

On the Issue of Studying the Factors of Sustainable Socio-economic Development: Health Level of Workforce

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Abstract: Workforce and its quality are the primary factor in ensuring sustainable progressive development in the modern world. An important rate of the quality of workforce is the health level, since it affects labor productivity in socio-economic systems. The purpose of this research is to identify dynamics of the health level of the working-age population and study trends in its development. The numerical analysis of this paper is carried out on the Udmurt Republic by using primary modern data, reflected in the state statistical accounting system for the period 2000-2019. Calculations have shown that the health level of the working-age group of the region's population has been declining in recent decades. The share of healthy people in the region in the age group of 15-72 years decreased from 59.8 % in 2000 to 42.1 % in 2019. The share of people with chronic diseases increased: 33.2 % in 2000 and 48.5% in 2019. The share of people with disabilities in the total population of the age group 15-72 years increased from 7.0 % to 9.4 %. The trends of changes in the dynamics of the health level of the working-age population in the region identified and analyzed in the research indicate a decrease in the rate of positive influence of labor resources on economic dynamics and the labor market. The analysis indicated that there is a need to create additional conditions to reduce the level of general morbidity and disability in the region.

1 INTRODUCTION

In the modern conditions of the formation of the innovative economy of a number of countries, the high quality of their labor resources is a necessary factor for sustainable innovative development. The quality of the workforce is determined by a combination of factors, such as health, intelligence, knowledge and skills, and the culture level of the working person. In recent decades, it is the quality of labor resources that has a primary impact on the pace of socio-economic growth (Auzina-Emsina, 2014; Nakamura et al., 2019; Ketova and Saburova, 2020.). The funding, allocated for maintaining and improving the quality of labor resources, is determined by state policy (Willis et al., 2018). Investment in human resources is a factor of economic security of the country. Modern trends in state financing of labor resources, for example, in the regions of the Russian

Federation, are analyzed in papers (Sleptsova and Ryndina, 2020; Konorev, 2020).

The study of the quality of labor resources from the point of view of the experience of empirical testing of complex tools for its mathematical assessment is considered in researches (Ketova, 2007; Ketova and Vavilova, 2020; Kalil Moraes et al., 2021).

As noted above, the quality of workforce is the health level of the working population. In this paper, we study the health level of labor resources using the example of one of the regions of Russia.

The population health state is the greatest value and benefit, it is importance for socio-economic growth of society and the practical implementation of new innovative development paradigms (Roslender et al., 2012.). The health state determines the capabilities of a person during labor activity and the degree of his participation in it (Sinyai and Choi, 2020). A healthy person has the objective possibility

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of full self-realization. A healthy person demonstrates greater work efficiency. Health problems are obviously limiting the worker.

Investments in health care development reduce morbidity and mortality rates, and extend the working period of life. A mathematical analysis of these processes is presented in researches (Ketova and Rusyak, 2009; Vavilova and Ketova, 2020).

Since the working-age group of the population participates in the production of the gross domestic product, then in the calculations we take the age limit of 15-72 years. At the same time, juvenile potential is of great importance for the formation of labor potential as a social resource for economic development in the context of a change in the technological structure in connection with the innovative economy development (Ilyakova et al., 2020). It is important to preserve the health of the younger generation for the possibility of a long and active life.

2 RESEARCH MATERIALS AND METHODS

The analysis of the structure and dynamics of the health level of the working-age group of the population is carried out on the example of the region of the Udmurt Republic (UR). According to the state of health, the population is grouped as follows:

- a healthy person;
- a person with chronic diseases;
- a person with a 3rd disability group (capable of working);
- a person with a 2nd disability group (partially capable of working);
- a person with 1st disability group (incapable of work).

Let us analyze the structure and dynamics of general and primary morbidity in the region. Under the medical classification, the general morbidity is the sum of primary diseases and diseases accumulated in previous years (known earlier). Primary diseases are diseases detected in the current year. Tables 1 and 2 show statistical data on the general and primary morbidity of the population of the Udmurt Republic for the period 2000-2019 (http://rmiac.udmmed.ru/inform-analit_materialy).

The general morbidity of the population of the UR in the working-age group for the period 2000-2019 increased by 33.3% and amounted to 1889.6 diseases per 1,000 people.

Table 1: General and primary morbidity of the working-age population of the UR in the 15-72 years-old age group for the period 2000-2019.

Year	Population in 15-72 age group, thousand people	General morbidity (units per 1,000 people)	Primary morbidity (units per 1,000 people)
2000	1199.12	1417.41	621.71
2001	1239.81	1383.42	570.12
2002	1201.63	1405.61	584.71
2003	1204.41	1537.59	621.32
2004	1204.83	1542.11	606.43
2005	1202.02	1496.13	583.18
2006	1197.44	1526.29	568.59
2007	1189.43	1606.58	589.11
2008	1181.71	1577.77	561.87
2009	1171.72	1688.89	608.41
2010	1161.41	1687.31	612.88
2011	1151.43	1749.11	803.67
2012	1144.09	1713.08	779.51
2013	1138.22	1731.03	817.71
2014	1133.21	1697.62	814.78
2015	1127.59	1711.84	817.31
2016	1122.18	1807.12	864.23
2017	1117.21	1847.18	853.11
2018	1113.78	1825.32	796.86
2019	1108.27	1889.62	811.41

Table 2: Growth rate of general and primary morbidity of the working-age population of the UR by 2000 for the period 2000-2019, %.

Year	General morbidity	Primary morbidity
2000	100.0	100.0
2001	97.6	91.7
2002	99.2	94.0
2003	108.5	99.9
2004	108.8	97.5
2005	105.6	93.8
2006	107.7	91.5
2007	113.3	94.8
2008	111.3	90.4
2009	119.2	97.9
2010	119.0	98.6
2011	123.4	129.3
2012	120.9	125.4
2013	122.1	131.5
2014	119.8	131.1
2015	120.8	131.5
2016	127.5	139.0
2017	130.3	137.2
2018	128.8	128.2
2019	133.3	130.5

For the whole republic, in terms of the total population aged 15 to 72 years, the general morbidity

for the period 2000-2019 changed from a value of 1699.6 thousand diseases to a value of 2094.5 thousand diseases.

An interesting fact is that the primary morbidity of the working-age population of the UR for period 2000-2019 increased by 30.5% in relation to 2000 and amounted to 811.4 diseases per 1000 people. In terms of the population aged 15 to 72 years, the primary morbidity changed from the value of 745.5 thousand diseases to the value of 899.2 thousand diseases.

Tables 3 and 4 present statistics of the population with disabilities, as well as statistics on the internal structure of this population category for the UR (<https://udmstat.gks.ru/folder/5193>, <https://sfri.ru/analitika/chislenost>).

Table 3: Statistical data of people with disabilities at the working-age of 15 to 72 years and in the distribution by groups of disabilities in the UR for the period 2000-2020.

Year	Total population with disabilities, thousand people	where including, %		
		3 rd group	2 nd group	1 st group
2000	83.63	29.31	51.67	19.02
2001	86.47	30.09	51.02	18.89
2002	89.04	30.88	50.29	18.79
2003	87.38	31.69	49.58	18.73
2004	86.85	32.48	48.92	18.60
2005	97.74	33.31	48.17	18.52
2006	101.46	34.13	47.48	18.39
2007	104.44	34.88	46.81	18.31
2008	107.38	35.68	46.11	18.21
2009	109.96	36.53	45.38	18.12
2010	111.87	37.32	44.68	18.00
2011	114.41	38.12	44.02	17.86
2012	111.46	38.91	43.29	17.80
2013	115.70	39.70	42.62	17.68
2014	111.23	40.41	42.02	17.57
2015	106.54	41.13	41.33	17.54
2016	108.82	41.79	40.69	17.52
2017	111.77	42.48	40.13	17.39
2018	104.30	43.50	39.22	17.28
2019	100.04	44.40	38.60	17.00
2020	97.54	44.76	38.22	17.02

The working-age population with disabilities increased in the UR from 83.6 thousand people in 2000 up to 97.5 thousand people in 2020. Figure 1 shows the dynamics of people with disabilities at the 15-72 years in the region and the chain rate of its growth for the period 2000-2020. The average annual growth rate of this indicator during the 20-year period was 0.8%.

Table 4: Statistical data of people with disabilities (per 100 thousand people of the working-age population) and the chain rate of growth of people with disabilities in the UR for the period 2000-2020.

Year	Population with disabilities (per 100 thousand people of the working-age population), ‰	Chain rate of growth of people with disabilities, %	
		Total population	Per 100 thousand people
2000	83.63	100.0	100.0
2001	86.47	103.4	97.6
2002	89.04	103.0	109.0
2003	87.38	98.1	98.0
2004	86.85	99.4	99.3
2005	97.74	112.5	112.8
2006	101.46	103.8	104.2
2007	104.44	102.9	103.7
2008	107.38	102.8	103.5
2009	109.96	102.4	103.2
2010	111.87	101.7	102.7
2011	114.41	102.3	103.2
2012	111.46	97.4	98.0
2013	115.70	103.8	104.4
2014	111.23	96.1	96.6
2015	106.54	95.8	96.2
2016	108.82	102.1	102.6
2017	111.77	102.7	103.1
2018	104.30	93.3	93.6
2019	100.04	95.9	95.9
2020	97.54	97.5	97.6

Figure 2 demonstrates the chain rate of increase in the people with disabilities at working-age group, Figure 3 – the basic growth rate in relation to 2000 of the people with disabilities of working-age group.

The analysis is demonstrated, that the total increase of population with disabilities of working-age for 20 years in the UR amounted to 13.9 thousand people. During this period, changes took place both upward and downward. The largest jump in the direction of increase occurred in 2005 (+12.5%), a sharp decrease of people with disabilities was observed in 2018 (-6.7%).

There are the indicators characterizing a group of people with disabilities at working age, calculated for 100 thousand people population of the UR. They allow for objective spatial and territorial comparisons.



Figure 1: Dynamics of population with disabilities at working-age group in the UR and its chain rate of growth for the period 2000-2020.

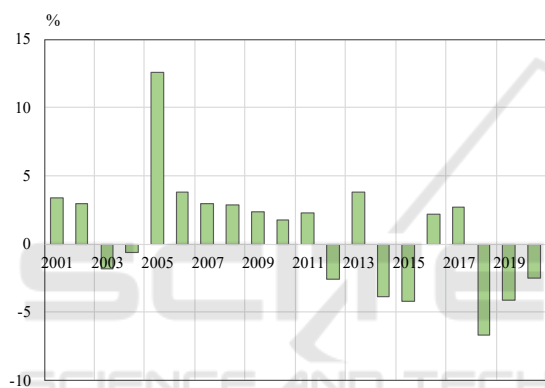


Figure 2: Chain growth rate of population with disabilities at working-age group in the UR for the 2000-2020.

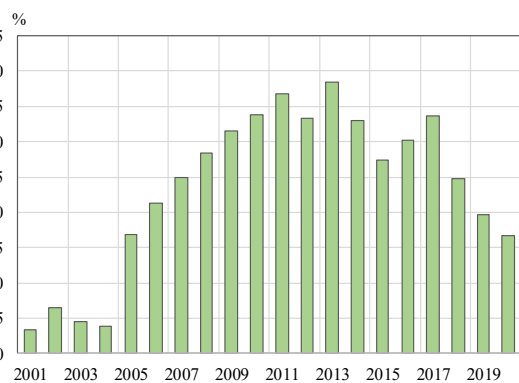


Figure 3: Basic growth rate (relative to 2000) of population with disabilities at working-age group in the UR for the 2000-2020.

Figure 4 presents people with disabilities per 100 thousand people of the working-age population of the Udmurt Republic and the chain growth rate of this

indicator for the period 2000-2020. Average annual growth rate of the number of people with disabilities per 100 thousand people of the working-age population in the UR amounted to 1.1%.

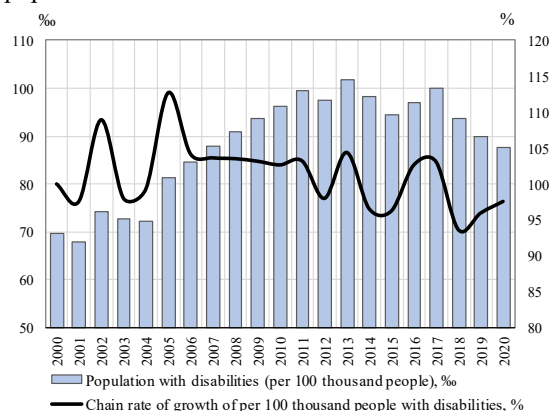


Figure 4: Dynamics of population with disabilities at working-age group in the UR per 100 thousand people and its chain rate of growth for the 2000-2020.

On Figure 5, it shows the chain rate of increase in the number of people with disabilities per 100 thousand people of working-age group, on Figure 6 – the chain growth rate in relation to the year 2000 of the number of people of the working-age group of the population with disabilities, per 100 thousand people in the UR.

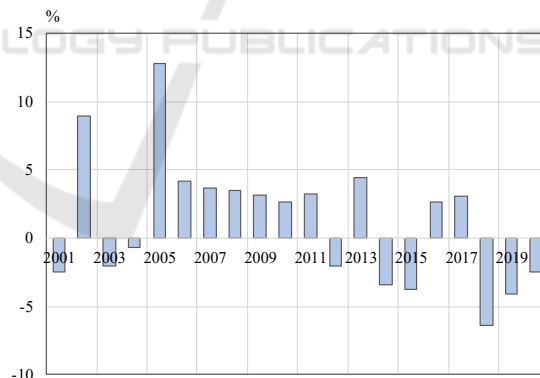


Figure 5: Chain growth rate of working-age population with disabilities per 100 thousand people in the UR for the period 2000-2020.

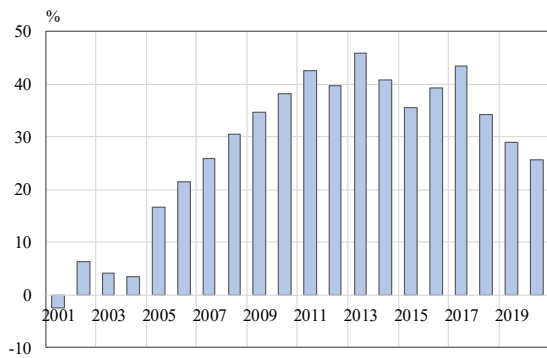


Figure 6: Basic growth rate (relative to 2000) of population with disabilities at working-age group per 100 thousand people in the UR for the 2000-2020.

For the UR in the period 2000-2020, dynamics of population with disabilities at working-age per 100 thousand people varied in the range from 68.0‰ to 101.7‰ (see Figure 4). The average value of the indicator for the period under review was 88.1 ‰. The largest leap towards an increase in the number of people with disabilities per 100 thousand people of the working-age population in the UR took place in 2005 (+12.8%), and its sharp decrease – in 2018 (-6.4%) (see Figure 6).

Basic in relation to 2000 growth rate of the indicator of the number of working-age people with disabilities per 100 thousand people in the UR, shown in Figure 6, correlates with the dynamics on Figure 3. This dynamics of changes in the latter indicator is influenced by the general decline in the population of working age in the UR for the period, the graph of which is based on statistical data (<https://udmstat.gks.ru/folder/51924>) (see Figure 7).



Figure 7: Dynamics of the population at working-age group in the UR for the period 2000-2020.

The change in the internal structure of the population of the region according to the degree of disability (disability groups) is shown in Figure 8.

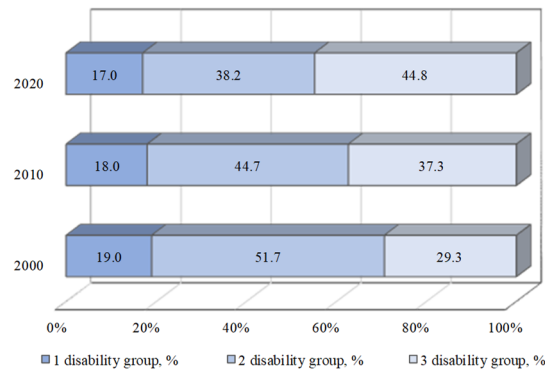


Figure 8: Distribution of population at the working-age group with disabilities, by the degree of disability, for the UR for 2000, 2010 and 2020.

The third group of disability presupposes the ability to work, the second group allows one to partially participate in the labor process, the first group of disability indicates the inability to work. Redistribution takes place between groups. The proportion of people able to work is increasing. Over the period 2000-2020, the increase in people able to work was 2 percentage points.

3 RESEARCH RESULTS

We designate the total population of the region as P ; the number of healthy people as P_H ; the number of people with chronic diseases as P_{CH} ; the number of disabled people as P_{INV} . Based on the data in tables 1-4, the number of healthy population per year t is determined by the formula:

$$P_H(t) = P(t) - P_{CH}(t) - P_{INV}(t) \quad (1)$$

Figure 9 shows the final diagram of changes in the structure of the health level of the working-age population of the UR for the period 2000-2019 (statistical data on the total population of the region are currently available only until 2019).

Structural-dynamic analysis of the health level is presented: the share of healthy people in this age group 15-72 years has decreased from 59.8% in 2000 to 42.1% in 2019; the share of people with chronic diseases increased (33.2% in 2000 and 48.5% in 2019). The share of people with disabilities increased for all groups: from 2.0% to 4.1% for the third

working group of disability; from 3.6% to 3.7% for the second partly working group; from 1.3% to 1.6% for the first non-working group.

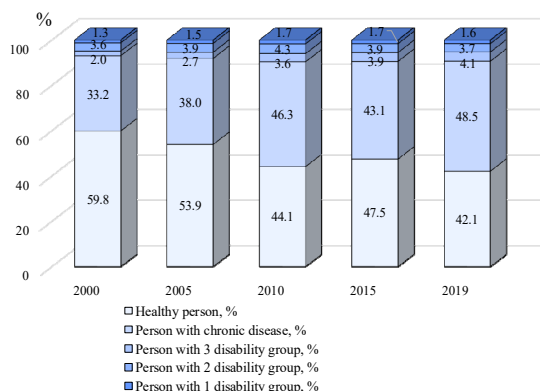


Figure 9: Dynamics of the structure of the UR's population at the working-age group according to the health level for the period 2000-2019.

In general, the share of people with disabilities in the total 15-72 years' age group has increased from 7.0% to 9.4%. Thus, for the studied period 2000-2019, the most significant changes were observed in the share of healthy people (the annual rate of decline was 1.9%) and the proportion of people with chronic diseases (the annual growth rate was 2.1%).

4 DISCUSSION OF THE RESULTS

In addition to external factors, affecting the health of the population (ecology, quality of nutrition and medical care, etc.), there is an important objective factor – the dynamics of the number of different age groups. Since human health deteriorates with age, in older age groups the indicator of the level of health decreases.

Figure 10 presents the distribution of the UR's population by age, for the initial year 2000 and the final year 2019 of the study period. Thus, in the working-age group of the population 15-72 years, over an 18-year period, there is a decrease in the number in younger ages in the interval 15-27 years, as well as in the age group 35-51 years. The increase in the number occurred in the age groups of 27-35 years old and 51-68 years old. As a result, there is a shift towards an increase in the population in older ages.



Figure 10: Density of distribution of the UR's population by age: 2000 (1); 2019 (2).

It is possible to assess the relationship between the health level of the population and age groups based on the results of correlation analysis. Table 5 shows the coefficients of linear correlation between these indicators in the UR for the period 2000-2019.

Table 5: Correlation between the health level of the population and age groups in the UR for 2000-2019.

Social group	Age groups of the population				
	15-25 years	26-35 years	36-45 years	46-55 years	56-72 years
Healthy person	0.71*	-0.69*	0.39	0.38	-0.71*
Person with chronic disease	-0.67	0.69*	-0.38	-0.37	0.66
Person with 3 disability group	-0.79*	0.81*	-0.26	-0.57	0.87*
Person with 2 disability group	-0.34	0.64	0.74*	0.13	0.24
Person with 1 disability group	-0.72*	0.70*	-0.46	-0.29	0.89*

*significant coefficient at a reliability level of 99%

According to the results of the correlation analysis, presented in Table 5, it can be seen, that there is a direct relationship between the structural dynamics of the population in terms of health and the age composition of the population:

- healthy population share and aged 15-25 population proportion;
- share of the population with chronic diseases and aged 26-35 population proportion;

- share of the population with 3 disability group and proportion of the population aged 26-35 and 56-72 years;
- share of the population with 2 disability group and the proportion of the population aged 36-45;
- share of the population with 1 disability group and the proportion of the population aged 26-35 and 56-72 years.

An inverse correlation is also visible between:

- healthy population share and proportion of the population aged 26-35 and 56-72 years;
- share of the population with 3 and 1 disability groups and proportion of the population aged 15-25.

5 CONCLUSIONS

Thus, a structural-dynamic analysis of the health level of the working-age population group as a group, that actively participates in the labor process of the region, generates benefits and sets the pace of sustainable economic growth was carried out. The calculations were performed using the example of the Udmurt Republic for the period 2000-2019.

It was found that the health level of the working-age population decreases: the share of the healthy population decreased from 59.8% in 2000 to 42.1% in 2019, the share of people with chronic diseases increased from 33.2% to 48.5% and the share of people with disabilities from 7.0% up to 9.4%. At the same time, the proportion of people able to work in the 15-72 age group is increasing. Over the period 2000-2019, the increase in people able to work was 2 percentage points.

The trends of changes in the dynamics of the health level of the working-age population in the region revealed and analyzed in the paper indicate a decrease in the rate of positive influence of labor resources on the economic dynamics and the labor market. The conducted analysis is indicated the emergence of the need to create additional conditions to reduce the level of general morbidity and disability. It needs to increase the volume of funding for the health care system in order to expand the scale of involvement of the population in a healthy lifestyle, develop a preventive health care system, improve the availability and quality of medical care.

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