

**ICEST 2021****II International Conference on Economic and Social Trends for Sustainability of Modern Society****SOCIO-HYGIENIC FACTORS OF HEALTH RISK OF  
AGRICULTURAL WORKERS**

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**Abstract**

The aim of the work is to assess the influence of social and hygienic factors on the formation of the health of agricultural workers on the basis of their subjective perception and the results of sanitary and hygienic and epidemiological studies. Comprehensive sociological, hygienic and epidemiological studies have been carried out on the example of the most widespread and demanded professional group in the agricultural sector - tractor drivers-machinists of agricultural production (agricultural machine operators). The most significant factors contributing to the development of risk-associated health disorders are unfavourable working conditions: microclimatic discomfort, noise, general and local vibration, air pollution with dust and chemicals, etc. Most of the respondents (64.8%) associated health deterioration with exposure to production factors, which, in their opinion, are the main cause of the development of chronic somatic and occupational diseases. A close correlation ( $r = 0.91$ ) was revealed between the subjective assessment of the state of health and the opinion of the respondents that it worsened in connection with work. In the nosological structure of occupational morbidity, the first place was occupied by vibration disease (36.7%), the second - radiculopathy (28.5%), the third - sensorineural hearing loss (24.6%), the fourth - mono- and polyneuropathies of the upper and lower extremities (7,2%). The health status of the rural population is also influenced by social and behavioural factors. Research results indicate the need to implement measures to manage social and occupational health risks.

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*Keywords:* Agricultural workers, social and hygienic factors, health risk



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## 1. Introduction

Prevention of the harmful effects of risk factors for public health is one of the priority areas of the modern concept of health care development in the Russian Federation (Decree of the President of the Russian Federation N254, 2019). At the present stage, the preservation and strengthening of the health of the rural population, characterized by a tendency to deterioration, manifested in an increase in morbidity, disability and mortality, is of particular relevance (Bezrukova et al., 2020; Popova, 2016).

The preservation of the health of the rural population is associated with the solution of many medical and social problems of the development of rural areas. This is a relatively low standard of living, especially in regions with a stagnating economy, underdeveloped engineering and social infrastructure of rural settlements, a low level of living conditions, limited access to primary health care and qualified medical care, a specific mentality and a conservative lifestyle, an orientation towards group norms. such as mistrust of official medicine, self-medication, recourse to folk remedies and methods of treatment (Luchkevich & Zelionko, 2016).

The most important factor among the factors affecting the health of the working rural population belongs to unfavourable working conditions, the impact of which poses a constant risk of developing occupational and chronic somatic diseases. According to the Federal Service for Surveillance on Consumer Rights Protection and Human Welfare, agricultural enterprises, together with forestry, hunting, fishing and fish farming, occupy one of the first rank places among other types of economic activity in terms of the number of cases of occupational diseases detected annually. The level of occupational morbidity (OM) in this industry in 2019 exceeded by 5.5% the value of OM for the Russian Federation as a whole (Novikova et al., 2018). Among agricultural workers over the past 10 years, the first rank place (about 70%) in the professional structure of persons with established occupational diseases belonged to tractor drivers-machinists of agricultural production (agricultural machine operators) (Popova, 2016).

However, the study of the role of socio-hygienic factors in the formation of the health of this most demanded qualified professional group of the agrarian sector of the Russian economy has not received enough attention, which indicates the relevance and significance of these studies.

## 2. Problem Statement

The results of our own long-term socio-hygienic and epidemiological studies testified that in the process of working, agricultural machine operators are exposed to the complex effects of a wide range of harmful production factors posing a risk to their health. The most significant factors of the working environment were increased levels of industrial noise, local and general vibration, unfavourable microclimatic and meteorological conditions, air pollution of the working area with dust of soil and (or) plant origin and toxic substances (exhaust gases, petroleum products, agrochemicals and pesticides).

Among the negative factors of the labour process, one should single out physical overloads and an irrational fixed working posture caused by design flaws and deterioration of the agricultural machinery in use. Also, the work of machine operators is associated with the load on the visual and auditory analysers, emotional stress arising from the limited timing of seasonal field work, their irregularity and irregularity (Fesenko et al., 2016).

A significant negative contribution to the health of rural residents is made by social, lifestyle and behavioural risk factors: alcohol consumption, tobacco smoking, poor nutrition, which can synergize the development of pathological conditions, exacerbating the impact of environmental factors, including the work environment (Federal Service for Supervision of Consumer Rights Protection and Human Welfare, 2020).

### **3. Research Questions**

Research questions included:

- Based on the results of a sociological survey, to analyse the self-perception of agricultural machine operators of the influence of social, household and behavioural factors (tobacco smoking, alcohol intake, nutrition, availability of medical care, etc.) on the formation of health.
- Using the example of a professional group of agricultural machine operators to study the relationship between self-assessment of the impact of production factors on health with an objective hygienic assessment of the working conditions of agricultural workers.
- Determine the contribution of production factors to the formation of risk-associated non-infectious general somatic and occupational diseases of agricultural machine operators.
- Establish priority areas for managing social and occupational health risks for agricultural workers.

### **4. Purpose of the Study**

Assessment of the influence of social and hygienic factors on the formation of the health of agricultural workers based on their subjective perception and the results of sanitary and hygienic and epidemiological studies

### **5. Research Methods**

A selective target sociological survey of 267 male machine operators of farms of various forms of ownership in the Saratov region, specializing in the production of grain crops, was carried out. The selection criterion was the professional affiliation of the respondents. The average age of the respondents was  $47.0 \pm 9.44$  years. Of these, 5.6% were between the ages of 21 and 29, 17.2% were between 30 and 39, 27.7% were 40-49, and 49.4% were over 50.

The average work experience in the profession was  $21.16 \pm 9.72$  years: up to 10 years - 12.4%, from 10 to 19 years - 27.3%, from 20 to 29 years - 37.8%, over 30 years - 22.5%.

The studies were carried out using a self-assessment questionnaire of the functional state and fatigue in the course of work of workers, recommended by the Research Institute of Occupational Medicine of the Russian Academy of Medical Sciences (Federal Center for State Sanitary and Epidemiological Supervision of the Ministry of Health of Russia, 2005) and adapted for research among agricultural workers.

The questionnaire contained closed-ended questions using coding of answer options for subsequent automated processing and included the following information blocks:

- basic socio-economic characteristics of individuals (gender, age, marital status, education, income, living conditions);
- behavioural factors and attitudes towards one's own health (alcohol consumption, tobacco smoking, physical activity);
- social status (satisfaction with work, medical and preventive services);
- self-assessment of working conditions and safety;
- self-assessment of health and the relationship of his condition with professional activity. In accordance with biotic norms, written consent of the respondents was obtained for the conduct of the study.

The hygienic assessment of working conditions was carried out based on the materials of our own long-term hygienic and ergonomic studies of the working conditions of agricultural machine operators during the main seasonal field work using the criteria and methods adopted in labor medicine (Federal Center for State Sanitary and Epidemiological Supervision of the Ministry of Health of Russia, 2004; Izmerov, 2005).

The level of occupational morbidity of agricultural machine operators was analyzed based on the materials of the Rospotrebnadzor departments for 82 constituent entities of the Russian Federation for the period from 2011 to 2017 using the indicators generally accepted in the analysis of OM (Medic, 2003).

Statistical processing and analysis of data were carried out using Microsoft Excel and Statistica 10.0. To assess the relationship between the studied indicators, Spearman's rank correlation ( $r$ ) was calculated. The significance of differences in the levels of indicators in subgroups was determined by the Mann-Whitney U-test. Differences were considered statistically significant at  $p < 0.05$ .

## 6. Findings

The results of a sociological survey showed that most of the male machine operators had a general secondary and specialized secondary education (90.4%) and were married (86.1%). Almost all respondents (99.25%) were satisfied with their living conditions and characterized them as favourable, as they lived in their own house or in a separate apartment, had personal plots and livestock (76.03%).

Analysis of the research results showed that at the time of the survey, more than a third of the respondents (27.72%) assessed their state of health as "bad", more than half (53.18%) as "satisfactory", 8.99% - "good", the rest 10.11% of respondents found it difficult to answer this question.

86.76% of respondents indicated the presence of chronic diseases, of which 66.29% - diseases of the musculoskeletal system and connective tissue, 35.21% - respiratory organs, 23.22% - digestive organs, 23.22% - system diseases blood circulation.

Clinically verified occupational diseases were found in 50.19% of the surveyed machine operators. Of these, 48.1% of patients were diagnosed with diseases of the musculoskeletal system and connective tissue (radiculopathy of the lumbosacral level), 9.3% suffered from vibration disease, 20.4% of sensorineural hearing loss, 20.4% of respiratory diseases (chronic dust non-obstructive bronchitis, allergic bronchial asthma, chronic obstructive pulmonary disease), 1.8% chronic brucellosis.

Despite the fact that the majority of the respondents (69.7%) noted the presence of chronic diseases, only 39.7% of the respondents were registered at the dispensary, which could indicate that the workers of the surveyed farms were insufficiently provided with medical care.

According to the survey, over the past year, 66.3% of respondents suffered from diseases of the musculoskeletal system and connective tissue, diseases of the respiratory system - 30.0%, circulatory system - 18.7%, digestive system - 9.7%. Over the past year, 3.0% of the surveyed machine operators did not get sick.

Despite the high incidence of:

- 68.54% of the respondents sought medical help only when necessary;
- 6.74% - once a month;
- 10.11% - 2 times a year;
- 8.61% - once a year;
- 6% did not apply at all.

The rare appeal of rural residents for primary health care and specialized medical care could be due to the territorial remoteness of medical organizations, their understaffing with medical personnel, and the high cost of reimbursable medical services. It may also indicate the priority for the rural population of labour duties to the detriment of their own health, in which seeking medical help is perceived as a last resort.

The poor organization of medical care for the rural population working in harmful and difficult working conditions was also evidenced by the survey data on the passage of mandatory periodic medical examinations by machine operators (PME). In the 5 years preceding the survey:

- 41.95% of employees passed the PME 1 time,
- 12.73% - 2 times,
- 9.74% - 3 times,
- 4.87% - 4 times;
- only 16.48% of the respondents passed the PME every year.

This fact indicated a violation of the regulations for passing the PME and could be a consequence of the opposition of employers and workers to the expert assessment of admission to work in the profession because of the unwillingness to lose workers on the one hand, and work on the other.

This state of affairs leads to the fact that most of the occupational diseases among agricultural machine operators are detected during self-referral to occupational pathology centres, and not during the PME. The counter-productiveness of the work of occupational pathological care of rural medical organizations is confirmed not only by the low coverage of the medical equipment of the subject contingent, but also by the persistent tendency of an increase in the number of patients with initially identified combined occupational diseases (two or more diagnoses), indicating late diagnosis of occupational diseases and low quality of preventive measures (Popova, 2016).

Most of the surveyed (64.8%) agricultural machine operators associated the deterioration of their health with unsatisfactory working conditions, which, in their opinion, were the main reason for poor health during work and the development of chronic diseases. We have established a close correlation between the subjective assessment of the state of health as “bad” and the opinion of the respondents that it worsened in connection with work ( $r = 0.91$ ). At the same time, 16.1% of the respondents believed that working conditions do not affect their health, and 19.1% found it difficult to answer this question. In the opinion of the respondents, harmful and difficult working conditions largely influenced the occurrence of diseases of the musculoskeletal system and connective tissue (66.29%), respiratory system (35.21%) and cardiovascular system (23.22%). In addition, 11.99% of respondents believed that the reason for the deterioration in health was neuro-emotional stress associated with irregularity and irregularity of work load.

The results of the analysis of the questionnaire survey showed that the working conditions as “harmful” to health were assessed by 94.8% of the respondents, noting the totality of a number of production factors in the workplace. The unfavourable microclimatic conditions in the cabins of agricultural machinery were indicated by 55.8% of the respondents, of whom 41.57% pointed out an increased temperature, 14.23% - increased air humidity and 35.58% - an unsatisfactory speed of its movement. High noise levels were noted by 43.07% of respondents, general and local vibration - 52.81%, gas and dustiness of the air in the working area - 25.47% and 44.19%, respectively. Among the main harmful factors, in 22.0% of the answers, an uncomfortable working posture was noted, in 12.73% of cases, the irrational organization of workplaces. When assessing the severity of labour, more than half (58.05%) of the respondents rated their labour as “hard”, 36.7% - “moderately hard” and only 4.12% classified their labour as “light”. Of the factors of the severity of the labour process, physical overload was indicated in 53.56% of cases, neuro-emotional overstrain in 20.22%. The results of the analysis of the self-assessment of working conditions by respondents with different length of service in the profession showed that in the group of respondents with up to 10 years of experience, a large share (45.5%) assessed labour activity as moderate, 9.1% considered their work easy. In groups of machine operators with work experience of 10-20 years; 20-30 years and more than 30 years, the majority (respectively, 53.4%; 60.4% and 68.3%) considered their work hard and an insignificant part (2.7%; 4.0% and 3.3%, respectively) easy.

An irrational mode of work and rest was indicated by 79.4% of respondents, of whom 32.58% had a working day of 9-12 hours, 17.23% more than 12 hours and 29.57% of respondents worked in conditions of irregular working hours. The unfavourable influence of factors of working conditions on the organism of machine operators was confirmed by the results of self-assessment of feelings of fatigue in the process of work, which showed that their well-being worsened in the dynamics of the work shift. If at the beginning of the working day 39.70% of the respondents felt well, then at the end of the shift, only 9.7%. At the same time, the number of people with poor health by the end of the shift increased statistically significantly from 1.5% to 37.83% ( $p < 0.001$ ). With an increase in the length of service in the profession, the proportion of machine operators who felt well at the beginning of the working day decreased from 52% to 33%, and the number of workers who felt bad at the end of the working day increased from 24% to 45% ( $p < 0.05$ ), indicating the accumulation of fatigue in the process of work. At the same time, 75.28% of employees complained about the feeling of fatigue and pain in the lumbar region; in the back - 21.35%; in the hands - 29.569%; in the legs - 33.71%; also 20.22% of respondents experienced headaches. The reasons for the

appearance of fatigue and pain, according to 55.81% of the surveyed machine operators, were difficult working conditions. Based on the results of statistical analysis, we established a significant positive correlation between the subjective manifestations of pain at the end of the shift and the assessment of physical overload and uncomfortable body position ( $r = 0.81$  and  $r = 0.56$ , respectively) as the main unfavourable factors of labour.

At the beginning of the next working day, a significant part of the respondents (16.9%) did not feel rested, which could be due to the high workload in unfavourable working conditions and the short periods of rest and recovery due to the irrational organization of work. Only 7.9% of the respondents always felt rested; 64.8% indicated that it happens “in different ways”. The presented data show that the accumulation of fatigue by the beginning of the next working day led to additional stress in the body's adaptive systems. Repeated daily throughout the entire working week, this can lead to depletion of the body's compensatory capabilities, the development of overwork and, as a result, functional overstrain of various organs and systems. In addition, the constant feeling of fatigue that does not leave a person even after a night's rest is an important professional burnout syndrome (Bukhtiyarov, et al., 2018). The presented data indicated the unfavourable effect of working environment factors and their ability to serve as an etiopathogenetic basis for the formation of various functional disorders and pathological conditions in agricultural machine operators (Novikova et al., 2018). This provision was confirmed by the conjugation of the survey results with the results of sanitary-hygienic and epidemiological studies, indicating the significance and role of harmful factors in the formation of risk-associated pathologies in agricultural machine operators. It was found that due to the specifics of production activities, agricultural machine operators in the process of work were exposed to a complex of harmful production factors (noise, general and local vibration, unfavourable microclimate, physical overstrain), the levels of which exceeded the hygienic standards to varying degrees, forming harmful working conditions 2 -4 degrees (see Table 1).

**Table 1.** Hygienic assessment of the working conditions of agricultural machine operators when performing the main types of seasonal field work

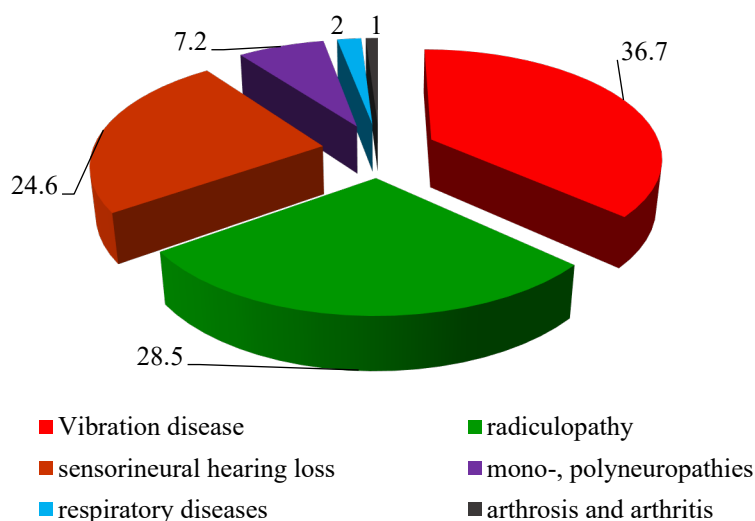
Factor name	Working conditions class according to R 2.2.2006-05					
	Harrowing	Sowing cereals	Grain harvesting	Arable work		Snow retention
				Summer	Autumn	
Microclimate	2	3.2-3.4	2*-3.4	3.2-3.4	2*-2	3.1
Aerosols of predominantly fibrogenic action	3.1-3.3	3.2 - 3.4	2*-3.3	3.1 - 3.3	2*-3.1	-
Noise	3.1*-3.3	3.2-3.3	2*- 3.2	3.1-3.3	3.1*-3.2	3.1
General vibration	2*- 3.2	3.2	2*- 3.2	2*-3.2	2*-3.2	3.1
Local vibration	2*-3.1	3.1	2* -3.2	2*- 3.1	2*-3.1	3.1
The severity of labour	3.1*-3.3	3.3	3.1*-3.3	3.1*-3.3	3.1*- 3.3	3.2
Labour tension	3.2	3.2	3.2	3.2	3.2	3.2

*Note:* \* - when working on domestic equipment of new samples and imported production with a service life of no more than 5 years.

In the formation of harmful working conditions for agricultural machine operators, a certain role was played by the constructive imperfection of the cabins of physically and morally obsolete agricultural

machinery, which determines the inconsistency of hygienic indicators at the workplace with sanitary and epidemiological requirements for working conditions. The leading unfavourable factors were noise, microclimatic conditions, the severity of the labour process, the levels of which exceeded the hygienic standards within the limits that could have a negative effect on the human body, lead to the development of occupational diseases from mild to severe severity, including with the loss of occupational and general working capacity (Federal Service for Supervision of Consumer Rights Protection and Human Welfare, 2020). Thus, exposure to increased noise levels can initiate the formation of sensorineural hearing loss (Adeninskaya et al., 2017), exposure to general and local vibration leads to the development of vibration disease (Lakhman et al., 2019), and, in combination with a static fixed working posture, contributes to the development of bone diseases. -muscular system and connective tissue (Novikova et al., 2019).

The occupational health risk of agricultural machine operators when working on mobile agricultural machinery was confirmed by the results of a study of occupational morbidity among agricultural workers registered in Russia in the period from 2011 to 2017. In total, during the analysed period, occupational diseases were identified in 960 working in the profession of tractor driver-machinist of agricultural production, who were diagnosed with 1052 occupational diseases. Most occupational diseases developed in agricultural machine operators under the influence of vibroacoustic factor (61.3%) and physical overload (36.7%). As can be seen in Figure 1 below, in the nosological structure of PZ accumulated over the studied period, the first rank place was occupied by vibration disease (36.7%), the second - radiculopathy, predominantly of the lumbosacral level (28.5%), the third - sensorineural hearing loss (24, 6%), fourth - mono- and polyneuropathy of the upper and lower extremities (7.2%).



**Figure 1.** Nosological structure of accumulated occupational morbidity of agricultural machine operators (2011-2017)

The frequency of cases of diagnostics of combined occupational pathology among tractor drivers of agricultural production has almost doubled since 2015 from 9.5 to 18.8%, which indirectly indicated the low quality of periodic medical examinations in terms of early detection of occupational diseases (Popova,



2016). The most frequently diagnosed combinations of occupational diseases: vibration disease and sensorineural hearing loss (47%), lumbosacral radiculopathy and sensorineural hearing loss. (fifteen%).

The negative impact of factors of the working environment can contribute to the development of a number of nosology that are not occupational, such pathologies are production-related. Among occupational diseases among agricultural machine operators, diseases of the circulatory system (arterial hypertension) (Novikova et al., 2020), the musculoskeletal system and connective tissue (reflex syndromes of the cervical and lumbosacral levels), respiratory organs (chronic dust non-obstructive bronchitis, bronchial asthma) (Poteryaeva, 2018).

The most important factors affecting the individual health of the rural population are social conditions. Some respondents (0.75%) associated the deterioration of health with unsatisfactory living conditions - the lack of basic housing services (water supply, sewerage, hot water supply, central heating).

According to the survey data, 85.39% of respondents after a working day for 3-5 hours were forced to work in their personal subsidiary plots and caring for livestock, during which they were also exposed to certain health risk factors inherent in their professional activities: dust of mineral, vegetable and (or) animal origin, physical manual labor.

It is well known that human health is directly related to behavioral factors and attitudes towards one's own health. According to the international studies of the "Global Burden of Disease" (GBD), conducted in 204 countries of the world in the period from 1990 to 2019, the global list of factors initiating the incidence of no communicable diseases and premature mortality of men and women of all ages, among the 10 most important (out of 87 studied) included smoking, diet and diet, and alcohol consumption (Abbafati et al., 2020).

We found that among the surveyed machine operators, smokers accounted for 58.43%, which is consistent with the literature data on the prevalence of tobacco smoking in Russia (Melnichenko et al, 2010). Smoking experience of 18-25 years had 31.415% of respondents; more than 25 years: 50% of the respondents. Smoking as a cause of chronic bronchopulmonary diseases was indicated by 17.6% of the respondents.

Alcohol was consumed by 70.03% of the respondents, of whom 2 times a week: 61.05%; 3 to 5 times: 8.61%; more than 10 times a month: 0.37% of respondents. However, the opinion that alcohol consumption has a negative impact on their health was expressed by only 1.12% of the respondents.

According to 14.61% of respondents, the occurrence of chronic diseases was associated with unsatisfactory and irregular nutrition, which, in their opinion, is largely due to its poor organization during field work.

Changes in the country's economy negatively affect the rural population, which becomes the cause of permanent stress load, which can turn into a serious threat to health. 12% of respondents indicated neuro-emotional stress and stress as reasons for deteriorating health, linking them to an unstable and (or) unsatisfactory family budget and fear of losing their jobs.

## 7. Conclusion

Thus, the results of the studies carried out made it possible to establish a significant influence of social and hygienic factors on the health of agricultural workers. Most of them are manageable, their

correction is possible when creating favourable social conditions, improving working conditions, improving medical and social security, forming a commitment to a healthy lifestyle, raising awareness of risk factors and their impact on health.

The research results indicate the relevance of further development and implementation among agricultural workers of measures to manage social and occupational health risks.

1. Among social, household and behavioural factors, the main role in the deterioration of the health status of agricultural workers belongs to tobacco smoking and alcohol consumption.

2. The most significant factors contributing to the development of risk-associated health disorders of agricultural machine operators are unfavourable working conditions, which is confirmed by a significant correlation between the results of an objective hygienic assessment of working conditions and the survey data.

3. Priority measures to manage social and occupational health risks of the rural population are the formation of a health-saving social and domestic and industrial environment, correction of behavioral risk factors, improvement of medical and social security, raising awareness of domestic and industrial health risk factors.

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