERENCES

1. Ivanova A.A. Timofeev L.F. Potapov A.F. Aprosimov L.A. Mediko-demograficheskaja situacija v arkticheskih rajonah Respubliki Saha (Jakutija) [Medical-demographic situation in the Arctic regions of the Republic of Sakha (Yakutia))] Bjulleten' NNII obshhestvennogo zdorov'ja RAMN [Bulletin of the Research Institute of Public Health, RAMS]. Moscow, 2012, Issue 4, P.57-60.
2. Ivanova A.A. Aprosimov L.A. Potapov A.F. Timofeev L.F. Sravnitel'nyj analiz obshhej smertnosti naselenija razlichnyh grupp rajonov Respubliki Saha (Jakutija) v 2010 g. [Comparative analysis of the total mortality rate in different groups of regions in the Republic of Sakha (Yakutia) in 2010)] Dal'nevostochnyj medicinskij zhurnal [Far-Eastern Medical Journal]. Khabarovsk, 2012, № 4, P. 109-111.
3. Kakorina E. P. Efimov D.M. Chemyakina S.-D.N. Sovremennye aspekty smertnosti naselenija Rossijskoj Federacii ot boleznej organov dyhanija [Contemporary aspects of

population mortality in the Russian Federation from respiratory diseases] Problemy social'noj gigieny, zdravoohranenija i istorii mediciny [Social Hygiene, Health Care and History of Medicine]. Moscow, 2010, № 1, P.3- 9.

4. Timofeev L.F. Krivoshapkin V.G. Zdravoohranenie territorij s nizkoj plotnost'ju naselenija: na primere Respubliki Saha (Jakutija) [Healthcare of territories with low population density; the case of the Republic of Sakha (Yakutia))]. Novosibirsk: Nauka, 2006, 211 p.

Authors:

1. Albina Ammosovna Ivanova, Candidate of Medicine, Associate Professor, Department of Anesthesiology, Reanimation and Intensive Care, Institute for Post-graduate Medical Training, Ammosov North-Eastern Federal University. Address: 677000, Yakutsk, Oyunskogo Str., 27. Phone: 8-924-762-2916. E-mail: iaa_60@mail.ru.
2. Leonid Arkadievich Aprosimov, Candidate of Medicine, Dean, Institute of Post-graduate Medical Training.
3. Leonid Fedorovich Timofeev, Doctor of Medicine, Professor, Department of Public Health, Hygiene and Bioethics, Medical Institute, Ammosov NEFU.
4. Alexander Filippovich Potapov, Doctor of Medicine, Head, Department of Anesthesiology, Reanimation and Intensive Care, Institute for Post-graduate Medical Training, Ammosov NEFU.