

Features of Morbidity of Workers in the Copper Industry

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Abstract The aim of the study was to study the state of health, age and occupational characteristics of morbidity of workers of the honey smelting and processing plant. Includes data on medical appeals and periodic medical examinations of 1761 workers of the main workshops of the copper smelter and enrichment plant. The leading diseases among the workers were respiratory, digestive, skin and subcutaneous diseases. Predicting the risk of developing various classes of diseases depending on age and work experience allows developing the most effective preventive measures.

Keywords Mining industry, Copper, Age, Work experience, Health status, Morbidity, Risk factors, Temporary disability

1. Introduction

The mining and metallurgical combined is the basis of most industries, therefore, in most countries of the world, the mining and metallurgical industry has great economic and social importance. According to experts of the International Labor Organization, the mining and metallurgical industry is considered as a unique industry, which, along with hard work, is affected by unfavorable working conditions, harmful and dangerous production factors. [4,6]

Unfavorable working conditions are the main reason for the development of diseases associated with poor health and temporary disability of people of various professions. [3]

The working conditions of workers in copper mines are characterized by a number of harmful and dangerous production factors, mainly high levels of dust, fibrogenic aerosols, strong noise, vibration and uncomfortable microclimate, labor intensity, their levels are significantly exceeding hygienic standards. [1,2,8,9]

The constant improvement of working conditions and the improvement of personal protective equipment partially prevents the impact of harmful production factors on almost all workers. [6,8]. It should be noted that the health of workers is affected not only by harmful and dangerous production factors, but also by their lifestyle and conditions, bad habits (smoking, alcohol consumption), natural processes of biological aging and etc. [10]

Among the classes of health disorders and diseases of workers working in hazardous and unsafe production conditions, diseases of the musculoskeletal system and connective tissue predominate.

However, vibration disease, tumor diseases of the ear and mammary glands, diseases of the respiratory system and the

nervous system are also common among miners. [5,7]

An increase in the duration of work in hazardous working conditions (work experience) was noted in the dynamics of the incidence of diseases of the circulatory system and the nervous system, the musculoskeletal system, and the respiratory system.

The work done is an important element in minimizing the risk of developing diseases associated with MTD, taking into account the age and experience of miners.

2. Aim

To study the characteristics of the health status of workers at the Copper Processing Plant (CPP) and the Copper Smelter (CS), the influence of age and work experience on the development of diseases.

3. Materials and Methods

We studied the data of the medical examination of 1761 workers by random selection of workers working at the Copper Processing plant (CPP) and the Copper Smelter (CS), the number of calls to outpatient clinics (2015-2020).

In order to study the dynamics, five (20-29 years old, 30-39 years old, 40-49 years old, 50-59 years old, 60 years old and older) and six groups of internships (20-29 years old, 30-39 years old) were examined. The health status of workers, indicators of general morbidity depending on age and length of service (up to 6 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, 26 years and older) (Figure 1). The state of health of workers was assessed by extensive and intensive indicators (the proportion of disease classes in the total morbidity, % of cases and the number of days per 100 workers).

Microsoft Excel 2010, SPSS 25 statistics, Student's t,

relative risk (RR), correlation coefficient (r) Pearson's method was used to assess the processing and reliability of the results.

4. Results and Discussion

80.2% were men and 19.8% were women out of the selected 1791 workers. The average age of workers was 38.58 ± 0.28 years, and the average total length of service

was 13.19 ± 0.2 years. The correlation coefficient showed that there is a direct and strong relationship between the average age of workers and the total length of service. ($r=0.81$) (Table 1). Changes in the dynamics of the health status of workers, general morbidity depending on age and work experience in five (20-29 years old, 30-39 years old, 40-49 years old, 50-59 years old, 60 years and older) and six groups of internships (up to 6 years old, 6-10 years old, 11-15 years old, 16-20 years old, 21-25 years old, 26 years old and over).

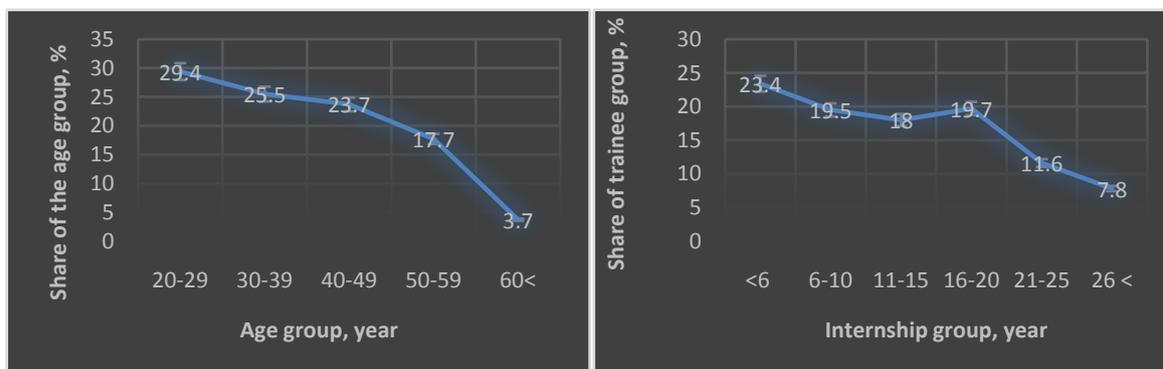


Figure 1. Distribution of workers by age and length of service

Table 1. Health status of employees of different age groups

Indicators	Age groups					total
	20-29	30-39	40-49	50-59	60 <	
Average age, year	25,21 ± 0,1	34,49 ± 0,12	44,36 ± 0,14	54,01 ± 0,154	62,05 ± 0,27	38,58± 0,28
average experience, year	5,07± 0,11	10,92 ± 0,22	17,51 ± 0,28	21,91 ± 0,38	23,94 ± 1,04	13,19 ± 0,2
Number of cases per 100 workers, cases	158,3 ± 4,2	193,8 ± 6,3	236,7 ± 8,8	299.1 ± 13,8	291,0 ± 29.	218,7±7,2
Number of sick days per 100 employees	1329,7 ± 56,2	1725,7 ± 79	2319,6 ± 111,1	3320,1	3550,2	2081,1±80,1
Average duration of one illness	8,4 ± 0,74	8,9 ± 0,65	9,8 ± 1,1	11,1 ± 1,6	12,2 ± 1,8	9,5±0,9
Practical healthy workers %	19,5±1,74	15,8±1,72	12,2±1,6	11,9±1,84	7,5±3.2	15,8±1,72

Table 2. Share of occupational diseases by main classes and age groups (in %)

Disease class	Age group				
	20-29 (n = 518)	30-39 (n = 449)	40-49 (n = 417)	50-59 (n = 311)	60 < (n = 66)
I. Some infectious and parasitic diseases	2,1 ± 0,6	0,8 ± 0,4	0,4 ± 0,3	0,4 ±	
III. Diseases of the blood, hematopoietic organs and certain disorders, some disorders involving the immune mechanism	1,7 ± 0,6	1,6 ± 0,6	0,5 ± 0,3	0,2 ±	
VI. Diseases of nervous system	9,2 ± 1,3	12,1 ± 1,5	11,7 ± 1,6	16,3 ± 2,1	12,5 ± 4,1
VII. Diseases of the eye and adnexa	5,0 ± 1,0	4,0 ± 0,9	3,8 ± 0,9	2,3 ± 0,8	5,2 ± 2,7
VIII. Diseases of the ear and mastoid process	4,9 ± 0,9	3,8 ± 0,9	1,6 ± 0,6	1,7 ± 0,7	5,2± 2,7
IX. Diseases of circulatory system	0,5 ± 0,3	2,2 ± 0,7	6,2 ± 1,2	14,9 ± 2,0	31,8 ± 5,7
X. Diseases of the respiratory system	40,9 ± 2,2	32,8 ± 2,2	25,3 ± 2,1	16,3 ± 2,1	16,7 ± 4,6
XI. Diseases of the digestive system	11,4 ± 1,4	11,4 ± 1,5	8,3 ± 1,4	6,6 ± 1,4	12,0 ± 4,0
XII. Diseases of the skin and subcutaneous tissue	4,9 ± 0,9	4,6 ± 1,0	4,1 ± 1,0	3,0 ± 1,0	1,5± 1,5
XIII. Diseases of the musculoskeletal system and connective tissue	5,1 ± 1,0	11,2 ± 1,5	14,4 ± 1,7	20,4 ± 2,3	7,8 ± 3,3
XIV. Diseases of the genitourinary system	4,9 ± 0,9	4,2 ± 0,9	2,6 ± 0,8	2,5 ± 0,9	3,1 ± 2,1
XIX. Injuries, poisoning and some other consequences	9,0 ± 1,3	9,6 ± 1,4	20,7 ± 2,0	14,5 ± 2,0	2,1 ± 1,8
Other diseases	0,5 ± 0,3	1,7 ± 0,6	0,4 ± 0,3	0,8 ± 0,5	2,1 ± 1,8
Total	100,0	100,0	100,0	100,0	100,0

When analyzing professional groups of workers, repairmen and plumbers 26.0%, locksmiths 11.5%, grinders 10%, drillers 8.2%, operators 7%, electric welders 7.3%, turners 5.3%, drillers 5.2%, electro mechanics 3.9%. and other specialties 15.6%.

The study of the features associated with an increase in the age groups of workers made it possible to identify significant changes in their health status, structure and level of morbidity (Table 2).

Relatively low morbidity rates in the working group aged 20–29 years (average age 25.21 ± 0.1 years) served as the basis for the assessment and statistical processing of morbidity rates in other age groups.

In the age group of 30–39 years (mean age 34.49 ± 0.12 years), there was an increase in the number of diseases and a decrease in the health index ($p < 0.05$) compared with the age group of 20–29 years. In terms of structure and severity, the leading classes were respiratory diseases, diseases of the nervous system, diseases of the digestive system, diseases of

the musculoskeletal system and connective tissue ($p < 0.05$).

In the age group of 40–49 years (average age 44.36 ± 0.14 years), the incidence increased by 1.5 times per 100 workers compared with the age groups of 20–29 and 30–39 years, and the number of practically healthy workers decreased in 1.6 times. Diseases of the musculoskeletal system and connective tissue, circulatory system, nervous system, respiratory organs decreased in growth ($p = 0.05$).

In the age group of 50–59 years, the incidence increased by almost 2 times per 100 workers, and the number of practically healthy workers decreased by 1.7 times. ($p = 0.05$). The incidence of diseases of the circulatory system and the nervous system has increased, the incidence of respiratory diseases has decreased ($p < 0.05$).

Due to the small number of workers aged 60 and over, it was difficult to analyze changes in their health. There were almost no healthy people among them, and the increase in the number of diseases per worker was statistically unreliable ($p = 0.05$).

Table 3. Temporary disability by age (per 100 employees)

Disease class	Age group				
	20-29 (n = 518)	30-39 (n = 449)	40-49 (n = 417)	50-59 (n = 311)	60 < (n = 66)
I. Some infectious and parasitic diseases	3,3 ± 0,8	1,6 ± 0,6	1 ± 0,4	1,3 ± 0,6	
III. Diseases of the blood, hematopoietic organs and certain disorders, some disorders involving the immune mechanism mechanisms and complaints etuvchi airim buzilishlar иммун механизми жалб этувчи айрим бузилишлар	2,7 ± 0,7	3,1 ± 0,8	1,2 ± 0,5	0,6 ± 0,3	
VI. Diseases of nervous system	14,5 ± 1,5	23,4 ± 2,0	27,6 ± 2,2	48,9 ± 2,8	36,4 ± 5,9
VII. Diseases of the eye and adnexa	7,9 ± 1,2	7,8 ± 1,3	9,1 ± 1,4	6,8 ± 1,4	15,2 ± 4,4
VIII. Diseases of the ear and mastoid process	7,7 ± 1,2	7,3 ± 1,2	3,8 ± 0,9	5,1 ± 1,2	15,2 ± 4,4
IX. Diseases of the circulatory system	0,8 ± 0,4	4,2 ± 0,9	14,6 ± 1,7	44,7 ± 2,8	92,4 ± 3,3
X. Diseases of the respiratory system	64,7 ± 2,1	63,5 ± 2,3	59,9 ± 2,4	48,9 ± 2,8	48,5 ± 6,2
XI. Diseases of the digestive system	18,1 ± 1,7	22 ± 2,0	19,7 ± 1,9	19,6 ± 2,3	34,8 ± 5,9
XII. Diseases of the skin and subcutaneous tissue	7,7 ± 1,2	8,9 ± 1,3	9,6 ± 1,4	9 ± 1,6	4,5 ± 2,6
XIII. Diseases of the musculoskeletal system and connective tissue	8,1 ± 1,2	21,8 ± 1,9	34,1 ± 2,3	61,1 ± 2,8	22,7 ± 5,2
XIV. Diseases of the genitourinary system	7,7 ± 1,2	8,2 ± 1,3	6,2 ± 1,2	7,4 ± 1,5	9,1 ± 3,5
XIX. Injuries, poisoning and some other consequences	14,3 ± 1,5	18,7 ± 1,8	48,9 ± 2,4	43,4 ± 2,8	6,1 ± 2,9
Other diseases	0,8 ± 0,4	3,3 ± 0,8	1 ± 0,4	2,3 ± 0,9	6,1 ± 2,9
Total	158,3 ± 4,2	193,8 ± 6,3	236,7 ± 8,8	299,1 ± 13,8	291,0 ± 29,0

Table 4. The health status of workers with different work experience

Indicators	Experience, year						Total
	<6	6-10	11-15	16-20	21-25)	26 <	
Average age, year	3,27 ± 0,6	7,97 ± 0,73	13,06 ± 0,08	17,83 ± 0,73	22,84 ± 0,1	30,2 ± 0,34	13,19 ± 0,2
average experience, year	26,98 ± 0,3	30,43 ± 0,3	40,14 ± 0,45	46,10 ± 0,39	49,7 ± 0,42	54,5 ± 0,44	38,58 ± 0,28
Number of cases per 100 workers, cases	142,6 ± 3,8	183,6 ± 6,7	219,6 ± 9,1	238,4 ± 9,7	301,5 ± 17,2	360,2 ± 26,2	218,7 ± 3,8
Number of sick days per 100 employees	1239,7 ±	1671,6 ±	1671,7 ±	2659,7 ±	2983,8 ±	3891,2 ±	2081,1 ± 48,4
Average duration of one illness	8,7 ± 0,7	9,1 ± 0,8	9,5 ± 0,9	11,5 ± 1,1	9,9 ± 0,9	10,8 ± 1,0	9,5 ± 0,9
Practical healthy workers %	19,5 ± 1,74	16,3 ± 1,5	14,5 ± 1,3	9,1 ± 0,8	7,8 ± 0,7	7,3 ± 0,6	15,8 ± 1,72

Table 5. Temporary disability by length of service (per 100 employees)

Disease class	Experience, year					
	<6	6-10	11-15	16-20	21-25	26 <
I. Some infectious and parasitic diseases	3,9±0,95	1,5±0,6	0,9±0,5	1,1±0,5	1±0,6	1,5±1,04
III. Diseases of the blood, hematopoietic organs and certain disorders, some disorders involving the immune mechanism	3,2±0,88	1,5±0,6	3,2±0,9	1,7±0,7	0,5±0,5	
VI. Diseases of nervous system	8,5±1,4	6,7±1,3	6,6±1,4	10,1±1,6	12,2±2,2	11±2,68
VII. Diseases of the eye and adnexa	6,1±1,2	6,7±1,3	8,8±1,6	12,9±1,8	4,9±1,5	9,6±2,5
VIII. Diseases of the ear and mastoid process	6,1±1,2	8,7±1,5	6,3±1,3	3,7±1,01	4,9±1,5	5,1±1,8
IX. Diseases of the circulatory system	10,2±1,5	15,7±1,9	25,6±2,4	41,7±2,6	74,1±3,06	86±2,9
X. Diseases of the respiratory system	43,7±2,4	56,9±2,6	64,7±2,7	64,7±2,5	57,6±3,45	66,2±4,06
XI. Diseases of the digestive system	19,9±1,9	20,4±2,2	24,9±2,4	17,8±2,05	11,7±2,2	16,2±3,1
XII. Diseases of the skin and subcutaneous tissue	9,5±1,4	13,1±1,8	7,3±1,4	7,5±1,4	4,9±1,5	13,2±2,9
XIII. Diseases of the musculoskeletal system and connective tissue	10,7±1,5	16,6±2,01	26,8±2,5	29,3±2,4	65,9±3,3	69,9±3,9
XIV. Diseases of the genitourinary system	5,1±1,1	9,3±1,6	10,1±1,7	12,9±1,8	6,3±1,7	2,9±1,4
XIX. Injuries, poisoning and some other consequences	15±1,7	23,3±2,8	32,2±2,6	33±2,5	55,6±3,4	77,2±3,6
Other diseases	0,72±0,4	3,2±0,9	2,2±0,8	2±0,7	1,95±0,9	1,4±1,01

Thus, the first part of the study showed that 1/5 of workers under the age of 30 are practically healthy workers. The structure and degree of their incidence is dominated by respiratory diseases, injuries caused by external causes, poisoning and some other consequences, diseases of the digestive system and diseases of the nervous system. There is a deterioration in the health of workers in the age group of 40-49 years.

The second part of the study is related to the study of the health status, structure and degree of morbidity of workers with different work experience (Table 4). An analysis of the results of a scientific study showed that more than 20% of employees with less than 6 years of work experience do not have chronic diseases.

There are significant changes in the health status of workers with a work experience of 6-10 years: a relative increase in the number of diagnosed diseases per 100 workers and a decrease in the number of practically healthy workers ($p < 0.05$).

An increase in the number of diagnosed cases per 100 workers with work experience of 11-15 years by 1.54 times was noted, but no significant decrease was observed in practically healthy workers. The most pronounced increase in extensive and intensive distribution was observed in diseases of the respiratory system ($p < 0.05$).

An increase in the number of diagnosed cases per 100 workers with an experience of 16-20 years by 1.67 times was noted, but in practice, a 2-fold decrease was observed in healthy individuals ($p = 0.05$).

A decrease in growth and diseases of the respiratory organs was noted due to diseases of the circulatory system, diseases of the musculoskeletal system and connective tissue, injuries caused by external causes, poisoning and some other consequences. It has been established that the dynamics of health indicators of miners in groups of 21-25, 26 and more

work experience is significantly lower than in groups with 6-10 and 11-15 years of experience.

The number of diagnosed cases per 100 workers increased by 2.57 times, but in practice the number of healthy individuals decreased by 2.67 times ($p = 0.05$). Diseases of the nervous system and the circulatory system is increasing with the increase in work experience. Diseases of the musculoskeletal system and genitourinary system, respiratory and digestive organs, the degree of endocrine pathology did not change significantly.

5. Conclusions

Summarizing the data on the initial state of health of workers and its changes with different work experience, we can draw the following conclusions:

1. A study of the state of health, taking into account changes in age and work experience, showed that workers have an increased risk of injury, poisoning and some other consequences of external causes from diseases of the nervous system and circulatory system, musculoskeletal system and connective tissue. However, the importance of diseases of the eye and its accessory organs, diseases of the respiratory system, digestive organs, skin and subcutaneous tissue, some infectious and parasitic diseases decreases with age and work experience.
2. 22.0% of miners with less than 6 years of experience do not have chronic diseases. There are changes in the health status of workers with work experience of 11-15 and 20-25 years, manifested by a 2.34-fold increase in the number of diagnosed diseases per 100 workers and a decrease in the number of practically healthy workers;

3. Determination of age and work experience is one of the most effective preventive measures in determining the risk of developing various classes of diseases.

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