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Original Empirical Research

Individual Level of Responsibility and Emotionality as a Factor in the Occurrence of Hazardous Industrial Events

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Abstract

Introduction. The human factor is the cause of 70–80% of industrial accidents. This is the reason for scientific interest in this topic. Researchers are studying the issues of assessing occupational injury risks based on individual employee qualities. However, nonparametric methods are not used when analyzing the relationship between these qualities and hazardous incidents. At the same time, parametric statistical approaches for processing non-numeric information are unreasonable without first checking the distribution of variables for normality. The presented scientific work is intended to correct the situation. The aim is to identify and statistically substantiate the relationship between individual factors and realized production risks.

Materials and Methods. The authors observed the staff of Gazprom Transgaz Surgut LLC and created a questionnaire. They anonymously interviewed 569 workers and measured their level of responsibility (according to 34 statements) and emotionality (according to 26 statements). Eight variables were used in data processing: “injury”, “age”, “education”, “length of service in the company”, “total years of service”, “profession”, “responsibility”, and “emotionality”. The statements of 206 people (36.2%) with experience of injuries and occupational diseases and 363 (63.8%) without such experience were summarized. The correlation of independent variables and dependent variable (“injury”) was studied using the contingency tables. Estimates of the Pearson’s chi-square and the level of its statistical significance were supplemented by calculations of the intensity and direction of the relationship of variables (gamma coefficient).

Results. High internal consistency of the statements (Cronbach's alpha 0.923) and high content validity of the questionnaire have been proven. The significance ($p < 0.001$) for all variables allowed us to reject the null hypothesis about the subordination of the studied set of features to a normal distribution. Median frequencies of the “degree of responsibility” and “emotionality” variables for the group without injuries were 2 and 3, respectively, and noticeably higher in the group with injuries (5 and 5). The group differences in the statements were statistically significant ($p < 0.05$). Employees with realized risks had higher than average ranks in terms of qualitative severity of responsibility and emotionality. There was no significant difference in socio-demographic indicators for the grouping feature “injury” ($p > 0.05$). The Pearson’s chi-square value was 78.704 for the “responsibility — injury” pair and 35.350 for the “emotionality — injury” pair. Gamma was 0.514 and 0.359, respectively. Spearman's coefficient was 0.344 for responsibility and injury, 0.242 for emotionality and injury. The significance of all three criteria was <0.001.

Discussion. The outcome of risks was determined by individual rather than socio-demographic characteristics of employees. This was indicated by:

– high median frequencies of “responsibility” and “emotionality” variables in the “injury” group;

– average ranks among respondents with realized hazardous events ($p < 0.05$).

The risk increased with increasing severity of signs of emotional instability and low responsibility. The relationship between “responsibility” and “injury” in gamma was stronger than in Spearman’s, therefore, gamma better accounted for nonlinear monotonic trends and showed a more significant monotonic average relationship.

Conclusion. Responsibility and emotionality are significant determinants of hazardous incidents. The research results will allow us to develop occupational safety and select staff more effectively. In the future, it is possible to build personalized (targeted) approaches to work with employees, and depending on their individual characteristics, predict the occurrence of hazardous events.

Keywords: determinants of hazardous incidents, low responsibility as a risk factor, emotionality as a risk factor, occupational risk, processing of non-numerical information

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Оригинальное эмпирическое исследование

Индивидуальный уровень ответственности и эмоциональности как фактор реализации опасных производственных событий

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Аннотация

Введение. Человеческий фактор — причина 70–80 % несчастных случаев на производстве. Этим обусловлен научный интерес к данной теме. Изучаются вопросы оценки рисков производственного травматизма в зависимости от индивидуальных качеств работников. Однако при анализе связи таких качеств и опасных инцидентов не задействуются непараметрические методы. При этом подходы параметрической статистики для обработки нечисловой информации необоснованны без предварительной проверки распределения переменных на нормальность. Представленная научная работа призвана исправить ситуацию. Цель — выявление и статистическое обоснование связи индивидуальных факторов и реализованных производственных рисков.

Материалы и методы. Авторы наблюдали за персоналом ООО «Газпром трансгаз Сургут», создали опросник, анонимно опросили 569 рабочих. Измерили выраженность у респондентов ответственности (по 34 утверждениям) и эмоциональности (по 26 утверждениям). При обработке данных задействовали восемь переменных: «травма», «возраст», «образование», «стаж на предприятии», «общий стаж», «профессия», «ответственность», «эмоциональность». Обобщались утверждения 206 человек (36,2 %) с опытом травм и профессиональных заболеваний и 363 (63,8 %) без такого опыта. По таблицам сопряженности исследовали взаимосвязь независимых переменных и зависимой («травма»). Оценки хи-квадрата Пирсона и уровня его статистической значимости дополнили расчетами интенсивности и направления связи переменных (коэффициент гамма).

Результаты исследования. Доказана высокая внутренняя согласованность утверждений (альфа Кронбаха 0,923) и высокая содержательная валидность опросника. Значимость ($p < 0,001$) для всех переменных позволяет отвергнуть нулевую гипотезу о подчинении исследуемой совокупности признаков нормальному распределению. Медианы частот переменных «степень ответственности» и «эмоциональность» для группы без травм — соответственно 2 и 3, а в группе с травмой заметно выше (5 и 5). Групповые различия в утверждениях статистически значимы ($p < 0,05$). У работников с реализованными рисками выше величины средних рангов по качественной выраженности ответственности и эмоциональности. Для социально-демографических показателей нет значимой разницы по группирующему признаку «травма» ($p > 0,05$). Получили значение хи-квадрата Пирсона 78,704 для пары «ответственность — травма» и 35,350 — для пары «эмоциональность — травма». Гамма — соответственно 0,514 и 0,359. Коэффициент Спирмена 0,344 — для ответственности и травмы, 0,242 — для эмоциональности и травмы. Значимость всех трех критериев <0,001.

Обсуждение. Исход рисков определяется индивидуальными, а не социально-демографическими характеристиками работников. На это указывают:

– высокие медианы частот переменных «ответственность» и «эмоциональность» в группе «Травма»,

– средние ранги у респондентов с реализованными опасными событиями ($p < 0,05$).

Риск растет при увеличении выраженности признаков эмоциональной неустойчивости и низкой ответственности. Связь «ответственности» и «травмы» по гамме сильнее, чем по Спирмену, следовательно, гамма лучше учитывает нелинейные монотонные тренды и показывает более существенную монотонную среднюю связь.

Заключение. Ответственность и эмоциональность — значимые детерминанты опасных инцидентов. Результаты исследования позволят развивать охрану труда, лучше подбирать персонал. В перспективе можно выстроить персонифицированную (адресную) работу с сотрудниками и в зависимости от их индивидуальных качеств прогнозировать реализацию опасных событий.

Ключевые слова: детерминанты опасных инцидентов, низкая ответственность как фактор риска, эмоциональность как фактор риска, профессиональный риск, обработка нечисловой информации.

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Introduction. The complex impact of harmful and hazardous factors in the industrial environment and labor processes can potentially increase occupational risks and lead to dangerous events, such as occupational injuries and diseases. The ontology of occupational risk is the possibility of a hazardous event and the severity of its consequences.

The outcome of an occupational risk is unknown in advance and can be significant and severe. It is impossible to predict in advance the number of injuries or who will experience them. Injury results from a random process, a potential for different outcomes that is influenced by some stochastic mechanism [1]. Let us assume that one component of this stochastic mechanism is an individual factor, such as the characteristics of each person that influence their work performance. This assumption allows us to hypothesize that the following individual (personal, subjective) qualities of an employee play an important role in determining occupational risk and whether a dangerous event occurs:

– moral (responsibility, discipline, etc.);

– professional (knowledge, skills, professional training, etc.);

– psychological (personality characteristics, professionally important qualities, etc.);

– physiological (state of health, biorhythms, etc.);

– physical (strength, endurance, reaction speed, etc.).

In [2], the issues of assessing individual mental, psychological, and physical qualities of employees and the risk of occupational injuries are considered.

A functional approach to the study of the causes of occupational risks allows us to identify the sources of risks:

– general, objective, caused by the working environment (height, noise, vibration, electric current, etc.) [3];

– subjective, caused by the individual qualities of an employee performing work duties at the moment (temperament, motivation, etc.).

In [4], the personnel of an enterprise are considered from the perspective of a source of risk. It is stated that the human factor is the cause of 70–80% of industrial accidents. In a full-time enterprise, hazardous events occur due to frivolity, fussiness, violations of discipline, and neglect of the rules of safe work.

The scientific literature discusses the influence of human factors on the possibility of production risks. However, there is no analysis of the relationship between individual employee qualities and hazardous events using non-parametric statistical methods. The use of parametric statistical methods for processing non-numeric data is not reasonable without first checking for normality in the distribution of variables.

In this study, we consider individual qualities such as emotionality and responsibility as factors in the implementation of dangerous industrial situations.

Emotionality has traditionally been studied as a component of temperament, which represents a set of qualities that describe the dynamics of the emergence, course, and termination of emotional states. Temperament is believed not to change throughout life.

Responsibility as a personality trait is closely related to motivation. The motif characterizes a person's subjective, changeable attitude to certain objects and phenomena of the surrounding world. The results of the study of employee motivation at the enterprise are presented in [5]. In [6], debatable issues about the impact of purposeful activities (actions) of an employee on the production process are investigated. In [7], employee errors are considered as the main category of causes of occupational injuries. In [8], the relationship between occupational injuries and employee behavior is statistically substantiated (haste, work in a state of fatigue, non-compliance with work and rest conditions, etc.). In [9], personnel errors (missteps, violations, etc.) are analyzed and, using analytical statistical methods, it is shown that a person is the key cause of realized hazardous events in the workplace.

Thus, identifying the relationship between individual factors and realized hazardous events (occupational injuries, occupational diseases) is an urgent task and requires a deeper study.

The aim of this study was to investigate and statistically verify the relationship between individual factors and realized hazardous events.

Objectives of this research:

1) analysis of literary sources on the influence of the human factor on occupational injuries;

2) justification of the choice of non-parametric statistical methods for analyzing non-numeric data;

3) conducting an experiment;

4) empirical data processing using non-parametric statistical methods;

5) determining the direction of further research.

Materials and Methods. The five stages of this scientific work are presented below:

1) monitoring the behavior of employees;

2) developing a questionnaire;

3) conducting an anonymous survey;

4) checking the questionnaire for reliability and validity;

5) statistical processing of empirical data.

A questionnaire was developed to study the relationship between individual factors and realized hazardous events. It measured the severity of the categories of indicators that determined the individual qualities of employees — responsibility and emotionality.

For nine years, operating and non-operating situations at the enterprise were monitored; people were asked about their attitude to labor protection requirements, to health, to the assessment of their experience, and to team members. We also talked about the subjective perception of the sources of occupational risks, which were regarded by employees as independent of their actions.

The questionnaire contained two blocks of statements.

The first one, “Responsibility”, described the respondents' (employees') attitude to the team, to themselves, to their health and measured personal responsibility, an important motivational component of a personality. 34 statements were formulated for this block.

The second block, “Emotionality”, measured its degree and described various emotional states. 26 statements were formulated for the “Emotionality” block.

All statements were stated from the first person in an unambiguous affirmative form and were understandable. Each statement had one of four possible answers: “no, I disagree”, “probably, no / unlikely”, “probably, yes / maybe”, “yes, I agree”. The statements were formulated in such a way that the respondents' choice of answers "probably, yes / maybe” or “yes, I agree” qualitatively expressed signs of a low degree of responsibility and emotional instability.

The following are examples of statements from the “Responsibility” section:

– if I break a mercury thermometer at the enterprise, I will hide this fact;

– the clutter of my workplace suits me perfectly, because I know exactly what's where, and I quickly find what I need;

– if I have an urgent task, I turn a blind eye to safety requirements.

Next are examples of statements from the “Emotionality” section:

– when a supervisor devalues my work, I get upset;

– sometimes I talk to other employees in a raised voice;

– I am impatient with the long search for necessary work equipment (documents, supplies).

The questionnaire had information on socio-demographic indicators (age, education, length of service in the company, total years of service, profession) and on the facts of accidents, micro-injuries and occupational diseases.

It should be noted that the questionnaire had its drawbacks, namely: the initial empirical data depended not only on the sincerity of respondents, but also on their ability to express their opinion and analyze their actions, situational emotional reactions.

The main criteria of the questionnaire's suitability as a working tool were empirically identified — its reliability and validity. The reliability of the questionnaire was characterized by the internal consistency of statements. The statistical indicator of the internal consistency of statements in the questionnaire was Cronbach's alpha. This value varied from 0 (there was no consistency) up to 1 (full consistency) [10].

The determination of substantive validity made it possible to identify the correspondence of statements to measurable individual qualities. The semantic adequacy of the statements was assessed by experts (heads of structural divisions) using the method of formal logic.

The anonymous survey was conducted online in Yandex Forms. The respondents were employees of the main and auxiliary industries of the gas transmission enterprise (n = 569). They were informed about the aim of the scientific study of occupational risks, but not about the categories of indicators that the questionnaire measured. The survey results were used in a generalized form.

To calculate individual ratings for the “Responsibility” and “Emotionality” blocks, the frequencies of choosing the answers “probably, yes / maybe” and “yes, I agree” were summed up. In other words, the signs of qualitative expression of the respondents' indicators of emotional instability and low level of responsibility were measured.

Eight categorical variables were created to process empirical data. These were the dependent variable “injury” and the independent variables: “age”, “education”, “length of service in the company”, “total years of service”, “profession”, “degree of responsibility”, “emotionality”. The variables “degree of responsibility” and “emotionality” were ranked and divided into four groups.

To create a binary (dichotomous) dependent variable “injury”, employees were divided into two groups based on quality.

The first group “Injury” (n = 206, 36.2%) — employees who were injured and/or had an occupational disease at the enterprise. Negative experiences at this company and at previous jobs were taken into account. This was micro-injuries, occupational diseases, and bodily injuries (severe bruises, sprains, fractures, burns, deep cuts, etc.).

The second group “Without injury” (n = 363, 63.8%) consisted of employees who were not injured and/or had an occupational disease at the enterprise.

Statistical processing of experimental data was carried out in the IBM SPSS Statistics 23 software package [10]. Critical significance level p was assumed to be 0.05when testing null hypotheses (hypotheses about the absence of relationship). If the significance level of the statistical criterion of this value was exceeded, the null hypothesis about the absence of a relationship between the variables was accepted.

The distribution of qualitative variables in the studied set of features was evaluated using the Kolmogorov—Smirnov single-sample criterion [11]. The null hypothesis about the correspondence of the existing distributions to the normal one was tested.

The reliability of differences between the studied groups was assessed in terms of the qualitative severity of indicators of responsibility and emotionality. For this purpose, ranking criteria were used for all statements in the questionnaire: the Mann-Whitney U test and the Kraskel-Wallis criterion. This approach made it possible to identify statistically significant differences between independent groups by analyzing the ranked values:

– two (Mann-Whitney U test);

– three or more (Kruskal-Wallis criterion).

The null hypothesis about the coincidence of the distributions of two samples was tested [11]. Statements that there were no statistically significant differences between the "Injury" and "No injury" groups were excluded from further analysis.

To study the relationship between the independent variables and the dependent variable "injury", an analysis of the contingency tables was used. Estimates of the Pearson’s chi-square criterion and the achieved level of statistical significance of this criterion were supplemented with calculated estimates of the intensity and direction of the relationship between the studied variables (the gamma rank correlation coefficient). The null hypothesis about the absence of a statistical relationship between variables, i.e. about the independence of features, was tested [11]. The absolute value of the Pearson’s chi-square criterion was determined by the number of rows and columns in the contingency table, therefore, it did not allow us to unambiguously judge the presence or absence of a statistical relationship between the variables under study. The key indicator was the asymptotic significance of this criterion [11].

Results. The Cronbach's alpha for the authors' questionnaire (0.923) indicated a high internal consistency of statements. A high degree of substantive validity was also noted.

The results showed a small value ($p < 0.001$) of the achieved significance level for all the variables studied. This allowed us to reject the null hypothesis about the subordination of the studied set of features to a normal distribution. Therefore, it was reasonable to use only nonparametric methods in statistical data analysis [11].

All analyzed variables belonged to non-metric (nominal or ordinal) scales of qualitative characteristics (Table 1).

Table 1

Association of variables from the questionnaire with the measurement scales

Variable	Indicator	Type of measurement scale
Age	Less than 25 years old 26–40 years old 41–60 years old 61 years and older	Ordinal
Education	School College Institute	
Length of service in the company	Less than 1 year 1–5 years 6–15 years More than 15 years	
Total years of service	Less than 5 years 5–20 years old 21–30 years old More than 30 years	
Profession	Workers of main production professions Workers of auxiliary production professions	Nominal
Degree of responsibility	Four groups based on the frequency of choosing the answers “Probably, yes / maybe” and “Yes, I agree”	Ordinal
Emotionality	Four groups based on the frequency of choosing the answers “Probably, yes / maybe” and “Yes, I agree”	
Injury	Yes No	Nominal

The well-known typology of scales (nominal, ordinal, interval, scale of relations) was based on acceptable operations and transformations in these scales. According to measurement theory, the analyzed data was strictly formal and non-numerical in nature, because when measuring on nominal and ordinal scales, there was no information about the magnitude of the differences between the elements in the studied population. Therefore, any arithmetic operations (addition, multiplication, exponentiation, calculation of the arithmetic mean, etc.) with the resulting values did not make sense.

From the measures of the central tendency to the studied data, it was reasonable to apply the median and the mode. Table 2 presents the median frequencies of the “degree of responsibility” and “emotionality” variables of the studied groups.

Table 2

Median frequencies of the “degree of responsibility” and “emotionality” variables of the studied groups

Variable	“Without injury” group	“Injury” group
Degree of responsibility	2	5
Emotionality	3	5

Table 2 shows that the median frequencies of the “degree of responsibility” and “emotionality” variables were higher in the “Injury” group.

The Mann-Whitney U test was used to identify statistically significant differences in responses to statements between the groups ($p < 0.05$). Sample examples of statements are given in Table 3.

Table 3

Assessment of differences between groups in the qualitative expression of degrees of responsibility and emotionality

Statement	Group	Average rank	*U*-Mann—Whitney criterion	
			value	significance
"Degree of responsibility" Block (examples)				
The clutter of my workplace suits me perfectly, because I know exactly what's where, and I quickly find what I need	No injury (n = 363)	276.24	34207.50	0.017
	Injury (n = 206)	300.44		
If I have an urgent task, I turn a blind eye to safety requirements	No injury (n = 363)	265.28	30232.00	0.000
	Injury (n = 206)	319.74		
I come to work with a temperature above 37 degrees	No injury (n = 363)	262.03	29050.50	0.000
	Injury (n = 206)	325.48		
"Emotionality" Block (examples)				
I easily get into arguments with others	No injury (n = 363)	272.19	32739.00	0.007
	Injury (n = 206)	307.57		
I talk aloud to myself and comment on my actions with exclamations	No injury (n = 363)	275.25	33851.50	0.025
	Injury (n = 206)	302.17		
I am annoyed by a person who counts change at the checkout in a store for a long time and slows down the queue	No injury (n = 363)	266.35	30618.50	0.000
	Injury (n = 206)	317,87		

Table 3 demonstrates that the values of the average ranks were higher among workers with realized hazardous events ($p < 0.05$).

To visualize statistically significant differences in the severity of individual qualities between the studied groups, histograms of relative frequencies were constructed (Fig. 1, 2).

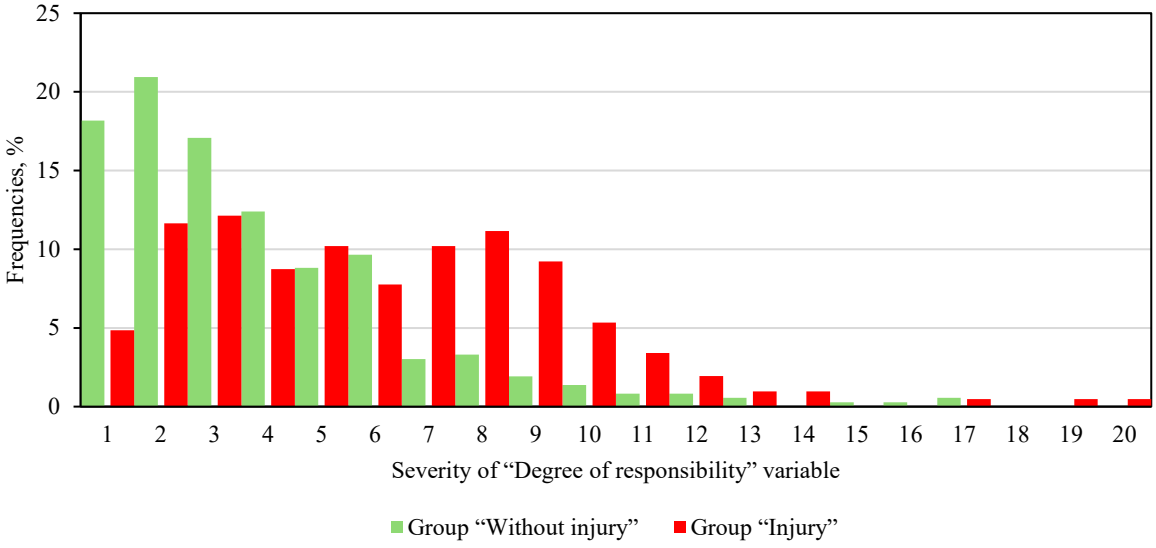

Fig. 1. The severity of the "degree of responsibility" variable in the studied groups

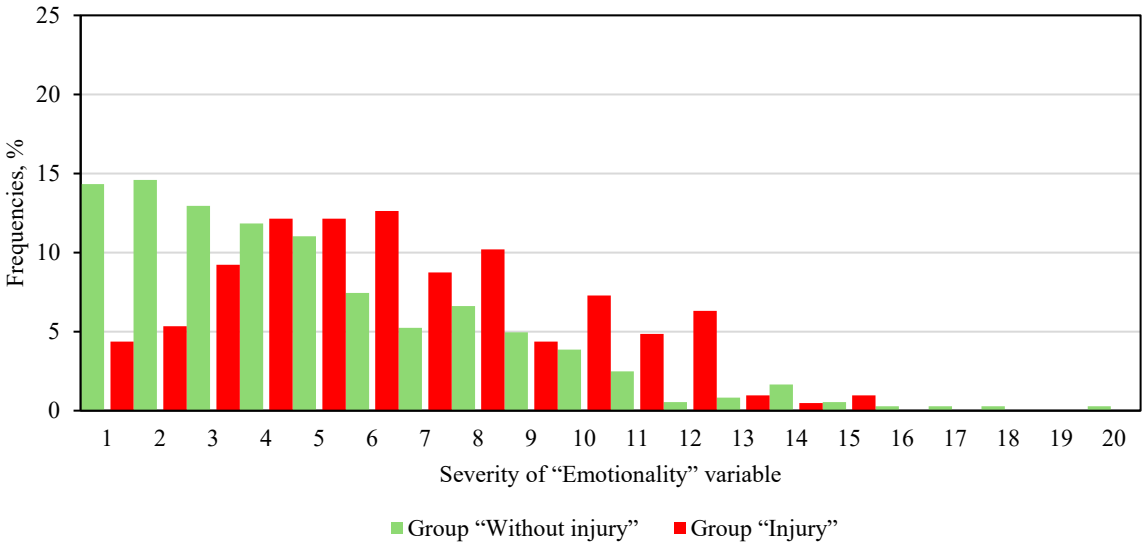

Fig. 2. The severity of the "emotionality" variable in the studied groups

Figures 1 and 2 show what happened in the "Without injury" group: As the qualitative expression of signs of responsibility and emotionality increased, the relative frequencies of choosing statements expressing a low degree of responsibility and emotional instability decreased. The situation in the "Injury" group was different. The maxima shifted towards higher values of variables. The difference between the groups was statistically significant ($p < 0.05$).

For socio-demographic indicators, no statistically significant difference was found in the "injury" grouping feature ($p > 0.05$) (Table 4).

Table 4

Assessment of differences between groups by socio-demographic indicators

Variable	Group	Average rank	Criterion value	Criterion significance
Age	No injury ($n = 363$)	285.15	0.001	0.973
	Injury ($n = 206$)	284.73		
Education	No injury ($n = 363$)	287.58	0.304	0.581
	Injury ($n = 206$)	280.46		
Length of service in the company	No injury ($n = 363$)	281.51	0.502	0.479
	Injury ($n = 206$)	291.16		
Total years of service	No injury ($n = 363$)	281.65	0.482	0.488
	Injury ($n = 206$)	290.90		
Profession	No injury ($n = 363$)	283.25	0.165	0.684
	Injury ($n = 206$)	288,02		

Table 5 summarizes the results of the study of the relationship between independent variables and the dependent variable “injury”.

Table 5

Analysis of the relationship between independent variables and the dependent variable “injury”

Paired variables	Pearson's Chi-square	Asymptotic significance (two-way)	Gamma value	Approximate significance
Degree of responsibility — injury	**78.704**	**0.000**	**0.514**	**0.000**
Emotionality — injury	**35.350**	**0.000**	**0.359**	**0.000**
Age — injury	4.386	0.223	–0.003	0.973
Education — injury	0.535	0.765	–0.043	0.583
Length of service in the company — injury	0.526	0.913	0.049	0.478
Total years of service — injury	1.868	0.600	0.049	0.493
Profession — injury	0.166	0.684	0.037	0.406

Table 5 demonstrates the statistical significance ($p < 0.001$) of the Pearson’s chi-square criteria for the “degree of responsibility” — “injury” and “emotionality” — “injury” paired variables. This meant that the probability of rejecting null hypotheses about the independence of these variables was very low, provided that the null hypotheses were correct. Thus, there were statistically significant correlations between the analyzed variables “degree of responsibility” and “injury”, as well as “emotionality” and “injury”.

The gamma rank correlation coefficient in the contingency tables allowed us to conclude about the strength and direction of the identified relationships between the variables “degree of responsibility” and “injury”, as well as “emotionality” and “injury”. This coefficient evaluated the strength and direction of the relationship, ranging from –1 (strong negative relationship) to +1 (strong positive relationship). Zero indicated that there was no relationship. Medium and weak positive statistically significant correlations were revealed between the studied variables. The gamma coefficient was obtained for two groups of variables:

1) “degree of responsibility” and “injury”,

2) “emotionality” and “injury”.

The coefficient values were 0.514 ($p < 0.001$) and 0.359 ($p < 0.001$) for the first and second cases, respectively.

However, according to Table 5, there were no statistically significant ($p < 0.05$) associations with the dependent variable “injury” for variables that determine socio-demographic indicators (“age”, “education”, “length of service in the company”, “total years of service”, “profession”).

Another measure of the relationship for variables belonging to the nominal and ordinal scales was the Spearman’s rank correlation coefficient. A value of –1 indicated a strong negative correlation, +1 indicated a strong positive correlation, and zero indicated no correlation.

The correlations of the analyzed variables are presented in Table 6.

Table 6

Correlations of independent variables and the dependent variable “injury”

Approximate significance	Spearman's coefficient	Two-way significance
Degree of responsibility — injury	**0.344**	**0.000**
Emotionality — injury	**0.242**	**0.000**
Age — injury	–0.001	0.973
Education — injury	–0.023	0.582
Length of service in the company — injury	0.030	0.479
Total years of service — injury	0.029	0.488
Profession — injury	0.017	0.685

Summarizing the data in Table 6 demonstrated statistically significant ($p < 0.001$) weak correlation between the variables “degree of responsibility” and “injury”, as well as “emotionality” and “injury”. Socio-demographic indicators did not correlate with the dependent variable “injury” ($p > 0.05$).

Discussion. In a production environment, it is impossible to control all staff simultaneously and influence every action of each employee. Therefore, the behavior of employees is determined by their own responsibilities. The data collected confirm the hypothesis regarding the relationship between realized hazardous events (occupational injuries, occupational diseases) and the individual qualities of employees:

– responsibility as part of internal motivation;

– emotionality as part of temperament.

A low level of responsibility leads to unsafe employee behavior (neglect of personal protective equipment, haste, carelessness, etc.), which increases occupational risks. Emotional instability and impulsivity reduce concentration in normal and non-standard situations.

The results of this research are consistent with other studies on the role of personnel in ensuring safety [4] and the dependence of occupational injuries on the human factor [9].

The presented study mathematically demonstrates the relationship between responsibility, emotionality, and the consequences of occupational risks. Furthermore, individual qualities play a significant role, rather than socio-demographic factors. This is supported by the lack of a statistically significant correlation between age, experience, education, and profession with realized hazardous events.

Employees with realized hazardous events tend to choose more statements that qualitatively characterize a low level of responsibility and emotional instability. This is how they differ from workers without injuries. This conclusion is justified by the higher median frequencies of the variables “degree of responsibility” and “emotionality” in the “Injury” group, as well as the values of the average ranks of employees with realized hazardous events ($p < 0.05$). In other words, the potential signs of a lower degree of responsibility and emotional instability in this group are qualitatively more pronounced than in the group of employees without injuries. Figures 1 and 2 also confirm the assumption that the individual qualities of employees in the “Injury” group differ ($p < 0.05$). They have more pronounced signs of low responsibility and emotional instability.

The analysis of the contingency tables confirms the presence of a statistically justified relationship: the level of occupational risk tends to increase with an increase in the severity of qualitative signs of emotional instability and low degree of responsibility among respondents.

The comparison of statistically significant gamma (Table 5) and Spearman’s (Table 6) correlation rank coefficients deserves special attention. Both coefficients are positive, which indicates a direct relationship between the variables: as the rank of one variable increases, the rank of the other also tends to increase. The difference in the values of the gamma and Spearman’s coefficients arises due to differences in their calculation algorithms. Let us consider Spearman's correlation coefficients for pairs of variables “degree of responsibility” and “injury”, as well as “emotionality” and “injury”. They are equal to 0.344 and 0.242, respectively ($p < 0.001$), which indicates a weak positive monotonic dependence that is not perfectly linear in the rank space. At the same time, the gamma correlation coefficients for these variables are higher — 0.514 and 0.359, respectively ($p < 0.001$). That is, a stronger relationship was found for the “degree of responsibility” and “injury” variables than the Spearman correlation coefficient shows. Thus, in comparison with the Spearman’s coefficient, the gamma coefficient captures nonlinear monotonic trends better and shows a more significant monotonic relationship of average strength.

When interpreting the results, it is important to consider some limitations of the study. The answers given by the respondents are subjective in nature, and this should be taken into account. At the same time, any sociological survey relies on the assumption that people will express their subjective opinions.

Conclusion. It has been established that responsibility and emotionality are statistically significant determinants of the realization of hazardous events in the workplace ($p < 0.05$). At the same time, no significant relationship ($p < 0.05$) was found between the realized hazardous events and such characteristics of the respondents as age, experience, education, and profession. Thus, it can be argued that individual qualities influence the realization of risks, while socio-demographic qualities do not.

In this case, the presence or absence of correlation was revealed using a specially designed questionnaire (Cronbach's alpha 0.923).

The results of the study have practical applications for improving occupational safety and health management systems, particularly in the professional selection of candidates for vacant positions.

Based on the presented research, it will be possible to develop personalized (targeted) approaches to working with employees and predict the occurrence of hazardous events depending on their individual characteristics in the future.

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