



WORKING CONDITIONS AS A DETERMINANT OF HEALTH INEQUALITIES BETWEEN THE OLD AND NEW EU COUNTRIES

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Abstract: *Poor employee health is currently one of the most important constraints in the process of managing human resource performance. This problem is related both to the need for companies to incur high economic costs related to absenteeism and staff turnover, and to the burden on national economies of lost productivity of human resources. The aim of this study was to determine the impact of factors related to occupational risks on the potential of labour resources in the EU-27 countries. An analysis of the burden of the consequences of the loss of health or premature death of people of working age was carried out. The trends observed in the analysed phenomenon in the countries of the "old" and "new" EU are assessed. The analysis uses data from the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019, which shows the impact of occupational risk factors on the number of years of healthy life lost as a result of premature death (YLL - years of life lost) or disability (YLD - years lived with disability). The results of the study made it possible to assess the situation in Central and Eastern European countries against the background of Western European economies, providing a basis for identifying patterns of convergence in this area and for discussing the profitability of health programmes from an employer's perspective.*

Keywords: *loss of productivity, loss of health, occupational risk, work-related factors, YLLs - years of life lost, YLDs - years lost due to disability, inequalities in the EU*

Introduction

Poor working conditions are a major health burden worldwide. Estimates of the global burden of work-related disorders (diseases and injuries) suggest that occupational risk factors contribute significantly to the health burden, and there are wide variations in the estimated prevalence of work-related disorders between countries and regions. However, despite the growing importance of OSH issues, research in this area shows that in many cases workers are still exposed to unhealthy working conditions and perceive a link between their work and health risks. According to Eurostat data, in 2020, more than 62% of respondents aged 15-64 say that they are exposed to risk factors at work that may affect their physical health and almost 45% of respondents confirm the presence of factors at work that negatively affect their physical health and have an impact on their mental well-being [17]. Almost 15% of people in this age group report having had work-related health problems [18].

The magnitude of the burden of occupational risk factors estimated by the Institute for Health Metrics and Evaluation (IHME) as part of the Global Burden of Disease Study 2019 [19] shows that in 2019, occupational risk factors were responsible for 1.22 (95% CI: 1.08-1.37) million deaths, or 2.2% of all deaths worldwide.

Occupational risk factors were responsible for 32.9 (95% CI: 30.0-35.9) million premature years of life lost (YLL) and 33.2 (95% CI: 24.3-43.2) million years lived with disability (YLD), representing 2.0% of global YLL and 3.9% of global YLD. Over the last three decades, significant progress has been made in the area of occupational safety and health in the EU - between 1994 and 2018, the number of fatal accidents at work in the EU fell by about 70% [11]. While factors such as de-industrialisation and better medical care have undoubtedly contributed to this decline, the EU OSH system has also played an important role. However, despite this progress, there were more than 3,300 fatal accidents and 3.1 million non-fatal accidents in the EU-27 in 2018, and more than 200,000 workers still die each year from work-related illnesses. Maintaining and improving standards of worker protection is therefore a constant challenge and necessity.

The aim of this study was to determine the impact of factors related to occupational risk on the potential of the labour force in the EU-27 countries. An analysis of the burden of the consequences of loss of health or premature death of people of working age was carried out. The trends observed in the analysed phenomenon in the countries of the "old" and "new" EU are assessed. The analysis uses data from the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019, which shows the impact of occupational risk factors on the number of years of health lost due to premature death (YLL) or disability (YLD). The results of the study made it possible to assess the situation in Central and Eastern European countries against the background of Western European economies, which provided the basis for identifying patterns of convergence in this area, as well as for discussing the profitability of health programmes from the employer's perspective. The empirical part of the analysis was preceded by a review of the main theoretical concepts describing the mechanisms of the links between working conditions, health and productivity of employees.

Cost-effectiveness of 'healthy organisations' - outlining the problem

Poor employee health is currently one of the most important constraints in the process of managing human resource performance. This problem is associated with both the need to incur high economic costs related to absenteeism and staff turnover [2][4][5], and the issue of reduced productivity of people who are present at work despite limited physical and mental fitness [6][7][42]. The results of research in this area suggest that in many companies these costs are mostly underestimated, both due to the lack of a clear methodology for measuring them [9] and the real possibility of conducting appropriate analyses at the level of individual organisations [29][30]. The growing scale of the problems associated with the deterioration of workers' health, including those directly caused by the conditions of the working environment, has led to discussions about new organisational models in which the working environment contributes to the improvement of workers' physical and mental health [37].

According to the theory of 'healthy organisations', investing in the health of employees can combine the goal of achieving a high rate of return with meeting the expectations of a wide range of stakeholders, including those expressed in the concept of corporate social responsibility [32][40]. Research on employers in this area shows that some of them already recognise the fact that rationally targeted expenditure on improving health can be justified not only by concern for the well-being of employees, but also by a reduction in the costs associated with absenteeism, reduced productivity or staff turnover due to ill health [1][34][35]. Research in this area also confirms the positive return on investment in workplace health promotion [3][43].



The negative impact of ill health on people of working age and the associated loss of output are the sum of several components. The most important of these are the costs to patients in terms of lost income, the costs to government budgets in terms of reduced employment, and the costs to companies in terms of increased staff turnover. The worsening of the risk factors that determine the level of morbidity in society for chronic diseases is particularly evident in highly developed countries, where the growing, unfavourable ratio of the number of years of total life to the number of years lived in full health is becoming a significant problem [26][27]. The rising costs of ill health, especially chronic health problems, have also become a significant burden for organisations whose effectiveness depends on the individual performance of their employees [12][39]. The unexpected unavailability of employees due to illness (absenteeism) or a decrease in their work efficiency as a result of illness (presenteeism) forces employers to accumulate surplus labour in order to flexibly adjust the number of employees to the expected production [36]. Companies will bear the brunt of costly OSH prevention and risk assessment if the expected benefits outweigh the direct costs. Some of the most important expected benefits include lower rates of workplace accidents, illnesses and sickness absence, and higher levels of overall job satisfaction among employees[33].

In this context, the growing interest in the possibility of estimating the economic value of OSH interventions, analysed in terms of the profitability of expenditure at the level of individual companies, is understandable. Acceptance of the thesis of a clear relationship between the health of workers and their productivity has led to the fact that the state of health is now proposed in the literature as one of the basic factors for increasing or maintaining productivity in the workplace [8][10] [38]. Most of them assume that the increasing number of health risks leads to a greater loss of productivity, defined as the difference between the potential level of production achievable under normal conditions and the level achieved in the event of a problem [13]. The definition of the category of "lost productivity" currently proposed in the literature suggests the need to take into account both the number of days of absence from work (absenteeism) and the situation of reduced productivity of people who are present at work despite illness, i.e. so-called presenteeism [23][31]. Work-related health problems are defined in different ways and include problems resulting from exposure to harmful chemicals and unfavourable conditions related to work ergonomics, as well as those related to the occurrence of undesirable effects of work, such as stress. Research shows that an inadequate working environment can exacerbate mental health problems [41], which in turn can lead to significant productivity losses, particularly in the form of presenteeism [22]. As the literature review shows, although the topic of assessing the cost-effectiveness of health promotion and prevention interventions seems to be increasingly the subject of research, few of them have attempted to assess the economic justification of these interventions at the level of a single organisation [21].

Material and methodology

The analysis of the level of disease burden of economies due to exposure to poor working conditions was carried out using the indicators of years of life lost due to premature death (YLL) and years of life lost due to disability (YLD). The analysis used data from the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease Study 2019 [19]. The level of occupational risk results from the aggregation of all individual occupational risks modelled as risk factors, including: work-related accidents; ergonomic factors; and occupational exposure to particulate

matter, fumes and gases, carcinogens, noise and asthma triggers. The selection of the variables analysed was made on the basis of a review of the methodology proposed in the literature [14][15] to assess the phenomenon under study. This method is based on the estimation of disability-adjusted life years lost due to illness or injury. The results are compared with an ideal scenario in which no disability-adjusted life years are lost in a country or region due to absenteeism, fatal accidents or illness. The level of burden represented by the YLL and YLD indicators on an annual basis due to workplace hazards can also be expressed in financial terms. Such costs are calculated by multiplying the value of the YLL and YLD indicators for a given country by the annual work value of an employee in that country [25][28].

Comparability of data between EU Member States has been achieved by using intensity indicators, which relate the number of observed cases to a given population size. The analysis uses an indicator that measures the number of years of life lost due to premature death (YLL) and the number of potential years of life lost due to disability (YLD) from diseases caused by occupational risk factors (OR) per 100 000 persons, i.e. the YLL(OR) rate and the YLD(OR) rate. The population attributable fraction (PAF) approach was used for most risk factors. For the purpose of the planned assessment of inequalities in the level of burden of the EU economies with the effects of work-related diseases between the "old" and "new" EU economies, two groups of countries were distinguished: (1) EU-14, representing highly developed economies with market traditions that joined the EU before 2004, and (2) EU-CEE - Central and Eastern European countries that joined the EU structure after 2004 and have experience of political transformation. The degree of dispersion of the analysed parameters at the level of the EU-27 countries and in relation to the analysed groups of countries was determined using statistical measures. Due to the strong gender differentiation of the phenomenon under study, the analysis was carried out separately for women and men. The research presented here is also part of ongoing research on inequalities in occupational workloads and environmental risk factors between the 'old' and 'new' EU [24].

SDI and occupational risk burden

The preliminary analysis of the data shows that the level of socio-economic development of a given region to some extent differentiates the extent of the burden of diseases resulting from the impact of occupational risk factors in a given area. According to data from the Institute of Metrics and Health Assessment [19] on the burden of disease in world economies, depending on the level of socioeconomic development of a given area (SDI measurement), the YLL(OR) rate (i.e. YLLs per 100,000 people) varied in 2019 from 146.5 (high SDI countries) to 167.6 (low and middle SDI countries) for women and from 647.9 (high and middle SDI countries) to 793.2 (low and middle SDI countries) for men. The YLD(OR) rate (i.e. YLD per 100,000 population) ranged over the period analysed from 277.4 (low SDI countries) to 360.4 (medium SDI countries) for women and from 453.8 (low SDI countries) to 573.8 (high SDI countries) for men (Table 1). Thus, the level of the burdens examined does not show any significant differentiation between groups, and low levels of these burdens are observed in countries with the lowest level of development.



Table 1. Burden of disease caused by occupational risk factors (OR) - YLLrate/YLD rate, by country group (SDI breakdown), in 2019 and change in the period 1990-2019

Location name	YLL (OR) 2019				YLD (OR) 2019			
	Rate*		% all YLL		Rate*		% all YLD	
	F	M	F	M	F	M	F	M
2019								
High SDI	146.5	699.2	1.1%	3.9%	359.8	573.8	2.5%	4.9%
High-middle SDI	148.1	647.9	1.1%	3.1%	357.7	533.5	2.7%	5.1%
Middle SDI	163.7	655.4	1.1%	3.1%	360.4	520.0	3.0%	5.5%
Low-middle SDI	167.6	793.2	0.8%	2.9%	314.1	519.8	2.7%	5.6%
Low SDI	161.5	650.1	0.5%	1.7%	277.4	453.8	2.7%	5.3%
Change in the period 1990-2019 (in %)								
High SDI	8.2%	-30.4%	22.2%	-15.2%	6.7%	-10.2%	-7.4%	-23.4%
High-middle SDI	-43.9%	-42.6%	-15.4%	-13.9%	-5.5%	-10.8%	-18.2%	-22.7%
Middle SDI	-52.0%	-44.7%	-8.3%	-11.4%	-5.4%	-3.9%	-21.1%	-19.1%
Low-middle SDI	-30.1%	-39.1%	60.0%	31.8%	0.5%	-10.8%	-6.9%	-13.8%
Low SDI	-36.5%	-38.8%	-83.3%	-84.8%	-9.4%	-15.3%	-3.6%	-7.0%

* YLLs/YLDs per 100,000 persons

Source: own study based on the data: [19]

An analysis of changes in the level of exposure to occupational risk factors over the past few decades shows visible trends towards a reduction in the magnitude of the negative impact of occupational risk factors on health. Between 1990 and 2019, the number of years of life lost (YLL) due to occupational risk factors per 100 000 people in the world fell from 1159.0 to 690.4 for men and from 254.3 to 159.1 for women. At the same time, years of life lost (YLD) due to these risk factors decreased from 576.4 to 519.8 per 100 000 men and from 351.8 to 337.2 per 100 000 women. Within selected groups of countries, a different trend of changes in the analysed parameters occurred only in the group of countries with the highest level of socioeconomic development (High SDI) - in the years 1990-2019, in the group of women, there is a noticeable increase in the burden of both premature deaths (YLL rate) and chronic diseases (YLD rate) caused by exposure to occupational risk factors.

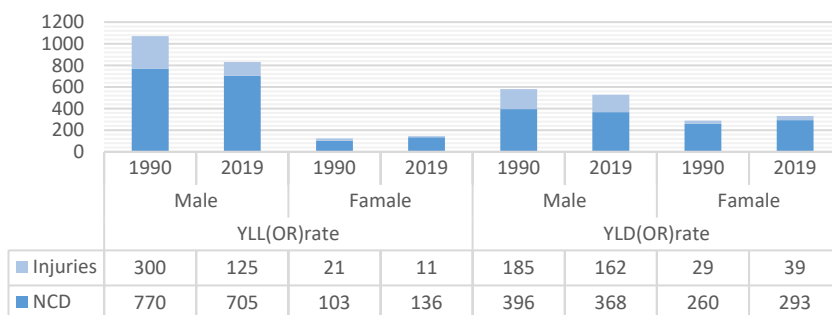
Occupational risk burden in EU countries

The IMHE estimate of the burden of occupational risk factors in the European Union indicates that 130,400 people died as a result of exposure to poor working conditions in 2019 (95% CI: 152.0-107.8). This represents 4.05% of the total number of deaths caused by all risk factors combined and 2.4% of the total number of deaths recorded in the EU during this period. Work-related factors were responsible for 2.48 (95% CI: 2.09-2.87) million YLLs and 2.21 (95% CI: 1.60-2.89) million YLDs, representing 2.88% of the total number of YLLs and 3.07% of the total burden of disease in the EU. Over the period 1990-2019, the death rate from occupational risk factors in the EU area increased from 24.2 to 25.3 (per 100 000 population), with the YLL(OR) rate decreasing from 430.8 to 428.7 and the YLD(OR) rate decreasing from 584.4 to 481.3. Noncommunicable diseases (NCDs) accounted for most of the burden of premature death due to occupational risk factors (YLL(OR)), accounting for 84.9% of life years lost for men and up to 92.6% for women. NCDs caused by occupational

factors also had a major impact on the burden measured in terms of long-term health loss. The contribution of chronic diseases to the total burden of work-related disability (YLD(OR)) was 69.5% for men and up to 88.4% for women.

It should be noted that, over the period analysed (1990-2019), the parameters studied have decreased significantly in the male group, mainly due to a reduction in the burden of health consequences of occupational accidents. On the other hand, there is a characteristic increase in the burden of health consequences of occupational risk factors for women, both in terms of years of life lost prematurely (YLLrate) and in terms of health (YLDrate). The characteristics of the variables examined are shown in Figure 1.

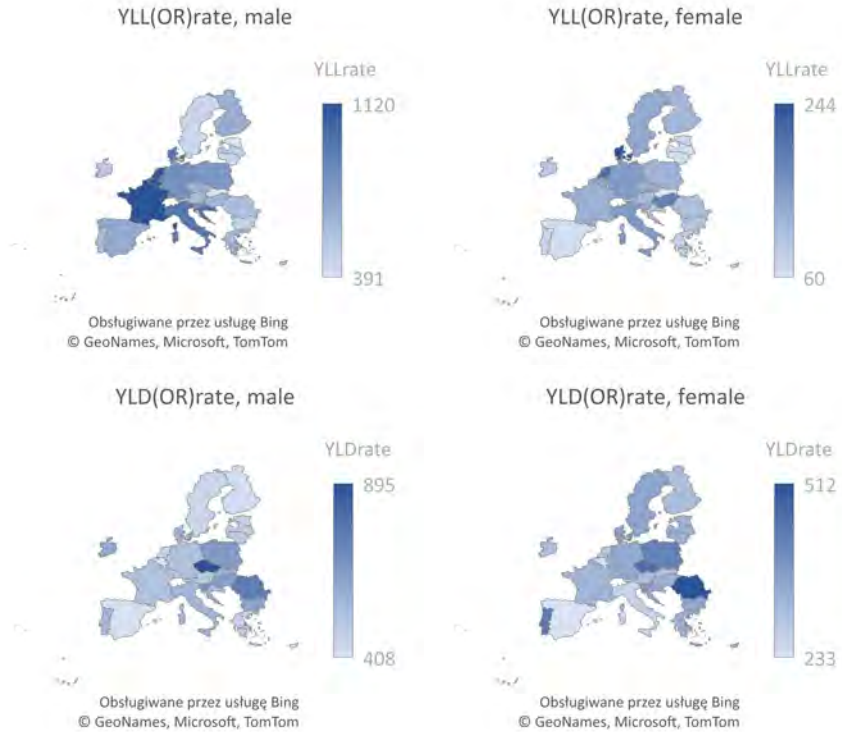
Figure 1. Burden of occupational risk factors (OR) - YLL/YLD rate, EU area, 1990 and 2019



Source: own study based on [19]

Data published by the Institute for Health Metrics and Evaluation (IHME) on the estimated burden of health outcomes due to exposure to occupational risk factors show significant differences in this phenomenon in the group of European Union Member States. These data also confirmed significant gender differences in this area. According to the estimates, the number of prematurely lost years of life (YLL) per 100 000 in the EU in 2019 due to the negative impact of factors related to occupational risks ranged from 391.5 (Estonia) to 1119.6 (France) for men and from 59.9 (Slovakia) to 244.0 (Denmark) for women. A slightly smaller dispersion was found for the values of the indicator defining the number of years lived with disability (YLD) per 100 000 population. For men, this parameter ranged from 408.0 (Belgium) to 894.9 (Czech Republic), while for women it ranged from 233.2 (Spain) to 511.8 (Romania). At the same time, it should be noted that the values of the above indicators are determined not only by the direct relationship with the working conditions in a given country, but also by the level of occupational activity and employment, the general level of prevention and health protection in a given country, and the legal aspects of reporting accidents at work and diseases caused by occupational risk factors. Figure 2 shows the distribution of the spatial level at which the individual EU economies are exposed to the consequences of occupational risk factors.

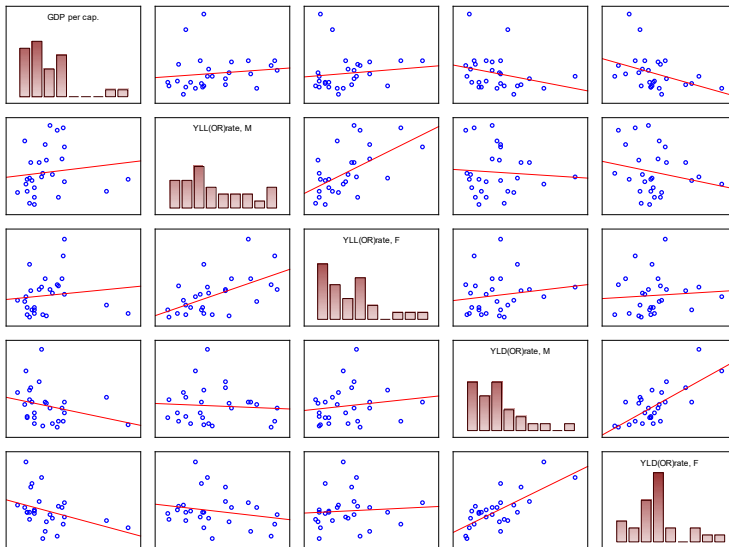
Figure 2. Spatial distribution of years of life lost (YLL) and years of life lost (YLD) per 100 000 inhabitants, EU countries, 2019 - Impact of occupational factors



Source: own study.

The analysis of the spatial distribution of the level of the burden of the effects of occupational risk factors in individual EU economies does not indicate the existence of a visible relationship between the location (East-West) of a given country and the level of the risk of loss of health and life as a result of poor working conditions. The assessment of the relationship between the level of socio-economic development of the country and the level of the burden of the effects of occupational risk factors also does not indicate the existence of a significant relationship between the indicated parameters observed in the group of EU-27 countries (Table 2).

Table 2. Correlation matrix – YLL and YLD(OR)rate, GDP per cap. (EU-27, in 2019)



	Average	SD	GDP per cap.	YLL(OR) rate, M	YLL(OR) rate, F	YLD(OR) rate, M	YLD(OR) rate, F
<i>GDP per cap.</i>	47389	19147	1	0,129	0,126	-0,278	-0,382*
<i>YLL(OR)rate, M</i>	694	215	0,129	1	0,574*	-0,071	-0,214
<i>YLL(OR)rate, F</i>	113	46	0,126	0,574*	1	0,157	0,076
<i>YLD(OR)rate, M</i>	545	114	-0,278	-0,071	0,157	1	0,725*
<i>YLD(OR)rate, F</i>	336	62	-0,382*	-0,214	0,076	0,725*	1

*Correlation coefficients determined are significant with $p < .05000$, $N=27$

Source: own study based on data: [19] [20]

The results obtained indicate that, in the case of EU countries, there is no clear correlation between the level of economic development of the country, measured by the value of the gross domestic product per capita (GDP per capita), and the number of years lost as a result of exposure to occupational risk factors (YLL(OR)rate) and (YLD(OR)rate). Relatively weak correlations ($r < 0.4$) were found for both variables (Table 2). Only in the case of the YLD(OR) indicator for women was a statistically significant result obtained ($p > 0.05$, for $\alpha = 0.05$), with a correlation coefficient of -0.38 , which could indicate a certain relationship between the increasing level of the product and the decreasing level of exposure of women to the health effects of occupational risks.

Inequalities in the context of the 'old' and 'new' EU - research results

For the purposes of the planned assessment of the magnitude of the impact of occupational risk factors on premature death or disability in the context of the situation observed in the countries of the 'old' and 'new' EU, the analysis distinguished between two groups of countries: (1) EU-14 - countries that joined the Union in 2004,



representing developed economies with market traditions, and (2) EU-CEE - countries that joined the EU structures after 2004, representing the economies of Central and Eastern Europe with experience of political transition. Due to the adopted substantive criterion, Cyprus and Malta were excluded from the group of countries that joined the EU after 2004. Basic statistics on the analysed parameters in the period 1990-2019, broken down into separate reference groups, are presented in Table 3.

Table 3. YLL (OR) rate, YLL (OR) rate - groups of EU-14 and EU-CEE countries, 1990 and 2019

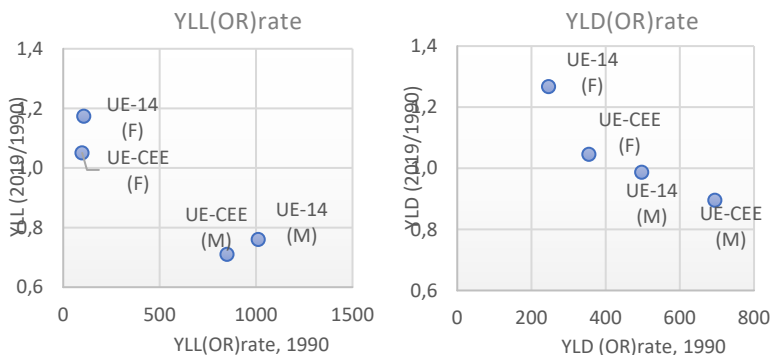
	<i>YLL(OR)rate</i>		<i>YLD(OR)rate</i>	
	UE-14	UE-CEE	UE-14	UE-CEE
	Male			
<i>1990</i>	1012	850	498	695
<i>2019</i>	769	603	491	622
<i>Change 1990-2019 (%)</i>	-24%	-29%	-1%	-10%
	Female			
<i>1990</i>	107	98	246	355
<i>2019</i>	126	103	312	371
<i>Change 1990-2019 (%)</i>	17%	5%	27%	5%

Source: own study based on data: [19]

The obtained results confirm the previously obtained description of the relationship between the examined parameters, indicating that the level of development of a given EU country does not clearly translate into the degree of health burden of exposure to occupational risk factors. However, the obtained characteristics indicate a different specificity of the studied phenomenon in the studied reference groups - the problem of a high level of premature deaths as a result of the impact of occupational risk factors is a characteristic feature of the group of EU-14 countries. On the other hand, the countries of Central and Eastern Europe are characterised by a higher burden of occupational risk factors, as measured by the number of years lived with disability. At the same time, the data obtained confirm that, in the case of men in the EU countries (for both groups surveyed), the level of occupational risk factors leading to premature death has been significantly reduced over the period 1990-2019. A smaller reduction in the burden was observed for the burden of long-term health loss leading to disability. The trends observed in the group of EU countries also confirm the observed global trends, which point to an increase in women's exposure to occupational risk factors, with this increase being particularly evident in the group of EU-14 countries.

The analysis of the changes in the burden on the economies of the EU countries with the problem of work-related disabilities and premature deaths over the period 1990-2019 shows different directions of response in the reference groups differentiated by gender. A detailed distribution of the examined parameters for both groups in the system of the initial value from the analysis period in relation to the rate of change (beta convergence concept) is shown in Figure 3.

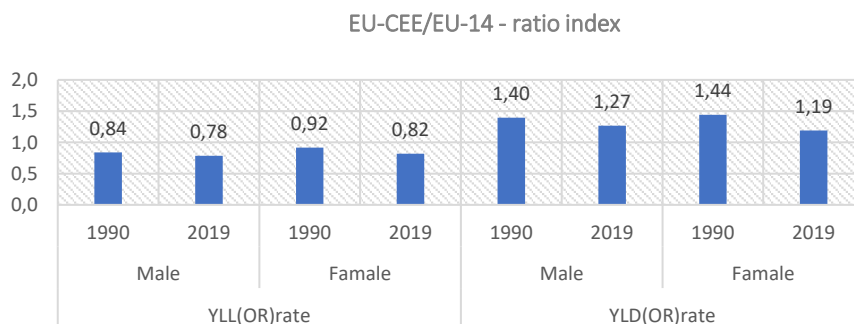
Figure 3. Relationship between the initial level of the YLL and YLD rate (occupational risk) and the rate of change in the period 1990-2019



Source: own study.

Changes in the level of the burden of the effects of occupational risks on the economies of the EU countries have also changed the burden ratios of the EU-CEE countries in relation to the EU-14 observed over the period 1990-2019 (Figure 4).

Figure 4. Burden of occupational risk factors - EU-CEE to EU-14 ratio index, 1990 and 2019



Source: own study.

The countries of Central and Eastern Europe have been able to maintain the trends observed in the EU in reducing the negative impact of occupational risks leading to premature death (YLL(OR)) among men, thus maintaining a favourable situation for this group of countries in relation to Western European countries. In the case of women, the EU CEE countries recorded the above-mentioned increase in the average level of the premature mortality burden, but the rate of increase in this group of countries was lower than in the EU-14 group, which improved their relative position.

In the case of the burden of the adverse effects of unsafe working conditions, measured in years of disability (YLD(OR)), the significant reduction in this burden observed in the EU-CEE group of men improved their relative situation, bringing the level of burden closer to that observed in the EU-14 group. Despite these positive changes, the level of this burden in the group of Central and Eastern European



countries was still 27% higher in 2019 than in the EU-14 group. In the case of women, the dynamic increase in the burden of disability due to work-related risk factors in the EU-14 group (an increase of 27%), compared with an increase of 5% in the EU-CEE group, resulted in the gap between the EU-CEE countries and the group of Western European countries narrowing by 44% to 19% of the surplus.

Conclusions

The levels of exposure to occupational risk factors estimated in the IHME GBD 2019 studies indicate that they continue to be a serious burden on health and life worldwide. Exposure to workplace air pollutants that cause chronic respiratory diseases, including asthma and pneumoconiosis, continues to contribute significantly to the burden of disease in all regions of the world, and occupational carcinogens are responsible for a significant number of diseases worldwide. Risk factors rarely (if ever) found in the non-occupational environment, such as silicosis and asbestosis, continue to be a problem in developing countries, causing a range of related diseases. Taking into account a relatively homogeneous group of EU-27 countries, the above research results indicate that the level (value) of production is not an obvious determinant of the level of burden with the effects of loss of health and life as a result of exposure to occupational risk factors. A higher level of development is associated with a greater degree of industrialisation, but both the conditions of occupational safety and the effectiveness of health care are improving. The research results show that the countries of Central and Eastern Europe, which are characterised by a lower production value, also have a high burden of long-term effects from exposure to occupational risk factors. These results therefore point to the need to strengthen occupational health and safety policies aimed at improving the protection of workers' health. The protection of workers' health and safety, enshrined in the Charter of Fundamental Rights [16], is one of the most important elements of the EU economy for the benefit of its citizens. The right to a healthy and safe workplace is reflected in Principle 10 of the European Pillar of Social Rights and is key to achieving sustainable goals. It is also a fundamental element of the European Health Union that is being created. In addition to health and well-being, there are important economic reasons for a high level of worker protection. Work-related accidents and illnesses cost the EU economy more than 3.3% of GDP per year (around €460 billion in 2019) [11]. In fact, occupational exposures cause a greater burden than a number of well-known risk factors, but there is still no sound methodological basis for quantifying the extent to which these figures translate into poorer population well-being.

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