

## **Occupational diseases among agricultural workers in the Russian Federation: review of statistical data**

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**Abstract.** The aim of the study is to analyze the epidemiological situation of occupational diseases among agricultural workers in Russia. To address this task, the analysis of occupational diseases incidence was carried out.

**Conclusions.** For the last decades the proportion of rural working population in Russia is gradually decreasing, but remains noticeably higher than in other industrialized countries. There is a huge difference between entities of the Russian Federation in occupational illnesses incidence rates among agriculture workers, which can be explained by: (a) the distinction of health care availability; (b) lack of occupational physicians in rural areas; (c) the high level of the incidence of non-communicable diseases, which can disguise occupational illnesses among agricultural workers. The improvement of the health care regulatory legal framework, development of evidence-based clinical practice guidelines, quality improvement in postgraduate education of medical doctors in rural areas, increasing in the number of occupational health physicians in rural areas, and implementation of long-term health promotion programs are necessary in order to maintain the health of agricultural workers in the Russian Federation. This list of priority measures is not sufficient, as it highlights only the main issues in the field of occupational health.

**Key words:** agricultural workers, occupational diseases, diagnosis.

## **INTRODUCTION**

Agriculture in both industrialized and developing countries is one of the most hazardous industries (Donham & Thelin, 2006). Agricultural workers are usually at risk for wide range of occupational diseases and injuries (Lessenger, 2006). However the incidence of occupational diseases among agricultural workers is considered to be underestimated (Solomon et al., 2007). The underdiagnosis of occupational diseases among agricultural workers is a common problem: the number of reported occupational

diseases in sphere of agriculture is low and reflects obvious underreporting (Kurppa et al., 2006).

The most common and costly occupational illness of agricultural workers are musculoskeletal disorders (MSD), which can be caused by work-related (i.e., ergonomic) and individual-related risk factors. The prevalence of MSDs in farmers is greater than in non-farmer populations (Osborne et al., 2012).

In Russia agricultural workers is one of the most numerous groups among patients with occupational diseases. But the level of occupational diseases incidence appears to be underestimated as well. Among the causes of the underdiagnosis there are: (1) low availability of medical care for rural population (particularly in occupational health), (2) lack of knowledge among health professionals. Currently the challenge ahead Russian specialists on occupational health is not only to restore lost priorities of Russian medicine that was aimed at prevention and the continuity of health care, but also create medical monitoring system of rural workers, as in Soviet Union health care policymakers were primarily focused on industrial workers.

The aim of this study is to analyze the epidemiological situation of occupational diseases among agricultural workers in Russia. To address this task, the analysis of occupational diseases incidence has been carried out.

## **MATERIALS AND METHODS**

The analysis included all cases of agricultural workers' occupational diseases, which were reported to the Russian Federal Service for Supervision of Consumer Rights Protection and Human Welfare over the years 2012–2014. For more detailed analysis we used all available data on agricultural workers' occupational diseases from Registry of Occupational Diseases of Tatarstan Republic over the years 2012–2014, as All-Russian Federal Registry of Occupational Diseases with total data, suitable for analysis, has been not created yet. We analyzed the level and structure of occupational incidence, as well as the number of cases among different occupations. For data obtained from the Register of Occupational Diseases, we assessed the sex-age structure of patients and the length of service in harmful working condition.

We also used Russian service of state statistics to obtain the official statistical data about number of rural population and key indicators of agriculture development (Russian Federal Service of state statistics).

Due to the lack of published large epidemiological studies, concerning either agricultural workers' health or quality of occupational health services, we used other available statistical data as a main comparison (Organisation for Economic Co-operation and Development, US Bureau of Labor Statistics, World Bank Open Data).

The software STATISTICA 8 (Statsoft Inc., USA) was used for the statistical data analysis. The data are presented as the arithmetic mean. The basic characteristics were processed using descriptive statistics. The difference between variables was evaluated by Student's t-test. The level of statistical significance was set at  $p < 0.05$ .

## RESULTS AND DISCUSSION

For the last three decades the percentage of agricultural population of Russia remains stable (Table 1). Decrease of the weight of agricultural population which took place in the middle of 20th century was caused by the country's industrialization and withdrawal of rural inhabitants to cities. The absolute number of rural population in Russia is also in slow decline. At the same time the number of employees in the agricultural sector decreased from 6.5 to 4.8 million people, i.e. by 25% over the period of last 10 years.

**Table 1.** Trends in number and proportion of rural population in the Russian Federation

Years	Number of inhabitants	Rural population	
		Number, million people	Proportion in the total population, %
1897 (in modern borders)	67,5	57,6	85
1914 (in modern borders)	89,9	74,2	83
1926	92,7	76,3	82
1939	108,4	72,1	67
1959	117,2	56,1	48
1970	129,9	49,3	38
1979	137,4	42,5	31
1989	147,0	<b>39,0</b>	<b>27</b>
2002	145,2	<b>38,8</b>	<b>27</b>
2010	142,9	<b>37,5</b>	<b>26</b>
2014	143,7	<b>37,1</b>	<b>26</b>

Nevertheless, compared to other industrialized countries, the share of agricultural population of Russia remains rather high, both against larger countries, such USA, and as well as against former Soviet republics. At the same time country's level of agriculture remains very low, i.e. poor level of production organization, insufficient mechanization, outdated agricultural technologies, high proportion of manual unskilled labor, etc. Most of agricultural machinery is domestic technique of old models, operated 10 years or more, amortization degree of which reaches 75% or more. Therefore, the added value per agricultural worker in Russia is much lower not only than in major industrialized countries, but also than in former Soviet republics, such Estonia (Table 2).

**Table 2.** Agriculture and rural development data in Russia, US and Estonia

	USA		Russia		Estonia	
	Absolute data	%	Absolute data	% to USA	Absolute data	% to USA
Employment in agriculture (% of total employment), data for the year 2014	<b>1.6</b>	100	<b>6.6</b>	412.5	<b>3.9</b>	243.7
Agricultural machinery, tractors per 100 sq. km of arable land, data for the year 2006	<b>272.3</b>	100	<b>27.1</b>	9.9	<b>604.7</b>	222.1
Agriculture value added per worker (constant 2010 US\$), data for the year 2014	<b>78,223.9</b>	100	<b>10,941.6</b>	13.9	<b>13,196.7</b>	16.9

In Russia mandatory monitoring of working conditions with quantitative evaluation of occupational exposures is being conducted since 1997 (i.e. toxic substances, noise, vibration, dust, physical stress, etc.). According to official statistical data, 30% of workers in agriculture have working conditions that do not meet safety requirements (Russian Federal Service of state statistics). The refore farmers are expected to be exposed to high occupational risks. However, in Russia the number of reported occupational diseases does not correspond to the level of anticipated occupational risk. Total incidence rates of nonfatal occupational illnesses is almost 19 times less than in United States, and almost three times less than in Estonia. With country's basic health status indicators compared to those in both the US and Estonia, occupational incidence rates are also expected to be significantly higher, especially under poor working conditions. Nevertheless, mortality and disability rates in the Russian Federation are higher than in compared countries (Table 3). Given the high level of prevalence of musculoskeletal diseases in adult population of the Russian Federation, these diseases could be considered to disguise occupational illnesses, particularly among agricultural workers.

**Table 3.** Health status indicators in Russia, US and Estonia, for the year 2014

	US		Russia		Estonia	
	Absolute data	%	Absolute data	% to USA	Absolute data	% to USA
Incidence rates of nonfatal occupational illness (all industries), per 10,000 full-time workers	<b>18.8</b>	100	<b>1.1</b>	5.9	<b>3.2</b>	17.0
Death rate, crude (per 1,000 people)	8.1	100	13.1	161.7	11.7	144.4
Disability prevalence (WHS, 2002–2004)	12.6	100	16.4	130.2	11.0	87.3
Life expectancy, Total population at birth, Years	78.8	100	70.6	89.6	77.0	97.7

The incidence rates of occupational illness among agriculture workers in Russia are lower than those for all occupations. However in Republic of Tatarstan, one of the most stable and developed regions in the Russian Federation, the incidence rates of occupational illnesses among agriculture workers are three times as much (Table 4). Other regions of Russia with higher level of occupational health care availability showed similar occupational incidence rates among agriculture workers (Bakirov et al., 2015).

**Table 4.** Incidence rates of occupational illnesses in Russian Federation and Republic of Tatarstan

	Russian Federation			Republic of Tatarstan		
	2012	2013	2014	2012	2013	2014
Incidence rates of nonfatal occupational illness (all industries), per 10,000 full-time workers	1.11	1.14	1.1	0.82	1.07	1.00
Incidence rates of nonfatal occupational illness (agriculture), per 10,000 full-time workers	0.86	0.83	0.69	2.71*	3.29*	2.78*

*The difference between variables was evaluated by Student's t-test.*

*Marked difference (\*  $p < 0.05$ ) is between compared data of Russia and Tatarstan.*

In Russia's agricultural sector more than half cases of occupational diseases were found among tractor drivers (53.0–59.7%), about one third – among livestock keepers (33.3–35.1%), there are a relatively large numbers of occupational diseases among veterinary officers (5.0–11.3%) due to brucellosis cases in southern regions of Russia, and the smallest number of occupational diseases registered among plant breeders (1.0–2.6%).

In Republic of Tatarstan the structure of occupational incidence is slightly different. The most numerous group of affected workers are livestock keepers (56.5–61.1%), and then tractor drivers (27.7–43.5%). The number of plant breeders 6–8%. Cases of occupational diseases caused by biological agents are very seldom – one case in several years. This difference in incidence structure can be explained by a higher level of hygienic control measures, which can help manage the risk of occupational diseases caused by biological agents. Most of big farms in Tatarstan are well-equipped with modern agricultural machinery, which resulted in lower levels of occupational diseases among tractor drivers. Unfortunately, levels of mechanization and proportion of manual labor remain the same. Therefore, the amount of occupational diseases among livestock keepers is quite high.

The structure of occupational morbidity among agricultural workers such as age-sex distribution in Russia cannot be analysed using only official statistical data of Russian Federal Service for Supervision of Consumer Rights Protection and Human Welfare. All-Russian Registry of Occupational Diseases there is still no in the Russian Federation. This is why we used the data from Registry of Occupational Diseases of Tatarstan Republic, where one of first Registries was founded. In Tatarstan Republic over the years 2012–2014 the most frequent occupational illnesses among agricultural workers were MSDs which amounted 65.2%; whole-body vibration syndrome and noise induced hearing loss turned out to be less frequent; other occupational diseases (one case of brucellosis and two cases of occupational chronic obstructive pulmonary disease) amounted only 2.9% (Table 5).

**Table 5.** Basic characteristics of occupational diseases among agricultural workers in Tatarstan Republic (2012–2014)

	Number / %	Age, mean (95% CI)	Length of service, mean (95% CI)	Gender, male/female
Whole-body vibration syndrome	27 / 19.5	52.4 (51.0–53.8)	30.2 (28.1–32.3)	27/0
Noise induced hearing loss	17 / 12.3	54.1 (51.9–56.2)	30.7 (27.3–34.1)	17/0
Bursitis and tenosynovitis	36 / 26.1	51.4 (50.2–52.6)	28.3 (26.3–30.3)	6 /30
Low back pain	18 / 13.0	49.6 (47.5–51.7)	26.5 (23.2–29.9)	2/16
Neck pain	36 / 26.1	50.3 (48.7–51.8)	26.7 (24.4–29.0)	6/30
Other diseases	4 / 2.9	47.3 39.6–54.9)	11.5 (8.2–14.7) *	2/2
In total	138 / 100.0	27.9 (26.4–29.3)	51.2 (50.4–52.2)	65/73

*The difference between variables was evaluated by Student's t-test.*

*Marked difference (\*  $p < 0.05$ ) is between compared group and all the others.*

Analysis of age distribution among agricultural workers with newly diagnosed occupational diseases reveals that the most likely reasons of underreporting of occupational diseases are both the fear of losing job and the lack of access to occupation health services. The overwhelming majority of occupational diseases are diagnosed at

the age 50 or over with the length of service of 26 years and more years with any statistically significant differences among groups of diseases, i.e. several years to retirement.

Undoubtedly, the reasons for under-diagnosis may include also a well known shortage of medical doctors, even occupational health physicians, in rural areas of Russia. The other reason may be a lack of awareness of medical doctors in occupational health due to absence of evidence-based clinical practice guidelines of MSDs diagnosis.

Furthermore, some of smallholder farmer often are uninsured in system of compulsory social insurance, that denied them the right to receive as the disability payment as medical rehabilitation measures, that does not help to consult a doctor. As a result, late diagnosis of advanced forms of occupational diseases among rural workers has made all the treatment and rehabilitation measures inefficient and increased disability level of working population in rural areas of Russia.

## CONCLUSIONS

In the Russian Federation the proportion of rural inhabitants among employed population has been gradually decreasing for the last decades, but still remains noticeably higher than in other industrialized countries. Level of added value per agricultural worker in Russia is lower than in major industrialized countries due to obsolete equipment, high rate of low-skilled manual labour, etc. As a result, approximately one-third of agricultural workers in Russia are forced to work under harmful working conditions. Therefore, the level of occupational diseases among agricultural workers is expected to be higher. However, over the past years in Russia the incidence rates of occupational illnesses among agriculture workers are significantly lower than those for all occupations. Given the fact that the total incidence rates of nonfatal occupational illnesses in Russia is almost 19 times less than in United States and almost three times less than in Estonia, we can conclude that there is considerable occupational diseases underdiagnosis also among rural workers.

The structure of occupational incidence of agricultural workers is different both in Russia and Republic of Tatarstan. In Russia's agricultural sector more than half cases of occupational diseases were diagnosed among tractor drivers, but in Republic of Tatarstan – among livestock keepers, which can be explained by higher level of hygienic control measures and agricultural equipment in Tatarstan. Proportion of manual labor remains the same, resulting in a quite high rate of occupational diseases among livestock keepers both in Russia and Tatarstan.

In general, underdiagnosis of occupational diseases in agriculture sector can be explained by: (a) low level of health care availability; (b) lack of occupational physicians in rural areas; (c) lack of awareness of medical doctors in occupational health; (d) high level of non-communicable diseases incidence, which can disguise occupational illnesses among agricultural workers; (e) lack of social security of smallholder farmers.

The improvement of the health care regulatory legal framework, development of evidence-based clinical practice guidelines, quality improvement in postgraduate education of medical doctors in rural areas, increasing in the number of occupational health physicians in rural areas, and implementation of long-term health promotion programs are necessary in order to maintain the health of agricultural workers in the

Russian Federation. This list of priority measures is not sufficient, as it highlights only the main issues in the field of occupational health.

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