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Occupational hazards and workers' health status of chemicals industries in Gabes, Tunisia

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Abstract:

Occupational health and safety remain critical concerns within chemical industry, where workers are routinely exposed to a range of hazardous conditions, including chemical agents, elevated temperatures, excessive noise, and radiation. This study examines the impact of occupational hazards on the health status of workers employed in the chemical industry in Gabes, Tunisia. Drawing on data collected from a survey conducted between September 2019 and January 2020 involving 498 workers across three chemical manufacturing facilities, the research assesses the prevalence of occupational illnesses and identifies key determinants influencing workers' health outcomes. Findings indicate a high incidence of health-related issues among workers, notably respiratory diseases, musculoskeletal disorders, and hearing loss—conditions closely associated with prolonged exposure to unsafe working environments. Multivariate analysis reveals significant correlations between health status and various socio-demographic and occupational factors, including age, educational attainment, years of service, history of workplace accidents, and perceived risk levels. These results highlight the pressing need for comprehensive occupational health and safety interventions, encompassing regulatory enforcement, hazard control measures, and worker education, to reduce health risks and enhance well-being in the chemical sector.

Keywords: Chemical industry, occupational hazards, health status, logistic model, Gabes, univariate analysis.

JEL Classification: C_{13} ;C_{83};I_{15} ;J_{81}

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Introduction

The chemical industry is widely recognized as a high-risk sector. Exposure to chemicals and physical hazards such as high temperatures, noise, and radiation contributes significantly to the development of occupational diseases. Workers in this industry may suffer from health conditions such as weakness, skin problems, eye irritation, respiratory issues, and different forms of cancers (Karaboyacı, 2019). Addressing these concerns is crucial for protecting workers' health and sustaining industrial productivity.

In the southeastern Tunisia, specifically in the governorate of Gabes, the chemical industry has been operating since 1970. It is now the region's main economic driver, providing significant employment opportunities and contributing substantially to the local economy. The sector employs approximately 49% of the industrial workforce in Gabes. Despite well-known hazardous working conditions, many young people are attracted to jobs in these factories due to the promise of higher wages and job stability.

Ensuring workplace safety is essential for protecting workers' health and enhancing productivity (Selvi, 2020). Prioritizing safety helps prevent occupational illness and injuries, but also supports a healthier, more resilient workforce— which is crucial for both individual well-being and overall economic growth (Jilcha and Kitaw, 2017).

Molamohamadi and Napsiah (2014) examined the relationship between workplace safety and sustainable development, emphasizing that the concept of sustainability extends beyond environmental, economic, and social pillars to include the health and well-being of workers. They argue that ensuring safe and healthy working conditions is integral to achieving truly sustainable development, particularly in industries prone to occupational hazards.

The World Health Organization (WHO) supports this perspective by recognizing workplace safety as a fundamental element of public health promotion. Industrial settings, especially manufacturing sectors, expose workers to a wide range of physical, chemical, and biological hazards. Jilcha and Kitaw (2017) report that these risks contribute to approximately 6,300 deaths globally each day due to workplace accidents and occupational diseases. Such statistics highlight the urgent need for preventive measures and stronger regulatory frameworks in hazardous industries.

In a related study, Beus, McCord, and Zohar (2016) conceptualized workplace safety as a defining characteristic of work systems, which reflects the likelihood of immediate or long-term physical harm to individuals, property, or the environment resulting from work-related activities. Although the occurrence of workplace accidents is commonly used as an indicator of safety, the authors point out that this metric merely reflects the absence of safety events, rather than providing a complete picture of overall workplace safety performance. In other words, a lack of recorded accidents does not necessarily equate to a truly safe work environment.

The importance of workplace safety extends beyond the individual level to organizational performance. As highlighted by Molamohamadi and Napsiah (2014), a healthy and safe work environment enhances worker well-being and is a key driver of industrial competitiveness. Similarly, Elsler et al. (2010) contend that the long-term success and profitability of organizations depend on how effectively they manage occupational safety and health. When workers feel secure and supported in their environment, they are more likely to be productive, engaged, and motivated.

Various theoretical models underscore the link between workplace safety, employee performance, and organizational outcomes. For example, Beus et al.'s *Integrative Safety Model* (2016) provides a comprehensive framework for understanding the multidimensional nature of safety, incorporating factors such as leadership, organizational culture, and employee behavior. Wang and Yang (2017), through their *Work Performance Model*, similarly argue that working conditions significantly influence both employee motivation and job performance. Chandrasekar (2011) reinforces this view, noting that the quality of the physical and psychosocial workplace environment plays a crucial role in shaping employee attitudes and effectiveness.

Given the critical importance of occupational health and safety, this study aims to assess the risks associated with working conditions in the chemical industry—one of the most hazardous industrial sectors. It also seeks to provide a detailed analysis of workers' health status in this context. Focusing specifically on the chemical industry in Gabes, Tunisia, this study will examine the extent to which exposure to occupational hazards has impacted workers' physical health.

The remainder of this paper is organized as follows: Section 2 reviews the literature, Section 3 describes the research methodology, Section 4 outlines the results, and lastly, Section 5 offers the concluding remarks.

1. Literature review

Occupational risks represent a major cause of morbidity and mortality among workers, primarily due to their exposure to hazardous conditions while performing their duties. Particularly, the phosphate processing industries are associated with dusty work environments and the potential exposure to ionizing radiation including radon and its decay products.

1.1. Occupational Health Risks in the Phosphate Industry

Block et al. (1988) conducted a seminal study on workers employed in the phosphate industry in Florida between 1950 and 1979 to investigate cancer-related mortality. The researchers categorized workers by age, gender, race, date of recruitment, and length of employment. They also evaluated the levels of industrial hygiene in various job roles. Their analysis revealed that the highest exposure to dust, chemical vapors, and radiation was associated with tasks such as drying, chemical processing, and maintenance.

The study found that the standardized mortality rate (SMR) for all causes of death was higher among white workers than non-white workers. This racial disparity was also observed in SMRs for all types of cancer. Moreover, a positive correlation was identified between the duration of employment and mortality rates. Specifically, SMRs increased from 1.22 for workers with 1–9 years of service, to 1.61 for those with 10–19 years, and reached 2.48 for workers employed for over 20 years. These findings suggest a cumulative effect of occupational exposure over time.

Checkoway et al. (1996) extended the Block et al. study by including an additional 14 years of follow-up data on mortality among phosphate industry workers. Their study aimed to examine mortality patterns, with a particular emphasis on the effects of chemical and physical exposures in the workplace.

The analysis was conducted in two stages. First, they compared cause-specific mortality rates of workers with those of the general population. Second, they examined lung cancer mortality rates in relation to job category and duration of employment. Their findings corroborated the earlier study: SMRs for all causes of death remained higher among white workers than non-white workers, with the exception of diabetes-related mortality. While cancer mortality rates were slightly higher among white workers, non-white workers experienced higher mortality rates from mouth and digestive system cancers.

Notably, the study did not identify a clear gradient of lung cancer risk based on duration of employment for either racial group. However, among white workers, there was a slight increase in relative lung cancer risk associated with radiation exposure (both alpha and gamma). In contrast, no such association was observed for non-white workers. The authors acknowledged that the lack of detailed industrial hygiene data limited the strength of their conclusions, indicating the need for more precise exposure assessment.

1.2. Occupational Hazards in Developing Countries

Birhan and Endawoke (2023) provided a clear distinction between occupational hazards and occupational health. Occupational hazards refer to workplace-related risks, including exposure to noise, extreme temperatures, and vibration. In contrast, occupational health pertains to the impact of workplace conditions on the physical and psychological well-being of employees. This distinction highlights the importance of effectively managing workplace risks—an issue of particular concern in developing countries. In these contexts, occupational health and safety are often neglected, despite the prevalence of serious health problems among workers. Poor regulatory frameworks, lack of protective equipment, and minimal enforcement contribute to unsafe working environments.

Elwardany and Mohammed (2020) conducted a study on workers in fertilizer production facilities in Egypt to explore the relationship between occupational hazards and workers' quality of life. The results were striking: 80.1% of the workers reported frequent headaches, 54.1% suffered from osteoporosis, and 77.3% experienced respiratory problems. These symptoms were attributed to chemical exposure and inadequate workplace ventilation.

The authors found a statistically significant negative correlation between occupational risks and quality of life. Among workers reporting a low quality of life, 93.3% experienced headaches. This figure declined to 74% among those with a moderate quality of life and 40% among those reporting a better quality of life. The study concluded that poor working conditions—characterized by chemical exposure, insufficient ventilation, and a lack of safety protocols—directly reduced workers' physical well-being and overall life satisfaction.

1.3. Research gap

While extensive research has been conducted on the health consequences of occupational hazards, particularly in the phosphate industry, there is a noticeable lack of economic and localized studies. Most research focuses on physical health outcomes, with limited attention paid to the socio-economic implications or worker well-being, particularly in the context of developing nations.

Furthermore, there is a significant gap in the literature concerning the chemical industry in Tunisia, especially in regions such as Gabes, which is home to one of the country's major chemical industrial zones. To date, very few empirical studies have assessed occupational health risks in this area.

The present study seeks to address this gap by providing a pioneering investigation into the health status of workers in the chemical industry in Gabes. By analyzing occupational risks in a localized context, the study aims to contribute to both national and global understandings of occupational health, with potential policy implications for workplace safety and labor regulations in Tunisia.

2. Materials and Methods

2.1.Data

The study focuses on identifying the impact of occupational hazards on health status of workers in the chemical industry in Gabes. To gather relevant data, a survey was conducted. The questionnaire was administered to workers directly between September 2019 and January 2020. 498 workers of three chemicals industries factories at Gabes were enrolled in this study.

The designed questionnaire include three parts: the first is about personnel data. It involves age, marital status, educational level, type of work, years of experience….
The second part is about environment of work and safety (questions 1 to 17). The third part (questions 18 and 19) is about health status of workers.

2.2.Study variables

The dependent variable represent the health status of workers. To differentiate between individuals in good health and those experiencing health issues, a dichotomous variable was introduced.

X = 1 if the worker reports suffering from an illness

X = 0 if the worker is free from any illness

Where X represents the health status of the workers.

The explanatory variables are classified in the following table.

Table 1 : List of explanatory variables

explanatory variables	Type of variable	Ranks
Socio-demographic		
Age	continuous	
Education level	Qualitative	Primary : reference Secondary: 1 University: 2
marital status	Qualitative	Single: 0 Married: 1 Divorced: 2 Widowed: 3
Environment Factors		
Experience work	continuous	
Type of work	Qualitative	Night shift work : reference Daytime work : 1 Shift work : 2
Danger level	Qualitative	No danger : reference Occasionally dangerous : 1 Low danger : 2

		High danger: 3
Work accident	Qualitative	Don't have an accident: reference Have an accident : 1
Number of accident	Continuous	

Source: the authors

2.3.Econometric analysis

In a first step, a bivariate analysis is conducted. The Chi-square test is used to examine whether a relationship exists between the dependent variable and the explanatory variables (Singhal & Rana, 2015). Then, the spearman test is applied to determine the correlation direction. This test was chosen due to the presence of ranked variables in our data (King & Eckersley, 2019).

In the second phase of the analysis, a multivariate approach is employed to identify the factors that influence workers' health status. Drawing on the methodological framework proposed by Kirouani, Kandi, and Meradi (2024), who utilized a logistic regression model to examine the determinants of occupational stress, this study adopts a similar probabilistic model to investigate the key variables associated with health outcomes in the workplace. The subsequent model is estimated.

$$\frac{\mathbf{p(1|X)}}{\mathbf{1-p(1|X)}} = \mathbf{a_0 + a_1 * X_1 + a_2 * X_2 + a_3 * X_3 + a_4 * X_4 + a_5 * X_5 + a_6 * X_6 + a_7 * X_7 + a_8 * X_8}$$

Here, $\boldsymbol{X_1}$ is age, $\boldsymbol{X_2}$ is years of service, $\boldsymbol{X_3}$is the level of risk, $\boldsymbol{X_4}$signifies the type of work, $\boldsymbol{X_5}$is the level of education, $\boldsymbol{X_6}$indicates a work-related accident, $\boldsymbol{X_7}$is marital status, and $\boldsymbol{X_8}$ is the number of work-related accidents.

3. Results and discussion

3.1.Characteristics of the sample:

3.1.1. Sociodemographic characteristics of workers:

Table 2 displays the distribution of the analyzed sample with respect to the personnel attributes amongst employees of the chemicals industries. It was noted that the average age of workers was 41 years with nearly 48% of them being under the age of 45. Approximately 69% of the workforce is in a marital union. Regarding the educational level, table 2 provides evidence that workers, on the whole, possess a limited educational background. Moreover, the workers constitute more than 86% of the sample and those who had an experience less than 10 years represent 71.49%.

Table 2: Distribution of the chemical industries workers regarding personal characteristics at Gabes City

Personnel characteristics	Percentage
Age	
25-34	22.89
35-44	47.59
45-54	23.69
55-59	05.82
Marital status	
Single	26.10
Married	68.88
Divorced	04.22
Widowed	0.80
Educational level	
Primary	42.17
Secondary	52.61
University	05.22
Type of work	
Worker	86.14
Technician	11.85
Administrative manager	01.20
Engineer	0.80
Years of experience	
1-5	
6-10	29.92
11-15	41.57
16-20	11.65
21-25	10.24
26-30	04.22
> 30 years	02.21
	0.2

Source: the authors

3.1.2. Health Characteristics of Workers:

The findings from the survey showed that 59% of employees in the chemical industry reported experiencing at least one of the diseases mentioned in question 20 of the questionnaire (see appendix). The common health problem of the chemicals industries workers were bone diseases, with 36.5% suffer from such conditions. About 22.7% of workers encountered respiratory diseases, with half of them experiencing asthma. These issues are likely attributable to the high absorption of chemical substances and other airborne contaminants in industrial settings, leading to alterations in pulmonary function among employees (Geetha et al., 2001) . A significant proportion, around 11.6%, reported facing hearing loss. These findings are consistent with those reported by Mallem, Loukil, and Boulakoud (2015), who conducted a study on the impact of fertilizers on workers' health in the Nitrate, Phosphate, Potassium unit in Algeria. Ranked fourth among occupational diseases, hearing loss appears to be primarily attributable to prolonged exposure to continuous industrial machine noise.

Table 3: distribution of workers by disease type

	Respiratory diseases	Cardiac complications	Gastrointestinal disorders	Hearing loss	Bone diseases	Skin irritation	Glandular diseases	Others
Chemicals industries workers in %	22.7	2	4.8	11.6	36.5	0.8	0.8	13.8

Source: the authors

3.1.3. The working conditions:

According to Menon and Tiwari (2021) working conditions refer to the context under which a worker is presumed to undertake his job. In chemical industries, this context involves three categories of factors that may influence the nature of work: structural job characteristics, interpersonal relationships and physical conditions.

In chemicals factories, workers encounter a myriad of hazards that jeopardise their overall health and safety. According to Boudissa (2024), occupational hazards are defined As conditions, circumstances, and behaviors that are harmful within the work environment. Such hazards can

lead to the deterioration of both physical and psychological health. These risks encompass the potential for falls, slips, asphyxiation due to gas leaks, or burns resulting from contact with acids or high temperature.

Among the cohort of the interviewed workers, 17.9% acknowledged their exposure to all these potential hazards, while 49.2% of them indicated their simultaneous exposure to three different types of hazards.

These perilous conditions are the primary factors leading to workplace accidents. Indeed, 46% of interviewed workers reported that they have experienced a workplace accident. Amongst these persons, 40.6% have experienced a single accident, 41 per cent have encountered tow accidents and 12.7% have undergone three accidents.

Similar to Patyk and Nowak-Senderowska (2022) we have assessed hazards based on employees' subjective perception of risks in the work environment. The surveyed employees has to identify the importance of hazards. Then, we proposed four levels: no danger, occasionally dangerous, dangerous, and very dangerous. The self-assessment of the danger level in the workplace has indicated that only 3.6% of respondents depicted their working conditions as hazardous, 15.3% categorize them as extremely dangerous and 73% of interviewed workers described their working conditions as occasionally hazardous.

3.2.Bivariate analysis:

The chi-square tests provide evidence that the health status of workers in the chemical industry is significantly explained not only by factors such as age, marital status, education, and years of service, but also by variables including the level of danger, work-related accidents, and the number of work-related accidents. Specifically, it is observed that 70.5% of married individuals, 72.4% of workers with primary education, and 89.4% of those who have experienced work-related accidents report suffering from at least one illness. Additionally, 62.2% of those who classify their working conditions as "occasionally dangerous" announce having at least one illness.

Spearman correlation tests display positive correlations between health status and variables such as age, marital status, years of service, the level of danger, work-related accidents and the number of work-related accidents. Conversely, education exhibit a negative association with health status. Finally, socioeconomic categories and job types are not significant and they will not be introduced in logistic regression (as shown in Table 4).

Table 4: Chi-squared and Spearman tests for the health status of workers in Chemical industries

Variables	Categories		N	Health status		Test de Chi 2	Test de Spearman
				Have at least one illness	Not have any illness		
Age	Continuous Variable		498	292	206	Chi2(34) = 156.08 Pr = 0.000	Rho = 0.457 Pr = 0.000
Marital status	qualitative Variable	single	130	33	97	Chi2(3) = 77.225 Pr = 0.000	Rho = 0.358 Pr = 0.000
		Married	343	242	101		
		Divorced	21	14	7		
		widowed	4	3	1		
Education	qualitative Variable	Primary	210	152	58	Chi2(2) = 29.825 Pr = 0.000	Rho = -0.240 Pr = 0.0000
		Secondary	262	128	134		
		University	26	12	14		
Socioeconomic categories	Qualitative Variable	worker	429	254	175	Chi2(3) = 1.789 Pr=0.617	Rho = -0.031 Pr = 0.485
		technician	59	34	25		
		Administrative	6	2	4		
		Engineer	4	2	2		
Length of service	Continuous Variable					Chi 2(30) = 90.009 Pr = 0.000	Rho = 0.338 Pr = 0.0000
Danger	qualitative Variable	No danger	16	4	12	Chi2(3) = 19.235 Pr = 0.000	Rho = 0.08 Pr = 0.077
		Occasionally dangerous	368	229	139		
		Low danger	73	39	34		
		High danger	18	13	5		
		NA	23				
Job type	qualitative Variable	Night	131	80	51	Chi 2 (2) = 1.127 Pr = 0.569	Rho = -0.008 Pr = 0.852
		day	216	122	94		
		Shift work	151	90	61		
Workplace accident	qualitative Variable	Have an accident	229	204	25	Chi 2(1) = 155.090 Pr = 0.000	Rho = 0.561 Pr = 0.0000
		Don't have un accident	263	88	175		
		NA	6				
Number of workplace accident	Continuous Variable	1	96	78	18	Chi 2(4) = 162.028 Pr = 0.000	Rho = 0.565 Pr = 0.0000
		2	94	92	2		
		3	29	27	2		
		4	10	10	0		

Source: the authors

3.3.Multivariate analysis

Table 5 displays the estimations of the logistic model. It indicates that the health status of workers is notably influenced by variables such as age, work-related accidents, education, number of work-related accidents, length of service, and the level of danger.

The results of our model underscore that inadequate workplace safety is associated with a decline in workers' health. Conditions labelled as "occasionally dangerous" contribute to a 6.8-fold increase in the risk of illness. Conversely, this risk is only multiplied by 5.3 when working conditions are classified as low danger.

This difference can be explained by the insufficient use of protective measures due to the unavailability of such means or a lack of awareness amongst workers to protect themselves, even during the simplest tasks. The risk of contracting a disease multiplies by 5.7 when working conditions are very dangerous. This is primarily the case for production department workers who have direct contact with chemicals and heat.

Furthermore, the risk of suffering from an illness is 5.5 times higher for those who have experienced a work-related accident. Consequently, each additional work-related accident results in a 2.1 fold increase in the risk of developing an illness. More than 17 per cent of the respondents reported being exposed to multiple risks, including falls, slips, burns, and suffocation. Being affected by these hazards significantly increases the risk of developing respiratory or bone-related illnesses, particularly.

The regression results communicate a significant effect of age. Specifically, an increase in age leads to a 1.09-fold higher risk of falling ill. Likewise, an increase in years of service is associated with a higher risk of developing an illness.

The estimation results indicate that education serves as a protective factor, given that the odds ratios are below 1. This outcome is not surprising, considering that less educated workers often hold more challenging positions. Consequently, having a secondary education level promotes a 2.6 fold reduction in the risk of developing an illness. This decrease is the almost the same for workers with a higher education level. Lastly, being widowed increases the risk of suffering from an illness by 3.

Table 5: Logistic Regression of the Health Status of Workers in the Chemicals Industries

Explicative variables	Odds ratio	z	p-value	IC 95%	
Age					
	1.087912	3.19	0.001	1.033067	1.145669
Length of service	1.10347	3.07	0.002	1.036313	1.174979
Danger					
Occasionally dangerous	6.797483	2.79	0.005	1.770213	26.10182
Low danger	5.256127	2.27	0.023	1.251151	22.08116
High danger	5.72648	1.88	0.061	0.9247798	35.45987
Education					
secondary	0.3870629	-3.01	0.003	0.2084164	0.7188381
University	0.3930778	-1.64	0.101	0.1289496	1.198221
Workplace accident	5.488269	2.52	0.012	1.461897	20.60412
Marital status					
Married	2.095523	2.02	0.044	1.021421	4.299124
Divorced	1.01062	0.02	0.987	0.2819467	3.622505
widowed	3.110939	0.70	0.482	0.131536	73.57636
Number of workplace accident	2.107891	1.69	0.092	0.8855762	5.017304
Constant	0.0074825	-4.14	0.000	0.0007367	0.0759999
LR chi2(14)	**289.03 (0.000)**				
Pseudo R2	**0.441**				
Number of observations	**486**				

Source: the authors

4. Conclusion

In conclusion, the findings of our survey support the hypothesis that exposure to various occupational hazards is associated with a range of diseases that negatively impact workers' quality of life. One unexpected result was the higher prevalence of bone-related diseases compared to respiratory illnesses. This outcome may be explained by the fact that exposure to chemical agents and dust can affect not only the respiratory system but also contribute to conditions such as osteoporosis and arthritis.

Furthermore, our survey revealed that 53.21% of workers consider salary to be their top priority, whereas only 14.25% identified workplace safety as their main concern. This finding aligns with the theory of compensating differentials, which suggests that individuals with a higher tolerance for risk may accept more hazardous jobs in exchange for higher wages, while risk-averse individuals tend to prefer safer, lower-paying positions.

Given that working conditions are often difficult to observe directly, we plan to conduct an experimental study in future research to evaluate the applicability of the compensating differentials theory within the context of hazardous industries.

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Appendix

Survey for workers in the industrial zone of Gabes

Product: **- Company:**
Gender: - Male - Female
Age:
Current Marital Status: - Single - Married - Divorced
Place of Original Residence:
Place of Residence after Employment:
Educational Level: - Elementary - Secondary- Higher
Year of Employment:
Duration of Work per Day:
Working Hours: - Day - Night
Professional Category: - Worker- Technician - Administrative Staff- Engineer

1. Was working in the current company the only opportunity available to you?
- No - Yes

2. If you were looking for a job today, would you choose to work in the current company?
- No - Yes

3. Have you ever regretted choosing to work in the current company?

4. What privileges does the current company provide for you?
- High salary - Grants - Free transportation - Career advancement - Occupational health and safety

5. If offered a job in another company today, on what basis would you choose it?
Rank the following criteria from 1 to 5:
Salary
Benefits and privileges
Career advancement
Proximity to home
Occupational health and safety

6. What type of uniform is required for your job?
- Regular uniform
- Fire-resistant uniform
- Chemical-resistant uniform

7. Does the company provide it for you? - No- Yes

8. What safety tools are required for your job?
1. Helmet 2. Safety shoes 3. Gloves 4. Ear protectors 5. Goggles

9. Does the company provide them for you? - No- Yes

10. What risks can you be exposed to during the performance of your job?
1. Falling 2. Slipping3. Burns4. Suffocation

11. Were you aware of these risks before joining the company?
- No- Yes

12. Have you ever had a work accident in the past years?
1. No 2. Yes

13. How many times have you had a work accident?
- 1- 2- 3 - More than 4

14. What are its side effects?
1. None 2. Burns 3. Joint pain 4. Spinal pain 5. Other

15. In the event of a work accident, does the company provide the necessary first aid?
- No - Yes

16. Are these first aid measures provided effectively (speed, presence of medical staff)?
– No - Yes

17. How do you classify the working conditions in the current company in terms of the level of danger?
1. No danger 2. Occasionally dangerous 3. Dangerous 4. Very dangerous

18. How would you evaluate your health?
1. Poor 2. Average 3. Good 4. Excellent

19. What illnesses do you suffer from? Place a mark in the appropriate box:

1) Nasal inflammation
2) Asthma or shortness of breath
3) Respiratory failure
4) coughing
5) Pulmonary fibrosis
6) Tuberculosis
7) Lung cancer
8) Cardiac complications
9) Gastrointestinal disorders
10) Hearing loss
11) Arthritis
12) Osteoporosis
13) Skin irritation
14) Glandular diseases
15) Other diseases