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MEDICAL-DEMOGRAPHIC AND SOCIO-HYGIENIC ASPECTS OF AGRICULTURAL LABOR RESOURCES

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Abstract

The paper gives the results of a comprehensive analysis of updated information on the demographic situation in rural areas of the Russian Federation and the working conditions in the agricultural sector. It is shown that from 2010 to 2018, a stable population growth was recorded only in 20.8% of rural municipalities, while 79.2% of settlements were characterized by a decrease in rural residents. The deformation of the age structure of the population and the associated increase in the demographic burden on the able-bodied rural population is critical for the sustainable development of rural territories due to the low birth rate and high mortality of working-age men, as well as the continued migration outflow of the economically active part of the population to the regional and federal centers of Russia. The number of workers in the agricultural sector in harmful and dangerous working conditions during the period from 2011 to 2017 decreased by 19.2%, while the share of this category of people in the total structure of workers in agricultural production decreased by only 4.4% to 29.4% in 2017. According to the results of inspections of the territorial bodies of the Rospotrebnadzor in the period from 2011 to 2017, the proportion of jobs that do not meet sanitary standards fell from 35.7 to 30.4%, which indicates a trend towards an improvement in the sanitary and hygienic situation at agricultural enterprises.

Keywords: Rural population, demographics, migration, agricultural industry, working conditions.

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1. Introduction

In the face of global challenges, progressive labor shortages and existing negative trends in the medical and social sector of the public health of the rural population are considered as one of the most important internal threats to the food and national security of the Russian Federation (Semikin et al., 2019; Uzun, 2019). Currently, sustainable rural development is one of the state priorities of socio-economic policy. In his speech at a meeting of the State Council on agricultural policy, the President of the Russian Federation Putin (2019), noted: "there are issues that require our special attention ... and here, first of all, issues of the economy of rural production, a comfortable living environment, conditions for improving the well-being of people and, of course, further strengthening the position of the Russian agricultural sector as a modern, globally competitive industry" (p. 1).

In accordance with the state program of the Russian Federation "Integrated Development of Rural Territories", the main objectives of state policy in the field of accelerated development of rural territories are "to increase the level and quality of life of the rural population, slow down depopulation processes and stabilize the rural population at a level of at least 25.3% of the total population of Russia, creating favorable conditions for the village to fulfill its production and other national functions "(Decree of the Government of the Russian Federation of May 31, 2019 N 696).

2. Problem Statement

One of the integral indicators of the effectiveness of the implementation of state programs aimed at the sustainable development of rural territories is the rural labor market, its qualitative and quantitative characteristics, due to the specifics of life in rural settlements, the mentality of the rural population, and the degree of development of the production sector. According to Reutov (2009), three of the most significant factors that form the labor resources of the village can be distinguished relationally as the following: demographic-territorial, migration, and labor.

The demographic situation prevailing in the territory is usually estimated by such indicators as the number of the rural population, its age and gender composition, the number of rural settlements and their characteristics, as well as the natural movement of the population. Migration activity of the population is characterized by the balance and orientation of intra-regional, inter-regional and international migration processes. Professional and labor relations are mainly reflected in the ratio of the levels of employment and unemployment of the economically active population, the structure of employment by type of economic activity, type of ownership, educational qualifications of workers, and average monthly nominal wages. At the same time, when considering the production environment that forms the labor resources of rural territories, as a rule, the most important indicator is excluded as working conditions in the professions accessible to the rural population, no less than the wages that determine their attractiveness to potential workers.

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3. Research Questions

The study analyzed:

- Medical and demographic situation in rural municipalities of the Russian Federation in the period from 2011 to 2017;
- The structure, orientation and balance of migration processes in rural regions of Russia;
- The dynamics of the labor force in rural areas in modern socio-economic conditions;
- The number and structure of labor resources engaged in agricultural production, according to the results of the All-Russian agricultural censuses of 2006 and 2016;
- The specifics of labor in agriculture and the dynamics of the number of workers in the industry in harmful and dangerous working conditions.

4. Purpose of the Study

The aim of the work was a comprehensive multivariate analysis of medical-demographic and socio-hygienic trends that form the labor resources of agriculture in modern conditions.

5. Research Methods

In the work generally accepted information, epidemiological, hygienic, sociological and statistical research methods were used. When analyzing current trends in the dynamics of the number and proportion of people working in agriculture in harmful and dangerous working conditions, as well as the proportion of jobs that do not meet sanitary standards, a linear regression analysis was applied at the agricultural enterprises with the determination of the determination coefficient (R2) of the considered models using the statistical functions of Microsoft Excel.

The research information base was presented by competent statistical materials of the Federal State Statistics Service and data on working conditions of agricultural workers for the period from 2011 to 2017, obtained from the departments of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare in 82 constituent entities of the Russian Federation based on our requests.

6. Findings

6.1. Medical and demographic situation in the rural settlements of Russia

According to Rosstat from 2005 to 2017, the number of rural residents decreased by 1 million 700 thousand people, excluding the population of the Republic of Crimea, mainly due to those employed in the agriculture, hunting and forestry industry, which lost more than 25% workers.

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The results of a detailed analysis of the population indicate that in Russia as a whole, from 2010 to 2018, stable population growth was recorded only in 20.8% of rural municipalities, while a decrease in the

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rural population was characteristic of 79.2% of settlements and in 11.4% of municipal districts it was happening at a very fast pace - more than 2% on average per year. The highest growth rate of the rural population was observed in the North Caucasus (59.0%), Southern (26.0%) and Ural (25.9%) federal districts; a high decline in rural residents was detected in the Northwestern (22.0%), Far Eastern (16.9%) and Central (15.5%) federal districts (Table 01).

Table 01. Groups of rural municipalities with different rates of population dynamics in 2010-2018, (%)

Federal District	**Defense group on population trends:**		
	Population growth	**Population decline up to 2% per year**	**Population decline more than 2% per year**
Central	18.4	66.1	15.5
Northwestern	20.5	57.5	22.0
South (within 2010)	26.0	71.7	2.3
North Caucasian	59.0	40.3	0.7
Volga	13.2	73.9	12.8
Ural	25.9	66.8	7.3
Siberian	18.7	74.7	6.6
Far Eastern	12.2	70.9	16.9
Russia as a whole	**20.8**	**67.8**	**11.4**

According to some researchers (Elin & Pashin, 2019; Simagin, 2019) population decline of over 2% per year is considered to be the boundary the rapid depopulation, which in the medium term could lead to the depopulation of the territories and an end to economic activity.

The consequence of the depopulation of regions is taking place to reduce the number of rural settlements as a continuation of their union in order to reduce administrative costs, and the abolition of the liquidation of the deserted villages. In recent years, the number of the latter was reduced to 5.6% (on January 1, 2012, there were 18831 rural settlements to the beginning of 2018 their number decreased by 1065).

Currently, more than half of rural settlements in Russia (58.5%) belong to groups with a population from 500 to 2000 people. However, over the past five years, there has been a decrease of 9.25% in this category of settlements, with an increase in the number of rural settlements with more than 7,000 inhabitants by 4.7%.

The decline in the rural population is a long-term trend that poses a threat to Russia's national security. Every year, the village "loses" more than half a million people, of which about 25% of people of working age. However, due to the implementation of government measures aimed at national conservation of rural population (Kondratenko, 2015), these losses in recent years has been reduced from 27.3% in 2011 to 23, 7% in 2016 (Table 02).

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Table 02. The dynamics of the natural decline of rural population

Population at the end of the year (thousand people)		Natural decline (thousand people)		Natural decline in working age (%)		
		Total	Working age	Total	Men	Women
2011	37314.4	569.02	155.19/124.78	7.1	10.6	3.0
2012	37228.8	552.70	145.99/117.61	6.8	10.1	2.9
2013	37118.2	539.30	140.20/ 113.05	6.6	9.8	2.8
2014	37985.1	549.56	140,96/ 113,87	6.6	9.8	2.8
2015	37887.3	546.65	134.58/ 108.27	6.4	9.4	2.8
2016	37772.0	536.07	127.12/ 102.62	6.2	9.1	2.6

The ultra-high mortality rate is of particular concern in rural settlements, which account for about 80% of all deaths at working age (Aganbegyan, 2017; Shalashova & Bezrukova, 2013). The results of the analysis of statistical sources allow us to trace a certain pattern: mortality due to external causes, including work-related injuries, was most often recorded in men under the age of 44; in the group of 45–49 year olds circulatory system diseases predominated; from the age of 50, neoplasms occupy the first ranking place among the causes of death.

The primary limitation of strategic demographic development of rural areas is a decline in the birth rate, a positive trend has replaced the number of births in the 2000-2013 years. Subsequently, the total fertility rate of rural population decreased from 2,318 (2014) to 2,056 (2016), indicating that the narrowed reproduction of the rural population now. Particularly sharp was the decrease in the total fertility rate in recent years from 14.4 % (2014) to 11.2 % (2017). The minimum, zero natural decline in the rural population was recorded only in 2013, when the birth rate increased from 9.8 ‰ (2000) to 14.5 ‰ (2013), and the mortality rate decreased from 17.1 % to 14.5 %, respectively (Table 03).

Table 03. The dynamics of natural growth of the rural population (%)

At 1000 the rural population	2010	2011	2012	2013	2014*	2015*	2016*	2017*
Born	14.0	14.1	14.7	14,5	14.4	12.8	12.2	11.2
The deceased	16.1	15.2	14.8	14.5	14.5	14.4	14.2	13.7
Natural growth	-2.1	-1.1	-0.1	-0.02	-0.1	-1.6	-2.0	-2.5

Note: *-subject to the Republic of Crimea

If in Russia as a whole, a natural growth of the population was observed between 2007 and 2016, then the village and in these years was characterized by a decrease and high mortality of men of working age, which in the long term could lead to a significant transformation of the structure of the rural population. Over the past decade, the highest average Life Expectancy was recorded in the regions of the North Caucasus (75.3 years), Southern (72.9 years) and Central (72 years) federal districts. The lowest values of this indicator in 2017 were traditionally characteristic of the Far Eastern (68.3 years), Siberian (67.8 years) and Ural (68.4 years) federal districts.

6.2. Migration processes in rural regions of Russia

Compared to the relatively inert natural movement population migration is a social component demographic processes more rapidly which affects the quantitative and qualitative characteristics of the

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workforce, their professional qualification, age and sex composition, structure and directions which, in the first place, determined by political, socio-economic and cultural factors livelihoods and quality of life of society (Khetagurova & Muriev, 2019; Slanova, 2017).

According to a number of researchers (Kovanova et al., 2019; Vorobyova & Rybakovsky, 2017), labor migration of rural residents in its current state is a process of spontaneous socio-economic self-organization of the population, aimed at improving the quality of life, professional growth and meeting growing material and spiritual requests.

According to sociological studies (Bondarenko et al., 2014), the main causes of migration sentiments are low wages in agriculture, its limited scope of application, and heavy physical activity, typical for almost all professional groups of the agrarian sector workers, poor on compared with the city social and engineering infrastructure of rural settlements.

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Table 04. Structure of rural population migration, thousands of people

Migration type	2012	2013	2014*	2015*	2016*	2017*
Intraregional	- 159.2	- 173.9	-159.9	- 89.1	- 81.7	- 90.1
Interregional	-76.1	-71.1	- 42.8	- 30.6	- 16.2	- 7.8
International	68.6	67.9	54.8	72.1	61.5	50.6
General migration	- 166.6	- 117.2	- 133.7	- 47.5	- 36.5	- 47.3

Note: *-subject to the Republic of Crimea

Among the directions of migration, the dominant position continues to be occupied within the regional, exceeding interregional migration by 11.6 times (2017 data). The component of international migration to rural Russia is the only one that showed a surplus in 2012-2017.

Modern migration flows of the rural population are primarily oriented from less developed to more developed regions of the country with a high level of wages and better socio-economic conditions, which can be considered as an objective indicator of the economic well-being of a region (Zarubin, 2018).

The traditionally high influx of rural population is typical for the Central and North-Western federal districts, the development of the territories of which is primarily due to the proximity of the largest megacities Moscow and St. Petersburg, where the main flow of migrants was sent in 2014-2017.

Modern trends of migration processes manifested in specific social phenomena as "seasonal work" and the related "distributed lifestyle» - phenomenon which emerged in a new market. Seasonal work of the XXI century is, in its essence, the return of labor migration (mostly inter-regional) most of the initiative of the economically active rural population, motivated to maintain a strong family welfare at the expense of lump (often seasonal) work in large cities and federal centers of Russia, providing for periodic returning rural settlements to society and preserving family and family relations (Yakshibaeva, 2017).

Assessing the scale of modern seasonal work is purely advisory in nature and, according to some sociological studies, depending on the socio-economic situation prevailing in rural areas can cover 10 to 50% of the economically active population (Plyusnin et al., 2015).

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So, during the period from 2011 to 2018 the number of rural dwellers of working age fell by 5.5 percentage points from 59.1% to 53.6%. In general, over the past seven years, the demographic burden on the working rural population increased by 24.7%.

6.3. The structure of economically active rural population and the level of employment

The above-mentioned processes of depopulation and population age structure deformation naturally affected the economically active population (the labor force in vozraste15-72 years) in rural areas. According to Rosstat, the number of economically active rural population for the period from 2011 to 2017 decreased by 568 thousand people (3.1%), of which busy - 241 thousand people (1.5%), unemployed - 327 thousand people (19.5%). This imbalance could indicate the relative stability of the number of people working in rural areas in various sectors of the economy, and a significant reduction in the number of unemployed, which in the absence of a comparable increase in jobs indirectly indicated a migration outflow of the population. At the same time, the share of people employed in different sectors of the economy in relation to the total number of rural residents in 2017 decreased significantly (Table 05).

Table 05. The employment rate of the rural population, %

Years	Total	Age groups (years)					
		15-19	20-29	30-39	40-49	50-59	60-72
2011	59.4	11.9	64.6	78.5	80.9	65.0	17.2
2012	60.2	10.9	65.0	79.2	82.0	66.1	18.1
2013	60.2	11.0	65.4	79.2	81.8	65.8	18.7
2014	60.6	9.7	65.8	79.5	82.6	66.1	19.6
2015	60.7	9.7	66.5	79.5	82.7	66.3	20.1
2016	60.7	10.4	67.0	79.4	82.7	66.7	20.5
2017	53.7	9.0	67.2	80.1	82.9	65.4	19.2
2017 to 2016 %	- 7.0	- 1.4	+ 0.2	+ 0.7	+ 0.2	- 1.3	
2017 to 2011 %	- 5.7	- 2.9	+ 2.6	+ 1.6	+ 2.0	+ 0.4	

In terms of age groups, the largest decrease in employed was noted among young people aged 15-19, whose share among employed decreased by 2.9% over the period under review, which, judging by sample sociological surveys (Elyarova et al., 2019), was associated with an increase young people studying, including outside the countryside, as well as the growing demands of employers on the training of job applicants.

In the regions of Russia, the level of rural employment in 2017 ranged from 45.6% (Republic of Tuva) to 72.2% (Chukotka Autonomous Okrug). The five regions with the highest rural employment, except for the Chukotka Autonomous Okrug, included the republics of Tatarstan (70.6%) and Mordovia (69.7%), Moscow (69%) and Murmansk (68.3%) regions; the lowest - Tyva (45.6%) and Ingushetia (48,4%), Zabaikal'skii region (51%), Arkhangel'skaia region (51.5%) and Karachaevo-Cherkessia (51.5%).

6.4. The structure of labor resources engaged in agricultural production

Agricultural production remains the main place of employment in rural areas. In 2017, it was involved 19.2% of total employment in this sector of the economy; second place ranking is engaged in wholesale and retail trade, repair of motor vehicles, household goods and - 15,0%.

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It should be noted that formed strong tendency reduce agricultural employment in recent years, the level of which is statistically significant (R2 = 0,957) was reduced from 23.7% (2010.) To 19.5% in 2017 year. At the same time, the decrease in the number of workers in the agricultural sector was primarily a consequence of the process of intensification of production associated with the introduction of advanced equipment and resource-saving technologies that affect the increase in labor productivity, which increased by 33.5% over the analyzed period (Subaeva, 2018).

Other reasons for reducing the number of employees were (Nefedova, 2013):

- The fall in the needs of agricultural organizations in mass unskilled labor;
- Migration outflow of youth to cities;
- The increasing number of older people, who upon retirement have the possibility of additional self-sufficiency from the gardens.

Changes in the labor force directly engaged in agricultural production can be traced when comparing the results of the All-Russian agricultural census of 2006 and 2016 (Table 06).

Table 06. Labor resources of agricultural organizations (farms) engaged in agricultural production

Index	**Agricultural organizations**	**Peasant (farmer) households and entrepreneurs**	**Total**
2006 All-Russian Agricultural Census			
Average number of employees, thous. people.	2613.9	553.5	3167.4
regular employees	2447.2	430.3	2877.5
temporary and seasonal workers	199.7	123.2	289.9
2016 All-Russian Agricultural Census			
Average number of employees, thous. people.	1386.4	377.4	1768.8
are engaged in agricultural production:	1233.2	366.7	1599.9
regular employees	1137.6	297.6	1435.2
temporary and seasonal workers	95.6	69.1	164.7

The total number of employees of agricultural organizations for 10 years was reduced by almost half - from 2.61 million in 2006 to 1.39 million in 2016, while the number of workers (peasant) farms and individual entrepreneurs has decreased by a quarter - from 470.16 thousand people in 2006 to 377.43 thousand people in 2016

There was also a significant change in the age structure of workers. The average age group from 30 to 60 years for men (47.7% in 2006 and 47.9% in 2016) and from 30 to 55 years for women retained a dominant position among regular agricultural workers. (30.1% and 27.6%, respectively). The youngest age group (19 to 29 years old) female workers declined from 6.9 to 5.1%; men - from 10.5 to 9.4%. The greatest changes occurred in the older age group, the proportion of which more than doubled: in men from 2.0 to 4.9%, in women - from 2.4 to 5.2%.

6.5. The specifics of labor in agriculture

Russian agriculture is a complex-industry, represented by two major sectors: livestock and crop production. Currently, agricultural producers, regardless of their form of ownership mainly focused on the cultivation of grain and industrial crops (70%). Among agricultural organizations and livestock farming enterprises, the majority work in the dairy and beef cattle breeding sector (more than 45%).

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Despite the large differences that are characteristic of technological processes and working conditions in individual sectors and types of agricultural activity, many years of scientific and practical experience of our scientific and medical hygiene center (Danilov et al., 2017) and data from other researchers (Popova, 2016) allow you to highlight the general aspects that determine the specifics and labor in agriculture:

- Seasonality of work and uneven workloads during the annual cycle;
- A high percentage of depreciation of fixed assets, a relatively low level of mechanization, a high proportion of manual labor, physical and static overloads;
- Frequent change of operations performed by one worker, especially in field cultivation;
- Exposure to adverse meteorological factors;
- Often significant remoteness of the place of residence from the place of work;
- Low availability of sanitary facilities;
- Professional contact with toxic (pesticides, agrochemicals, disinfectants and disinfestations) and biologically active substances (food additives, growth stimulants, antibiotics);
- The possibility of infectious diseases, including especially dangerous, transmitted from animals to humans;
- Relatively low wages, especially in economically depressed regions.

Data on working conditions in agriculture have never been presented as a separate line in the official statistics. This circumstance does not allow for an objective analysis of the dynamics of working in hazardous working conditions in the agricultural sector since the official statistics does not emit agriculture in a separate economic activity. According to the 2016 All-Russian Agricultural Exhibition, 430.3 thousand people out of 2877.5 thousand people employed in the industry worked in small businesses involved in agricultural production, in fact, every 7 agricultural workers “dropped out” of official statistics.

According to Rospotrebnadzor number of workers in the agricultural sector of Russia in harmful and dangerous working conditions in the period from 2011 to 2017 is statistically significant (R2 = 0,985) decreased from 682.19 to 551.23 thousand people, i.e. 19.2%.

Thus, in recent years, almost one in three runs in Russian agriculture has been affected by harmful occupational factors. At the same time, it has very high scatter in the n the share of people working in harmful working conditions for Russian agricultural regions (table 07).

Table 07. Proportion of agricultural workers employed in harmful and dangerous working conditions

High specific gravity		**Low specific gravity**	
Territory	**%**	**Territory**	**%**
2015			
Tyva Republic	79.1	БурятияBuryatia	6.3
Nenets Autonomous Okrug	73.3	Vladimir region	6.3
Kabardino-Balkaria	65.6	Jewish AO	2.6
Altai region	65.2	Altai Republic	1.9
Adygea	64.1	Yaroslavskaya oblast	1.7
Kemerovo Region	64.1	Chelyabinsk region	1.2
2017			
Bryansk region	78.1	Republic of Crimea	23.3
Kostroma region	73.9	Orenburg region	20.8

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Republic of Bashkortostan	72.3	Zabaykalsky Krai	19.9
Republic of Adygea	69.9	Ulyanovsk region	18.6
Kirov region	67.6	Volgograd region	13.9
Komi Republic	63.9	Novosibirsk region	13.1
Altai region	62.1	Penza region	12.1

In 2015, the highest percentage of agricultural workers employed in hazardous work conditions, has been registered in the Republic of Tyva and the Nenets Autonomous District, the smallest in Yaroslavl, Chelyabinsk regions and the Altai Republic. In 2017, the highest percentage of agricultural workers engaged in harmful and dangerous conditions, was recorded in Bryansk and Kostroma regions, the lowest in Novosibirsk and Penza regions. Along with the work in hazardous working conditions, the significant potential risk to workers' health (injuries, occupational diseases and work-related) are not meeting sanitary-epidemiological requirements to ensure the safety of agricultural production facilities (Shaprov et al., 2014).

According to the results of checks carried out by “Rospotrebnadzor” agencies in the period from 2011 to 2017, the proportion of jobs that do not meet health and safety standards for agricultural enterprises on average ranged from 35.7% to 27.9%. At the same time, the value of the reliability of the approximation coefficient ($R2 = 0.758$) and the nature of the linear trend of the time series of jobs that do not meet sanitary standards ($y = -1.075x + 36.94$), indicated a tendency to improve the sanitary situation at the surveyed agricultural enterprises.

In 2015, the highest percentage of jobs that did not meet sanitary standards was registered in the Irkutsk Region (69.1%), the Republic of Udmurtia (67%) and Mari El (56.3%), and the Chelyabinsk Region (52.8 %).

In 2017, the highest percentage of non-compliance was found in Kemerovo (87%), Rostov (69%) and Irkutsk (65%) regions, the Republics of Adygea (61%) and Mari El (58%); in 2017 - in the Sakha Republic (80%), Kemerovo (81%), Yaroslavl (66%) and Irkutsk (63%) regions. According “Rospotrebnadzor” in the Russian Federation, mainly during inspections recorded in descending order: exceeding the maximum allowable level of noise production→ working zone air pollution→ adverse microclimatic conditions.

7. Conclusion

The results of a comprehensive analysis of updated information on the demographic situation in rural areas of the Russian Federation and the working conditions in the agricultural sector, reveals the following medical and hygienic aspects and modern tendencies of formation of labor potential of the agricultural sector in modern conditions:

- Between 2010 and 2018, a stable population growth was recorded only in 20.8% of rural municipalities, while 79.2% of settlements were characterized by a decline in rural residents.
- Despite the differences in production processes and working conditions in certain types of agricultural activities, work specifics in agriculture is the general aspects that determine its severity and the unattractiveness, primarily for rural youth.

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- The number of workers in the agricultural sector in harmful and dangerous working conditions during the period from 2011 to 2017 decreased by 19.2%, while the share of this category of people in the total structure of workers in agricultural production decreased by only 4.4% to 29.4% in 2017.
- Based on the results of inspections carried out by Rospotrebnadzor in the period from 2011 to 2017, the proportion of jobs that do not meet health and safety standards, has decreased from 35.7 to 30.4% at agricultural enterprises, indicating that the current tendency to improve the sanitary and hygienic situation at agricultural enterprises.

Thus, along with demographic and socioeconomic factors, medical and hygienic aspects of working conditions in the agricultural sector plays an important role in shaping and maintaining the labor force in rural areas and their sustainable development.

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