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Statistical Monitoring of OSH: Analysis of Deviations and Recommendations for Optimization

Sholpan Abikenova[1], Shynar Aitimova[2], Gulzhan Daumova[3*], Andrey Koval[2], Inara Sarybayeva[2,4]

[1] National Confederation of Employers «Paryz», Astana 010000, Kazakhstan
[2] Republican Research Institute for Occupational Safety and Health, Astana 010000, Kazakhstan
[3] East Kazakhstan regional Branch of the Republican Research Institute for Occupational Safety and Health, Ust-Kamenogorsk 070018, Kazakhstan
[4] Department of Accounting and Audit, L.N. Gumilyov Eurasian National University, Astana 010000, Kazakhstan

Corresponding Author Email: Gulzhan.daumova@mail.ru

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ABSTRACT

The problem of occupational safety in society lies in the inability to create absolutely safe working conditions for individuals, where the impact of production factors is either eliminated or their levels do not exceed established norms. This article is dedicated to the statistical observation of occupational safety conditions with the aim of analyzing deviations and developing recommendations for optimization, using the example of the Republic of Kazakhstan. The paper explores the significance of systematic monitoring of working conditions and occupational injuries through factor analysis to ensure workplace safety and occupational health. In this process, information is collected on both general factors applicable to all enterprises in the industry, considered in accordance with relevant methodological recommendations (normative method), and specific factors unique to a particular enterprise, identified through the assessment of workplaces and the enterprise as a whole (monographic method). Economic and statistical analysis methods have helped identify deviations from established standards and norms. Based on the listed quantitative methods and supplemented by the expert assessment method using international experience, the authors of the study propose a series of recommendations for optimizing the occupational safety and health statistical monitoring system. This includes the implementation of new data collection and processing methods, updating statistical reporting forms, and introducing proactive approaches to improving working conditions and preventing accidents in the workplace.

1. INTRODUCTION

The quality of statistical information in the field of occupational safety and health holds strategic significance and serves as the foundation for implementing state policies and making managerial decisions aimed at improving working conditions and reducing occupational injuries and occupational illnesses. Statistics should become the digital backbone of a new analytical system for the performance and effectiveness of occupational safety management and measures to reduce occupational risks in enterprises.

In the realm of occupational safety and health, the application of statistical methods is both justified and widely practiced, marked by its distinct utility. Most often, government bodies require statistical information to assess the current situation and the impact of various standards, expressed in numerical and percentage terms. Additionally, statistical data is utilized for benchmarking against the levels of other countries, aiming to evaluate the progress of implemented policies and measures. Aggregated statistical data is used for such comparisons. For instance, the International Labour Organization Database (ILOSTAT) annually releases statistical information on occupational safety and health, encompassing occupational injuries and the status of fatal and non-fatal occupational injuries categorized by gender and occupation worldwide [1].

However, it is essential to acknowledge that official statistical data on occupational injuries may not accurately reflect the real situation in many, including highly developed and developing countries. In the study [2], it was found that many workplace injuries are not recorded in employers' logs as required by the Occupational Safety and Health Administration (OSHA), leading to an underestimation of such incidents in the Bureau of Labor Statistics (BLS) records, thus resulting in significant underreporting of occupational injuries in America. The lack of accurate data concerning workplace injuries and illnesses raises concerns among occupational safety specialists, researchers, workers, labor unions, employers, unions, and governmental entities.

The unsatisfactory compliance of employers with reporting requirements, as evidenced by the comparison of employer reports in OSHA with the Michigan's Work-related

Hospitalizations Surveillance System (MMSIISS), is noted in the study [3]. It was determined that employers did not report 1627 cases. Meanwhile, OSHA received 649 valid reports of hospitalizations from employers that were not identified in MMSIISS. Out of the 649 valid reports in OSHA, where the injuries included fractures, head injuries, or acute conditions such as heatstroke, it was revealed that hospitals either failed to report due to injury fears, or the illness was not coded as worker's compensation, or the hospital incorrectly identified and reported the requested diagnostic codes.

The fact that the actual situation regarding mortality from occupational injuries in any country is not accurately reflected and is underestimated in reports by government agencies, and ultimately in the official statistical agency ILOSTAT, is established in the study [4].

Analyzing deviations and discrepancies within the existing methodology of data collection and processing, as well as statistical reporting forms, is a crucial aspect in enhancing the effectiveness and accuracy of monitoring occupational safety and health conditions. This practice helps identify problematic areas within the statistical observation system, facilitating the development of targeted recommendations to refine methodologies and data collection processes, as well as statistical reporting forms. This, in turn, aims to ensure more reliable and accurate information for decision-making at all levels of management.

The aim of this study is to identify problematic areas and propose improvements in methodology, data collection, and forms of statistical reporting to enhance the quality and utility of statistical information on working conditions and occupational injuries. This, in turn, enables more effective analysis and prevention of workplace risks, as well as the development and implementation of appropriate occupational safety measures.

Currently, in the Republic of Kazakhstan, the assessment of occupational and environmental safety relies on a statistical method of analysis, using statistical indicators such as the number of registered accidents, occupational diseases, and workplaces with unfavorable conditions for workers' health as comparative measures.

The main conclusion drawn from the conducted research is the necessity to improve the system of statistical observation and data processing on working conditions and occupational injuries in the Republic of Kazakhstan, taking into account advanced international experience. This may involve revising and supplementing existing reporting forms, implementing digital tools for data collection and analysis, as well as updating the methodology for classifying incidents and the causes of workplace accidents. Additionally, adopting risk-oriented approaches could be beneficial.

Furthermore, attention should be directed towards the significance of collaboration among governmental bodies, employers, labor unions, and other stakeholders to enhance the quality of statistical data and its analysis. Only through joint efforts and the application of advanced methods can a more accurate and objective assessment of occupational safety and health conditions be achieved. This collaboration is vital to develop effective measures for preventing occupational injuries and illnesses.

The employee does not insist on an investigation, as they do not see any personal benefits from its results. Employers may conceal workplace accidents not only due to the potential negative publicity but also because an investigation into occupational injuries at the enterprise or organization could lead to additional inspections and fines related to occupational safety. The government contentedly relies on a simplistic statistical paradigm for evaluating the functioning of the occupational safety management system, based on the 'increase or decrease' principle. The peril of such collective tolerance towards injuries lies in its embodiment of a dismissive attitude towards the safety of other workers and the potential hardships faced by their families.

The primary tool enabling the neutralization of hazardous factors in the workplace environment could be the application of scientifically justified statistical methods for analyzing occupational injuries, along with preventive techniques for assessing the ratio of fatal to non-fatal injury cases.

Finally, it is important to emphasize that statistical observation, obtaining reliable information, and analyzing data on working conditions and injuries are integral components of the overall occupational safety and health system. Developing targeted programs and strategies aimed at ensuring worker safety and well-being within the work environment is only possible based on reliable and up-to-date data.

2. METHODS AND MATERIALS OF RESEARCH

The research employed methods of descriptive statistics (counting absolute and relative values, calculating means, medians, modes, ranges, standard deviations, identification of dynamic series, summarization, grouping, among others), correlation-regression analysis, and hypothesis testing. The primary focus was on statistical data regarding working conditions and occupational injuries in Kazakhstan over the past three years. The application of descriptive statistics provides a comprehensive understanding of the fundamental characteristics and indicators of occupational safety, offering initial insights into the statistical data on labor conditions. It serves as a crucial tool for managerial decision-making. Large datasets were processed into more manageable and informative characteristics using [tool/method], making them more accessible for analysis and interpretation of results.

The target group for the research includes the number of individuals working in harmful and/or hazardous working conditions, the number of casualties and fatalities due to occupational accidents, and the count of active legal entities. Additionally, the target group was categorized based on parameters such as gender, age, occupation, type of economic activity, geographical location, and the size and form of ownership of enterprises.

Statistical observation of the state of labor protection at the national level is carried out by the state authorized body, namely the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (hereinafter referred to as BNS). The activities of the BNS are regulated by the Law of the Republic of Kazakhstan «On State Statistics» [5] and the Regulations on the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, approved by the Order of the Chairman of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan [6].

Before commencing the process of collecting primary statistical data on an annual basis, the collection of suggestions from users and respondents, as well as regional statistical departments, is carried out. A survey of users of official statistical information is conducted using the Q-002

questionnaire «User Survey» Additionally, during the revision of statistical reporting forms, a procedure for coordination with governmental bodies, non-governmental organizations, and other stakeholders is followed. The statistical toolkit is developed in accordance with the requirements of international standards and norms in the field of occupational safety statistics.

The collection of data on working conditions, occupational injuries, and occupational diseases is carried out both in electronic form and on paper, based on the preference of the respondent. In the electronic format, the submission of statistical reports online is accompanied by automated arithmetic and logic checks, designed to prevent common input errors. Information processing procedures are automated using local software suites, and controls are implemented for input and output data.

For a clear representation and collection of statistical information on occupational injuries and to address identified contradictions, it is proposed to return to the classical concept of sampling. Sampling is a subset of elements from the general population used to estimate its parameters. To ensure that the sample is representative and reliable, it is necessary to correctly apply a full range of methods:

(1) Random Sampling: Elements are chosen randomly from the general population, providing equal chances for each element to be included in the sample. This helps reduce the probability of distorting the sample results.

(2) Systematic Sampling: Elements are selected at fixed intervals from the general population. For example, every 10th element could be chosen. This approach is particularly useful when the general population is ordered.

(3) Stratified Sampling: The general population is divided into several subgroups (strata), and elements are randomly selected from each subgroup. This approach allows for the consideration of the heterogeneity of the general population and ensures more accurate estimates.

The materials used for the research were aggregated data from the forms of the nationwide statistical observation, which are compiled and published in the form of an annual statistical bulletin:

(1) Statistical Form of Nationwide Statistical Observation «Report on the Number of Employees Engaged in Hazardous and Other Adverse Working Conditions» (hereinafter referred to as Form 1-T (working conditions)), with an annual frequency. The reporting deadline is January 31 after the reporting period.

(2) Statistical Form of Nationwide Statistical Observation «Report on Occupational Injuries and Occupational Diseases» (hereinafter referred to as Form 7-TPZ), with an annual frequency. The reporting deadline is until February 25 (inclusive) after the reporting period.

(3) Report on the Results of Mandatory Periodic Certification of Production Facilities for Working Conditions must be submitted within a month after the completion of certification. Additionally, a report on the results of production control for the last 12 months is also submitted.

To ensure the accuracy of primary statistical data, format and logic checks are in place. Data analysis is conducted. Presenting inaccurate or failing to submit primary statistical data to the relevant state statistical authorities within the prescribed timeframe constitutes administrative offenses, as outlined in the Administrative Offenses Code of the Republic of Kazakhstan [7].

However, it is important to acknowledge that considering the provided data on the status of occupational injury statistics in Kazakhstan, the current methodologies for collecting statistical reports and analyzing information do not comprehensively represent the situation regarding occupational safety and health.

A significant volume of unrecorded information is being generated, including the concealment of various degrees of severity of injuries at enterprises performing a full cycle of activities (large and medium businesses). Additionally, part of the small business enterprises and almost 2 million self-employed individuals (micro-businesses) fall out of the statistical scope. In this regard, the experience of processing similar statistical information in the countries of the Eurasian Economic Union and other developed countries is of interest for developing improvement directions in Kazakhstan.

Conclusions on the investigated problem and recommendations were developed based on the factor analysis of hazards and threats in the production environment, their statistical identification with the aim of preventing and reducing the risks of undesirable events in the field of occupational safety, and ensuring overall socio-economic impact.

3. RESULTS

According to the analysis of international standards in the field of occupational safety and health statistics, as outlined in the International Labour Organization (ILO) Convention on Labour Statistics, 1985 (No. 160) [8], and the Recommendations on Labour Statistics, 1985 (No. 170) [9], essential labor statistics, including information about occupational injuries and occupational diseases, should be collected and published at least once a year. These statistical data should be classified based on economic activity sectors and characteristics of workers, such as gender, age group, occupation, and skill level. It is noteworthy that the format of the national statistical observation largely adheres to this requirement.

A comparative analysis of international experience in statistical reporting forms revealed that the collection of comparable and reliable data on working conditions in European Union countries, conducted by Eurostat [10], and in the United States (Federal agency Bureau of Labor Statistics) [11], is achieved through computer-assisted telephone interviews and face-to-face interviews with the working population. These interviews gather information based on gender, age, occupation, employment status, and industry sector, taking into account risk factors for physical health and worker psychosocial well-being [12]. Moreover, statistical surveys of the work environment encompass a wide range of occupational factors that have an adverse impact on employee health (Table 1).

The comparative analysis of statistical observation forms for occupational injuries and occupational diseases in European countries has revealed certain discrepancies in the national systems in providing additional information about the accident and the injured worker resulting from that accident. For example, in Kazakhstan, unlike the USA and the EU, there is a lack of information on psychosocial indicators, while ergonomic factors are aggregated and generalized to the level of job severity and equipment hazard. However, physical factors in Kazakhstan are detailed more comprehensively than

in other entities, with clear levels of maximum standards and concentrations.

The statistical forms of the analyzed countries include such information as the average earnings of the injured worker, the amount of material damage paid, a medical report on disability, information about witnesses of the accident, etc. (Table 2) [13].

At the same time, in Kazakhstan, unlike Italy and Canada, there is no information about witnesses during an accident and the income level of the victims, information about returning to work, and the medical services provided. The highest number of indicators is in the systems of Italy and Canada (n=8), and the lowest in Kazakhstan (n=6) and the USA (n=5) (Table 2).

Currently, in the Republic of Kazakhstan, the assessment of occupational safety and the working environment is based on a statistical method of analysis that uses statistical indicators as comparative measures: the number of registered accidents, occupational diseases, and workplaces with unfavorable working conditions for employees' health [14].

Table 1. Comparative analysis of forms of statistical reporting on the examination of working conditions

Information on Indicators (Risk Factors for Physical Health and Psychosocial Well-Being)	**Countries of the European Union European Working Conditions Survey (EWCS) (Computer-Assisted Telephone Survey System)**	**USA Occupational Requirements Survey (BLS) (Broad-Format Survey)**	**Kazakhstan (BNS-Form 1-T Working Conditions)**
Psychosocial	• lack of time, • poor communication or cooperation, • lack of autonomy or influence over the pace of work or work processes, • dealing with difficult clients, patients, students, etc., • job insecurity, • long or irregular working hours, • discrimination	• verbal interaction • pace of work • availability of remote work • presence of a supervisor	absent
Ergonomic	• tiring or painful postures, • lifting or moving people/heavy loads, • repetitive hand or arm movements	• working postures • lifting and moving heavy objects • hand/foot movements	• heavy physical labor • working with unsafe equipment
Physical / Factors of the Work Environment	• high noise levels, • vibration from tools or machinery, • extreme temperatures (low/high), • smoke, vapors, dust, or powders, • exposure to chemical products or substances, • contact with infectious materials.	• noise level • low/high temperatures • humidity • vibration • hazardous pollutants • outdoor work	• elevated noise level • increased vibration level • dustiness, contamination, humidity of the work area air exceeding permissible levels • unfavorable temperature conditions • increased levels of electrical, magnetic, electromagnetic waves, radio frequencies • elevated levels of laser radiation • elevated levels of ultraviolet radiation • exposure to radiation • exposure to biological factors

Table 2. Comparative analysis of forms of statistical observation of working conditions

Information Provided	**Italy (INAIL)**	**USA (BLS)**	**Canada (WorkSafe BC)**	**Kazakhstan (BNS)**
Provided Information	available	available	available	available
Information about the employer (name, address, industry classification and size, identification number)	available	available	available	available
Information about the employee who suffered from a workplace accident (name, date of birth, gender, occupation)	available	available	available	available
Information about the accident (date, circumstances, causes)	available	available	available	available
Information about the injury sustained by the employee (nature and severity of the injury, including affected body parts, type of injury, transfer to another job / restriction)	available	available	absent	available
Information about the lost working time due to the accident (number of days of lost work capacity)	available	absent	absent	absent
Information about witnesses and other involved parties (name, address, contact details)	available	absent	available	absent
Details of the employee's income (payment method, overtime, other types of compensation)	absent	absent	available	absent
Information about the employee's return to work (transfer to different duties, work schedule)	available	absent	available	absent
Information about provided medical services/medical report	absent	absent	**a**bsent	available
Total number of information	**n=8**	**n=5**	**n=8**	**n=6**

Through an analytical investigation of the statistical observation system, it has been revealed that the official resource of the Bureau of National Statistics (BNS) lacks an approved methodology for collecting and processing statistical data on working conditions, occupational injuries, and occupational diseases. However, Instructions for filling out statistical forms for nationwide statistical observation are available [15]. For Form 1-T (working conditions), indicators are generated, including the average number of employees (excluding small enterprises), the number of employees working in hazardous and other unfavorable working conditions, the actual number of employees to whom benefits and compensation are provided for working in hazardous and other unfavorable working conditions, and the amount of expenditure for compensation for working in hazardous and other unfavorable working conditions.

Statistical Form 1-T (working conditions) is submitted by legal entities and/or their structural and separate units engaged primarily in agriculture, forestry, and fisheries, as well as industry, construction, transportation, warehousing, accommodation and food services, information and communication, professional, scientific, and technical activities, healthcare, and social services. This applies except for those reporting under the statistical form «Activities of Small Enterprises» (index 2-MP, annual frequency) based on their location, if they are authorized by the legal entity to submit statistical forms.

The analysis of the number of individuals employed in hazardous and/or dangerous working conditions over the past three years revealed that statistical observations are conducted through a selective method, covering only 11 out of 19 sectors, which amounts to 58% of the total sectors according to the International Standard Industrial Classification (ISIC) - Rev. 4. However, globally, for the assessment of employment in hazardous working conditions, an indicator known as «workers in arduous or hazardous jobs» (WAHJ) is utilized.

This indicator is expressed as a percentage of the total workforce and varies between 1% and 4% in European countries [16].

During the assessment of the number of enterprises based on the count of employees engaged in hazardous working conditions, it was determined that the scope of statistical observation is limited to only large and medium-sized enterprises. As of the end of the first quarter of 2023, this coverage amounted to 4,839 units, which accounts for 45% of the total number of large and medium-sized enterprises across all sectors of activity (4839 out of 11680 units), or 10% of the overall number of enterprises of all sizes (4839 out of 48420 units). Additionally, the share of the employee headcount at these enterprises is 42% of the total employee headcount (1.6 out of 3.9 million individuals) r 27% of the total number of hired employees within the organization (1.6 out of 5.9 million individuals).

It should be noted that small enterprises submit statistical reports using the «Small Enterprise Activity» form (index 2-MP, annual frequency). However, this form does not include information about the number of employees working in hazardous or dangerous conditions. The number of small enterprises not participating in the working conditions survey amounts to 37,648 or 78%. The share of the total workforce employed by small enterprises is 27% of the overall employee count (1.0:3.9 million people).

As a result of the conducted statistical analysis based on descriptive statistical methods (calculation of absolute and relative values, mean values, medians, modes, range, standard deviation, identification of dynamic series, summarization and grouping, among others), correlation-regression analysis, and hypothesis testing, it was found that in calculating the total number of employees, only the quantity of small enterprises owned by the state is taken into account. However, if we consider small enterprises as subjects of entrepreneurship, the number of such enterprises not included in the total listed number of employees was 1.7 million people. Consequently, there is a low coverage of statistical surveying encompassing all employees of small enterprises regarding working conditions. This coverage amounted to 2.8 million people or 47% of employed workers within the organization (2.8:5.9 million people). All of this does not allow us to speak about the randomness, representativeness, diversity, and transparency of the sample in relation to the general population. All of this requires adjusting the methodology of data collection, where a random sample is complemented by a systematic sample, where elements are chosen at fixed intervals from the general population. For example, every 10th element can be chosen, and stratified sampling when the general population is divided into several subgroups (strata), and elements are randomly chosen from each subgroup. This approach allows for accounting for the heterogeneity of the general population and ensures more accurate estimates.

The statistical analysis of the number of employees engaged in hazardous and/or dangerous working conditions revealed that the actual number of workers employed in such conditions in 2022 was 491.1 thousand people. Moreover, the number of workers receiving at least one form of compensation amounted to 680.1 thousand people, representing an increase of 28% compared to the actual figure.

However, starting from 2014, in addition to mandatory pension contributions from employees (at a rate of 10% of wages), employers are required to contribute mandatory professional pension contributions (hereinafter referred to as OPPV) at a rate of 5% of the employee's wage fund for those engaged in hazardous and/or dangerous working conditions, according to the List of industries, jobs, and professions of workers employed in jobs with hazardous working conditions, for which mandatory professional pension contributions are made by agents of mandatory professional pension contributions from their own funds [17]. Every contributor of OPPV, including individuals and legal entities, including foreign legal entities, conducting activities in the Republic of Kazakhstan, is obliged to open an individual pension account (hereinafter referred to as IPA) with the Unified Accumulative Pension Fund (UAPF) for their employees. The number of opened IPAs, in turn, indicates the number of workers employed in hazardous and/or dangerous working conditions, which, according to UAPF data as of January 1, 2023, amounted to 595,710. Figure 1 presents the numerical values of employment in hazardous and/or dangerous working conditions.

As seen in Figure 1, the identified discrepancy in the numerical values of individuals employed in harmful and hazardous working conditions indicates the lack of a clear methodology for collecting primary statistical data on working conditions. This is primarily associated with the absence of a unified approach to determining the actual number of workers employed in harmful and hazardous working conditions [18].

The surveyed enterprises are characterized by workplace environmental factors that affect the workers under unfavorable conditions. During the data collection for

statistical reporting using Form 1-T (working conditions), a list of 11 harmful and hazardous factors is provided. However, during the processing and aggregation of summary indicators, 5 of these factors are not taken into account. Additionally, each worker is counted only once regardless of the number of affecting factors (as shown in Table 3).

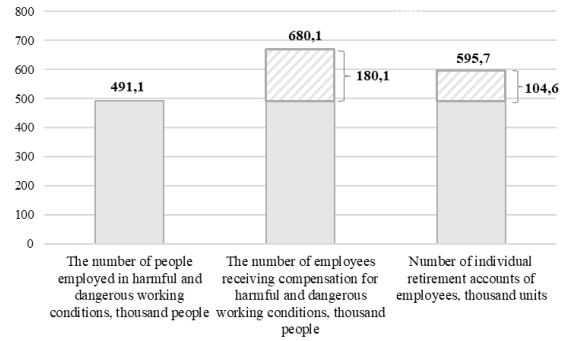


Figure 1. Number of individuals employed in hazardous and/or dangerous working conditions according to the data from BNS and UAPF for the year 2022, in thousands

Table 3. List of production factors for statistical accounting of working conditions

Workplace Environmental Factors Considered in the Statistical Reporting	Factors Not Included in Statistical Reporting
Increased noise level	Increased levels of electrical, magnetic, electromagnetic wave, and radiofrequency exposure
Elevated level of vibration	Elevated levels of laser radiation
Dustiness, gaseous contamination, humidity of the air in the work zone exceeding the permissible concentration	Increased levels of ultraviolet radiation
Unfavorable temperature conditions	Radiation exposure
Heavy physical labor	Biological factors' impact
Equipment safety to prevent injuries	

During the analysis of the statistical reporting form 1-T (working conditions), it has been identified that there is an incomplete reflection in the statistical records of the occupational environmental factors that have an adverse impact on the health of the worker.

Thus, there are several deviations in the current system of statistical observation of working conditions, namely:

• Lack of a clear methodology for collecting statistical data, as evidenced by the discrepancies in numerical values when determining the number of individuals employed in hazardous and/or dangerous working conditions;

• Low coverage of the statistical sample of respondents, i.e., surveyed enterprises, for the presence of hazardous and/or dangerous factors;

• Insufficient consideration of occupational environmental factors that have an adverse impact on the worker.

The statistical Form 7-TPZ is filled out in accordance with Chapter 20 «Investigation and Recording of Occupational Accidents» of Section 4 «Occupational Safety and Health» of the Labor Code of the Republic of Kazakhstan [19] and the order of the Minister of Healthcare and Social Development of the Republic of Kazakhstan «On Approval of Forms for Documenting Investigations of Occupational Accidents» associated with work activities [20].

Form 7-TPZ generates indicators such as the number of individuals injured in occupational accidents, the number of fatalities resulting from occupational accidents, the combined number of individuals injured and fatalities in occupational accidents related to work activities per 1,000 workers, the severity of the injuries sustained by the affected individuals, the loss of working time due to injuries related to work activities and occupational diseases, and the financial consequences of occupational accidents.

It is important to note the indicator of hidden injuries, which is determined as the ratio of the number of individuals injured with non-fatal outcomes to the number of fatalities. This indicator reflects the actual level of occupational injuries since the International Labour Organization (ILO) recommends, based on the experience of developed countries, using the ratio of the total number of injuries to one fatality case, ranging from 500-1000:1, to estimate the potential total number of affected individuals in countries with inadequate reporting of occupational injuries [21].

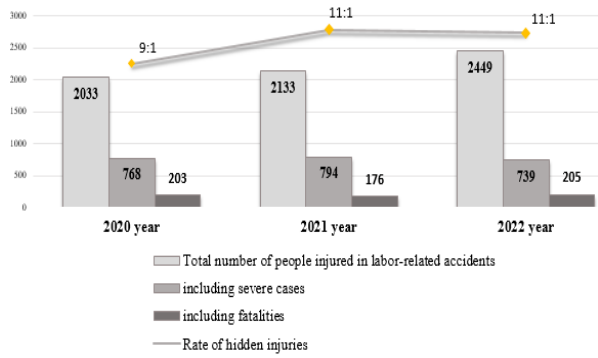


Figure 2. Indicators of occupational injuries for 2020-2022, people

Figure 2 presents a statistical analysis of occupational injuries on average for the years 2020-2022, where the indicator of hidden injuries at the national level is equal to a ratio of 11:1.

In other words, according to the ILO recommendation in Kazakhstan, approximately 100,000 non-fatal injuries should be registered for every reported case of fatal injury. This indicates a significant «shadow» of informal information regarding both hidden injuries across all enterprises and the absence of corresponding statistical records, particularly at small enterprises, significantly reducing the reliability of official information.

As a result of the comparative analysis of the statistical form 7-TPZ (Table 2) with international norms and reporting forms used in foreign countries, discrepancies were identified in Kazakhstan concerning the reflection of the following information. In Kazakhstan's statistical reporting forms, there is no information about the employee's salary, the amount of material compensation paid as a result of accidents, including insurance payments. Additionally, there is no information about the appointment of social benefits for disability and the degree of disability, which are confirmed by the conclusion of a medical and social examination.

In the current statistical reporting form 7-TPZ, in the List of types of incidents that led to accidents and the causes of accidents, non-detailed or unsupported incidents are classified as «other» (Table 4).

Table 4. List of types of accidents and causes of accidents for statistical accounting

Code	List of Incident Types Leading to Accidents	Code	List of Accident Causes
1	Road incident involving organization's transport	1	Elevated air pollution and gas content in the workplace
2	Road incident involving public transport	2	Elevated noise level
3	Road incident involving personal transport	3	Elevated vibration level
4	Railway transport incident	4	Elevated ionizing radiation levels
5	Air transport incident	5	Contact with sources of infectious diseases (specify disease names)
6	Water transport incident	6	Impact of physical overexertion on the human body
7	Fall of the injured person	7	Structural defects of machines, mechanisms, and equipment
8	Fall of the injured person from a height	8	Operation of malfunctioning machines, mechanisms, and equipment
9	Collapse, landslide, falling objects, materials, earth, etc.	9	Violation of technological processes
10	Impact of moving, scattering, rotating objects and parts	10	Violation of safety requirements during vehicle operation
11	Electric shock	11	Violation of road traffic rules
12	Impact of extreme temperatures (fire)	12	Violation of railway traffic rules
13	Exposure to harmful and hazardous production factors and substances	13	Violation of air traffic rules
14	Exposure to ionizing radiation	14	Violation of water transport traffic rules
15	Physical overexertion	15	Accidents
16	Injury from contact with animals and insects	16	Unsatisfactory organization of work production
17	Drowning	17	Unsatisfactory technical condition of buildings, structures, territory maintenance, and deficiencies in workplace organization
18	Homicide or bodily harm	18	Deficiencies in safe work practice training
19	Damage due to natural disasters	19	Lack of or non-use of personal protective equipment
20	Occupational disease and poisoning	20	Lack of collective protection means
		21	Violation of labor and production discipline
		22	Violation of safety and occupational health rules
21	Other	23	Violation of established work regimes
		24	Gross negligence of the injured person
		25	Other

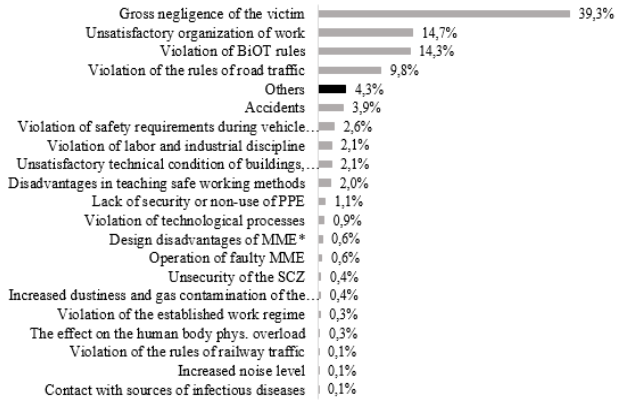
The statistical analysis of incidents leading to accidents from 2020 to 2022 showed that the top 3 types of incidents (falls, impact of moving objects, road incidents) together account for 51.2%, indicating no dominant pattern. The relative share of other, unspecified types averaged around 9%, ranking sixth in the overall list of incident types (Figure 3).

Figure 3. Distribution of accidents by incident types on average for the last three years, %

Next, we will conduct a statistical analysis of the causes of occupational accidents for the years 2020-2022 (Figure 4).

Based on the analysis of the causes of accidents during the period 2020-2022, it was found that the top 3 causes, accounting for 68.3%, are individual (gross negligence of the victim) and organizational (unsatisfactory work organization and violation of safety and occupational health rules) in the ratio of 39.3% to 29%. Other causes occupy the fifth place in the overall list of accident causes with a small share of 4.3%

Overall, it should be noted that the inclusion of the «other» category does not take into account possible consequences of accidents that could have been classified into separate categories with more detailed and expanded characteristics of accident types and causes.



Note: * machines, mechanisms, and equipment

Figure 4. Distribution of occupational accidents by main causes on average for the last three years, %

4. DISCUSSION

As a result of the analysis of the current methodology for collecting and processing statistical information, as well as the forms of statistical reporting on working conditions and occupational injuries, deviations and inconsistencies have been identified. To address these issues, a number of measures are recommended.

Using a statistical sample can provide reliable and representative data on working conditions without the need to survey all employees or workplaces. This approach saves time

and resources in research, although it requires carefully defined sampling methods to ensure statistically significant and reliable results.

When surveying working conditions to determine the number of individuals employed in hazardous and/or dangerous work conditions in the national statistical observation, statistical sampling includes large and medium-sized enterprises across 11 sectors of activity. The proportion of uncovered large and medium-sized enterprises, conducting their activities in sectors covered by the statistical sample, is 5,933 units, or 55% of the total number of large and medium-sized enterprises. The share of the listed number of employees in these enterprises amounted to 1.2 million people, or 43% of the overall listed number of employees in large and medium-sized enterprises.

As mentioned earlier, one of the problems is that small enterprises do not submit statistical reporting in accordance with Form 1-T (Working Conditions). The number of active small business entities, including small enterprises with state ownership, amounted to 378,232 units or 93% of the total number of active legal entities (407,439 units). The headcount of employees subject to examination in small enterprises was 2.8 million people, accounting for 47% of the total number of hired workers in the country.

The analysis conducted based on the uncovered statistical sample of industries and small enterprises leads to the conclusion about the importance of including conditions of labor inspection for these enterprises in the statistical observation. These results affirm the necessity of expanding the scope of statistical information considered in the analysis of working conditions and occupational injuries. By encompassing small-scale enterprises and all sectors of activity, statistical observation becomes more representative and accurate, contributing to a more comprehensive and objective understanding of the current situation and labor protection requirements. The inclusion of such statistical data also enables the identification of trends and issues within small-sized enterprises, facilitating the development of effective strategies and measures to improve working conditions and reduce the risks of occupational injuries.

Implementing the proposed initiative for formalizing statistical accounting in small enterprises and reducing the concealment of non-lethal injuries across any economic entities today is problematic for several reasons. Firstly, there is a low level of legal culture in society, which can only be addressed through education and enhancing the relevant competencies of staff, administration, trade unions, and other public associations, as well as government bodies. Secondly, there is an enduring predatory attitude towards labor resources. This means that the opportunity to save costs on safety and occupational health, and increase the rate of profit, is maintained through certain transactional costs and a corrupt component. This has become particularly relevant in the post-pandemic period from 2020 to 2023.

The update of the list of factors that have harmful and hazardous effects on workers' health will be carried out according to the new classifier of harmful and hazardous factors that determine the degree of occupational risk [22]. Therefore, in the statistical report form 1-T (working conditions), statistical data on working conditions should be generated in accordance with the new classifier of production factors/factor groups (Table 5).

The newly proposed project for the classification of occupational factors has a more distinct structure for classifying factors that adversely affect the health and safety of workers. This will allow for the identification of more accurate and reliable information regarding the number of individuals working in hazardous and/or dangerous conditions. However, along with the advantages compared to the existing document, during the expert assessment phase (Delphi method) and pilot testing on selected enterprises, several remarks were noted.

For instance, there is duplication of certain factors across groups. Dust from soil during agricultural harvesting operations can be classified as both physical factors (aerosol composition) and general industrial pollutants (non-toxic dust). Additionally, duplication within a factor was identified, such as electromagnetic fields and the impact of electric current under the category of physical factors, where electric current essentially constitutes an electromagnetic field.

The hypothesis for improving the list of factors has been substantiated, but the specific document, before its legislative approval, requires further testing, both concerning the list of factors and the methodology of its application, including permissible concentration levels.

At present, in the existing statistical reporting on Form 1-T (working conditions), employers provide information about the expenditures of the enterprise on benefits and compensation for working under hazardous and other unfavorable working conditions. This includes expenses for additional leave, shortened working hours, medical preventive nutrition, milk and/or equivalent food products, and allowances for hazardous working conditions.

The new discussed project of the classifier of production factors has a clearer structure for classifying production factors that have an adverse impact on the health and safety of workers. This will allow for the identification of the most accurate and reliable information regarding the number of individuals employed in hazardous and/or dangerous working conditions.

These expenditures for benefits and compensation related to hazardous working conditions are an integral part of the social responsibility of enterprises and organizations and ensure safe working conditions. However, they do not fully reflect the employer's expenses associated with ensuring occupational safety and health, which are regulated in accordance with labor legislation.

For the purpose of comprehensive statistical recording and analysis of expenses related to occupational safety and health, in addition to expenditures for benefits and compensation for hazardous working conditions, the following information should be included:

- Expenditures for training, instructing, and knowledge assessments on occupational safety and health matters for employees, managers, and individuals responsible for ensuring occupational safety and health.
- Expenditures for providing collective protection measures.
- Expenditures for providing sanitary and household facilities and amenities.
- Expenditures for conducting professional risk assessments.
- Expenditures for conducting periodic medical examinations and pre-shift medical assessments of employees.
- Expenditures for providing personal protective equipment.

Table 5. Classifier of production factors of the working environment

Factors Having Unfavorable Impact According to the Current Form 1-T (Working Conditions)	Factors According to the Draft of the New Classifier
Increased noise level Increased vibration level Unfavorable temperature conditions Increased level of laser radiation Increased level of ultraviolet radiation Increased level of tension Electric, magnetic, electromagnetic waves, radio frequencies	PHYSICAL FACTORS - Vibroacoustic factors - Radiations - Electromagnetic fields - Illumination - Exposure to electric current - Fire or explosion hazard - Climate/microclimate - Aerosol composition of air
Exposure to radiation factor	CHEMICAL FACTORS - Substances toxic - Harmful substances
Exposure to biological factor	BIOLOGICAL FACTORS - Microorganisms - Plants - Animals - Soil and agricultural dust
Injury protection of equipment	MECHANICAL FACTORS - Falls in the work area - Transportation accidents - Exposure to production equipment
Hard physical work	PSYCHOPHYSIOLOGICAL FACTORS - Severity of labor - Tension of labor
Dustiness, gassiness, humidity of the working area air exceeding the maximum permissible concentration concentration	INDUSTRIAL POLLUTION - Contaminated water - Solutions of non-toxic substances (dyes, adhesives, oily substances, etc.) - Non-toxic dust (small chips, small splinters, coarse dust)

The reflection of employer expenditures on occupational safety and health in statistical reporting is an important tool for ensuring safe working conditions in enterprises and organizations, improving the effectiveness of financial measures for occupational safety and health, and developing government policies in this field.

• Regarding the statistical reporting using Form 7-TPZ, in order to obtain more detailed and reliable information about accidents and the injured employees, it is recommended to supplement the following information:

• Average monthly earnings of the injured employee, which is used to determine the amount of temporary disability benefits (sick leave), insurance payouts from insurance companies, and government social benefits for loss of work capacity;

Results of the medical and social examination indicating the degree of work capacity loss, which allows determining the needs for rehabilitation and social support measures for the injured employees.

Including these items in the statistical reporting will enhance the database on occupational injuries and occupational diseases, which, in turn, contributes to a more accurate analysis and forecasting of trends in this field.

Updating the list of incident types and causes of accidents is a proactive measure that will contribute to identifying existing occupational risks and facilitating a more effective response to new occupational hazards in the workplace. This will enable the implementation of measures to reduce these risks more efficiently.

To ensure a clear representation and collection of statistical information on occupational injuries and address identified contradictions, it is proposed to revert to the classical concept of sampling. Sampling is a subset of elements from the general population used to estimate its parameters. To ensure that the sample is representative and reliable, it is essential to correctly apply a full range of methods:

(1) Random sampling: Elements are chosen randomly from the general population, providing equal chances for each element to be included in the sample. This helps reduce the probability of distorting the sample results.

(2) Systematic sampling: Elements are selected at fixed intervals from the general population. For example, every 10th element may be chosen. This approach is particularly useful when the general population is ordered.

(3) Stratified sampling: The general population is divided into several subgroups (strata), and elements are randomly chosen from each subgroup. This approach allows for the consideration of heterogeneity in the general population and ensures more accurate estimates.

5. CONCLUSIONS

In conclusion of this article on occupational safety, important aspects of statistical observation and data analysis for optimizing workplace safety have been identified. Encompassing the significance of statistical monitoring of working conditions and occupational injuries, the study highlighted the necessity for effective measures to improve safe working conditions.

Based on the obtained results of statistical analysis and identified deviations from established standards and norms, the authors have provided a series of valuable recommendations for optimizing the system of statistical monitoring of occupational safety. The proposed measures include the implementation of new data collection and processing methods, updating statistical reporting forms, as well as applying proactive approaches to mitigate the impact

of adverse workplace factors and prevent accidents in the workplace.

Regarding the statistical reporting on Form 7-TPZ, in order to obtain more detailed and reliable information about an accident, as well as the injured worker, it is recommended to supplement with the following information:

- Average monthly earnings of the injured worker, which serves as the basis for determining the amount of payments for temporary disability (sick leave), insurance payments from insurance companies, and government social benefits for loss of employability.

- Results of the medical and social examination indicating the degree of loss of employability, allowing for the determination of the needs for rehabilitation and social support measures for the injured workers.

Supplementing the statistical reporting with these items will improve the statistical database on occupational injuries and occupational diseases, thereby contributing to a more accurate analysis and forecasting of trends in this field.

The updating of the list of types of incidents and causes of accidents is a proactive measure that will help identify existing professional risks and react more effectively to new professional risks in the workplace in order to take measures to reduce them.

These conclusions open up prospects for further research in the field of statistical monitoring of occupational safety, which could lead to the development of more effective and accurate methods for assessing safety and occupational injuries. Furthermore, the provided recommendations can be adapted for various types of enterprises and industries, aiming to ensure nationwide improvement in occupational safety and protect the health of the working population.

In this regard, all occupational safety and health measures should be aimed at preventing occupational injuries and professional diseases. One of such measures should be the creation of a localization scheme for hazards within the surveyed object in workplaces with hazardous working conditions. This scheme helps identify harmful production factors that are common to many professional groups of workers or affect workers in specific areas or professions. The obtained research results can serve as a basis for decision-making by government authorities for the purpose of conducting statistical monitoring of working conditions and occupational injuries.

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