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EFFECTS OF WORK-RELATED FACTORS ON WORKERS' HEALTH IN BULGARIA

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Abstract: *Work plays a significant role in people's lives, in the functioning of companies and society. Many workers believe that their work affects their health. Occupational health problems are crucial economic and social issues. The 5-th European Working Conditions Survey (EWCS) was carried out in 2010 in all the countries in the EU. Our research presents a secondary analysis of the Bulgarian data set and identifies working conditions associated with workers' perception that their job is detrimental to their health.*

Keywords: *work-related health problems, healthy working environment, job factors, ergonomics.*

1. Introduction

Work-related health problems attract a lot of attention due to their high frequency and the significant impact they usually have on life. About 2 mln. work-related fatalities and 330 million work-related accidents still occur each year in the world [1]. In 2010 there were 109 work-related fatalities and 3086 work-related accidents in Bulgaria [2].

Working conditions of high quality and low health risk are both a legal requirement and a powerful stimulus for innovations and productivity of labour. To improve working conditions is a constant concern of the EU. During the past years, health-safety at work has often been considered an integral part of the individual and social prosperity as well as a determinant of quality management, competitive power, employment growth, economic progress etc.

In a European survey conducted in 2009, 42% of Bulgarians answered that their work had some negative effect on their health, whereas another 29% found this negative effect strong. In the same survey, 47% of Bulgarians said that health-safety at work had deteriorated for the previous five years, 9% considered the change significant, and only 15% reported that working conditions had improved. Many interviewees (60%) blaimed the deterioration of working conditions on the economic crisis [3]. A recent research [4] has demonstrated that working conditions may cause several health problems rarely recognized as work-associated diseases. Medical specialists should pay attention to the relation between patients and their jobs.

The aim of this research is to identify working conditions that have a strong impact on workers' health.

2. Materials and methods

The data have originated from the Fifth European Working Conditions Survey [5] that was carried out in 2010 by the European Foundation for the Improvement of Living and Working Conditions. This survey has been conducted every five years since 1991. The questionnaire covers a broad range of working conditions, work characteristics and workers' sense of satisfaction and perception of different aspects of their jobs.

In the 5-th EWCS, 1014 participants from Bulgaria were interviewed. Their profiles are presented in table 1. A stratified sample was used and a post-stratification weighting was carried out. Throughout this paper, all percentages are weighted after the W4 variable in the data set.

Table 1
Interviewees' profiles

Age	**Men (53 %)**	**Women (47 %)**	**Total (1014)**
under 30	9 %	7 %	**16 %**
30 – 49	29 %	26 %	**55 %**
over 50	15 %	14 %	**29 %**
Length of service in the same company (Q12)			
under 5 years	24 %	20 %	**44 %**
5 – 10 years	11 %	10 %	**21 %**
10 – 20 years	11 %	10 %	**21 %**
over 20 years	7 %	7 %	**14 %**
Level of education			
primary	0.5 %	0.4 %	**1 %**
lower secondary	6.3 %	4.3 %	**11 %**
upper secondary	36.0 %	27.6 %	**63 %**
semi-higher	1.0 %	2.2 %	**3 %**
higher	9.5 %	12.3 %	**22 %**

Disclaimer: The European Foundation for the Improvement of Living and Working Conditions and the UK Data Archive bear no responsibility for our further analysis and interpretation.

3. Results and discussion

3.1. Important correlations

There were 1014 Bulgarian participants in the survey; 4 of them refused to answer the Q67 question, "Does your work affect your health, or not?", and 58 participants had no opinion.

The remaining 952 interviewees answered as presented on fig. 1 and fig. 2.

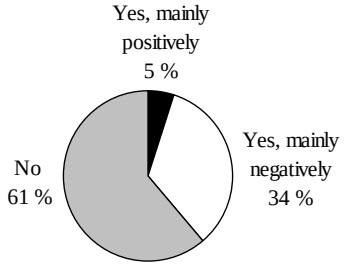

Figure 1. Answers of the Bulgarian participants to the Q67 question, "Does your work affect your health, or not?"

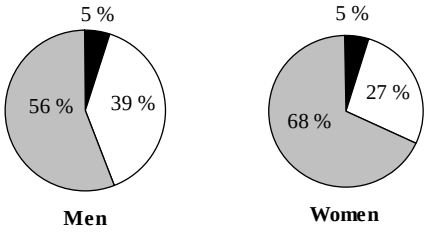

Figure 2. Answers by gender of the Bulgarian participants to the Q67 question, "Does your work affect your health, or not?"

The p-value returned by the χ^2-test is 0.0006, which means that the difference between the two distributions is unlikely to have occurred by chance. A strong correlation exists between the gender of an interviewee and his or her answer to Q67. Men report negative influence of work over health more often than women.

There is a strong correlation between the age of interviewees and their answers to Q67 ($p = 0.008$). Young people's health is the least frequently affected by work. The positive influence of work over health is common for interviewees aged 30 – 49 years. In the age group of 50+ years, the negative influence of work increases.

A strong correlation ($p = 0.003$) exists between the level of education and Q67. However, this correlation is controversial. While higher levels of education correspond to positive influence of work over health, negative influence can't be excluded either. Different kinds of education are best suited to different kinds of work with different risks (i.e. many other factors interfere and make difficult to deduce a simple rule).

The length of service (Q12) is another significant factor ($p = 0.01$). Its impact on health increases after 10 or more years.

Generally, health is negatively affected by manual work occupations more often than by clerical occupations ($p = 0.00002$).

The activity of the organisation where an interviewee works (industry or services) is not very strongly correlated ($p = 0.13$) with Q67. Nevertheless, health of industrial workers is negatively affected by their work a little more often.

With respect to health, no significant difference exists ($p = 0.46$) between the public sector and the private sector. And yet, a negative influence of work on health is reported a little more often by those who work in joint private-public companies.

Work affects the health of employees (positively or negatively) less often than the health of the self-employed ($p = 0.0004$). But the kind of the employment contract is not significant ($p = 0.14$).

The positive influence of work over health is almost doubled (from 4% to 8%) by new processes and technologies and by reorganization carried out at the workplace. This effect is somewhat obscured by the fact that the same absolute difference (i.e. 4%) is relatively smaller when compared with the other two percentages (about 34% for the negative influence and 60% for the absence of influence of work over health), which gives $p \approx 0.10 > 0.05$ (the standard significance level). Therefore, the effect of new processes and technologies and the effect of reorganization on workers' health is insignificant as a whole (the negative influence of work on health decreases little); but it is significant with respect to the positive influence (almost doubled).

The number of employees working together has little influence on their health ($p = 0.13$). Work in big companies that have over 100 employees affects health most (positively or negatively). Next to it in negative influence comes the case when an interviewee works alone. The gender of workers at the same workplace with the same job title as the interviewee is more important ($p = 0.06$). The negative influence of work is more frequent when the workers in the same job title are men. In this case, however, the positive influence of work is also strongest. (The positive influence depends not on the gender but on the number of workers; it is weakest when nobody else has the same job title as the interviewee.)

As expected, those who work more hours per week report a stronger (positive or negative) influence of work on their health ($p = 0.0007$). The influence is significant when the number of working hours per week is greater than 60; work that takes up 45 or less hours per week does not have a strong impact on health.

Working at night ($p = 0.0002$) or more than 10 hours a day ($p = 0.00001$) correlates with the negative influence of work on health.

Working in free time to meet work demands correlates with both the positive and negative influence of work ($p \approx 10^{-13}$).

A second paid job affects health little ($p = 0.30$). An occasional second job affects health positively; a regular one affects it negatively. Less than 10 hours per week are insignificant; 15 or more hours affect health negatively.

Both positive and negative outcomes of work on health increase ($p < 10^{-8}$) when a job involves working to tight deadlines most of the time.

Working at a very high speed less than 1/4 of the time affects health positively; otherwise the effect is negative ($p < 10^{-12}$).

Interruptions of the current task due to unforeseen tasks increase both the positive and the negative influence of work on health ($p = 10^{-6}$). Disruptive interruptions are those that increase the effect of work ($p = 0.0003$); positive and neutral interruptions do not.

Precise quality standards ($p = 0.10$), complex tasks ($p = 0.00002$) and solving unforeseen problems ($p = 0.03$) correlate strongly with the positive influence of work, but weakly with the negative one.

Learning new things correlates with the positive impact of work on health ($p = 10^{-3}$).

Monotonous tasks seem to increase the positive influence of work on health, but the difference is insignificant ($p = 0.28$).

Assessing the quality of one's own work has no impact on health ($p = 0.50$).

3.2. Geographical distribution

There is a significant correlation ($p = 0.03$) between the influence of work on health and geographical regions. The negative impact is more often reported in northern Bulgaria whereas the positive influence and the absence of influence are most frequently reported in southern Bulgaria (table 2).

There is an obvious difference between towns and villages ($p = 0.0005$). In villages, work does not affect health much (table 2). The positive influence of work on health is most frequent in cities with 50000+ inhabitants, and the negative one — in small towns (10000 – 50000).

Table 2
Geographical distribution

Size of Locality	Q67 Does your work affect your health, or not?			
	Yes, positively	Yes, negatively	No	*Total*
up to 500 inhabitants	0 %	14 %	86 %	**4 %**
501– 9999	3 %	30 %	67 %	**33 %**
10 – 50 thousands	3 %	40 %	57 %	**15 %**
over 50 000	7 %	36 %	57 %	**48 %**
Total	**5 %**	**34 %**	**61 %**	**100 %**

3.3. Occupational safety and health

Naturally enough, the negative influence of work on health jumps from 13.4% to 64.2% when workers' health and safety are at risk because of their work ($p \approx 10^{-62}$).

Jobs that require personal protective equipment are more frequently associated (44% vs. 28%) with the negative influence of work ($p \approx 10^{-7}$) but also with the positive one (6.8% vs. 3.8%), which is a paradox.

About 90% of workers *always* use their protective equipment, and 10% do not. Of the second group, *nobody* reported a positive effect of work on his or her health; but 62.4% were affected negatively. Contrariwise, those who *always* use their protective equipment reported either a positive (7.5%) or no impact (50.5%) of work on their health ($p = 0.056$).

Only those workers are positively affected by work who are well-informed about health and safety risks. The negative effect is most frequent (56.7%) among those who are not very well-informed. Surprisingly, those who are not at all well-informed most often say (80.6%) that work does not affect their health ($p = 0.0007$). Perhaps their jobs are free of risk.

3.4. Classification of factors

Factors can be divided into groups.

a) Factors that are correlated with the *negative* influence of work on health:

- Breathing in smoke, fumes, powder, dust or vapours such as solvents and thinners.
- Contact with chemical products.
- Repetitive hand or arm movements. (These all have $p < 10^{-9}$).
- Standing upright ($p = 0.00002$).
- Breathing in tobacco smoke from other people ($p = 0.0001$).
- Direct contact with materials that can be infectious ($p = 0.0005$).

Some of these factors seem to be correlated also with the *positive* influence of work. Most probably this correlation is a false one due to the small frequencies associated with the positive influence that violate one of the constraints of the χ^2-test.

b) Factors that are correlated with the *positive* influence of work on health:

- Dealing directly with people who are not employees, such as customers, patients, pupils etc. ($p = 0.02$).
- Working with computers ($p = 0.0004$).
- Using Internet / email ($p = 0.03$).

c) Factors correlated with both the *positive* and *negative* influence of work:

- Vibrations (Q23a) and noise (Q23b).
- High or low temperatures (Q23c,d).
- Tiring or painful positions (Q24a).
- Handling angry clients (Q24g).
- Short repetitive tasks (Q44).

The p-values are smaller than 10^{-6}, i.e. the correlation is very strong. The nature of the correlation must be carefully interpreted.

As a typical example, consider the impact of vibrations on health (table 3).

Table 3
Influence of vibrations on health

Exposed to vibrations	**Q67 Does your work affect your health, or not?**			
	Yes, positively	**Yes, negatively**	**No**	***Total***
(almost) all of the time	10 %	57 %	33 %	**12 %**
over 50% of the time	4 %	49 %	47 %	**7 %**
about 25% of the time	2 %	51 %	47 %	**7 %**
(almost) never	4 %	27 %	69 %	**74 %**
Total	**5 %**	**34 %**	**61 %**	**100 %**

Answers of those workers who are not exposed to vibrations have almost the same distribution as the set of all answers. Interviewees exposed to vibrations report a negative influence of work more often (51%, 49%, 57%) when they work in such conditions for a longer period. Suprisingly, the percentage of the positive influence of work (2%, 4%, 10%) also grows.

However, factors correlated with some kind of influence may or may not be its cause. Such factors may just accompany agents that affect health. For example, physical activity itself is healthful, even if involving tiring positions.

Not all factors of this group raise such problems. Some of them (e.g. Q24g) are dual in nature (their influence on a worker's health depends on his or her reaction to the factors).

d) Factors whose influence on health depends on their intensity:

- Carrying or moving heavy loads ($p < 10^{-9}$).
- Lifting or moving people ($p = 0.00002$).

These comply with the well-known principle that moderate physical activity is healthful, but overstrain is harmful.

3.5. Health problems

The questionnaire of EWCS 2010 contains a question (Q69) with 14 items to check for different health problems. Table 4 shows how they depend on Q67 (the smaller the p-value, the stronger the correlation).

The thirteen health problems in table 4 are both frequently reported and work-related (their p-values are smaller than 0.05). Other health problems are rarely reported (0.7%) and not work-related ($p = 0.21$ is too great).

All the health problems listed in table 4 correlate with the *negative* influence of work. Typically, about 30% of workers who do not have some health problem think that work affects health negatively (the percentage is almost the same for all the health problems). However, from 50% to 70% of workers who do have some health problem say that their work affects their health negatively (the percentage now varies from one health problem to another).

Health problems correlate with the *positive* influence of work too. However, the correlation itself can be either positive or negative, i.e. those who are sick may report a positive influence of work on their health either more frequently or less frequently than those who are healthy. The second column of the table contains both percentages and the correlation type (where ↑ stands for a positive correlation and ↓ stands for a negative one).

Table 4
Health problems

Health problems	Positive influence among		Q67 p-value	Frequency
	healthy	*sick*		
Hearing problems	4.5 % ↑	10.6 %	0.0004	4.2 %
Skin problems	4.6 % ↑	8.0 %	0.0004	5.2 %
Backache	5.2 % ↓	4.0 %	10^{-15}	33.1 %
Muscular pains in neck, shoulders and upper limbs	5.5 % ↓	3.4 %	10^{-16}	33.1 %
Muscular pains in lower limbs	5.1 % ↓	3.9 %	10^{-9}	30.0 %
Headache, eyestrain	4.6 % ↑	5.2 %	10^{-7}	37.4 %
Stomach-ache	4.8 % ↓	4.3 %	0.0002	10.7 %
Respiratory difficulties	5.0 % ↓	0.9 %	0.001	5.3 %
Cardiovascular diseases	4.7 % ↑	5.9 %	0.0002	8.9 %
Injury(ies)	4.8 % ↓	4.3 %	10^{-10}	6.7 %
Depression or anxiety	4.9 % ↓	4.5 %	10^{-8}	14.0 %
Overall fatigue	4.9 % ↓	4.6 %	10^{-15}	48.8 %
Insomnia	4.5 % ↑	6.0 %	10^{-7}	19.5 %
Other	4.9 % ↓	0.0 %	0.21	0.7 %

A positive correlation can be interpreted differently:

- Work affects *this* particular health problem positively.
- Work has a positive influence on *other* health problems accompanying this one.
- People suffering from the health problem find a suitable job more easily.

Not surprisingly, those who work when they are sick find their health affected by work twice as frequently as those who don't (table 5). This is a very strong dependence ($p < 10^{-11}$).

Table 5
Working when sick

Working when sick	Q67 Does your work affect your health, or not?			
	Yes, positively	**Yes, negatively**	**No**	***Total***
Yes	7 %	57 %	36 %	**23 %**
No	3 %	28 %	69 %	**77 %**
Total	**4 %**	**35 %**	**61 %**	**100 %**

3.6. Correlations between health problems and factors of the working environment

Multiple positive correlations exist between health problems and factors of the working environment.

Injuries correlate with tiring / painful positions, carrying or moving heavy loads, working with machines or hand tools.

Tiring / painful positions and repetitive hand or arm movements are correlated with backache, overall fatigue and muscular pains in shoulders, neck, upper limbs and lower limbs.

Muscular pains in lower limbs are also correlated with standing upright and with carrying or moving heavy loads (but not with lifting or moving people).

There is an association between headache and interruptions of the current task due to unforeseen tasks.

Stress at work corresponds with anxiety, depression, insomnia and overall fatigue.

Tasks which are in conflict with a worker's personal values correlate with insomnia.

3.7. Correlations between workers' profiles and factors of the working environment

Men more frequently than women are exposed to vibrations from machinery or hand tools, high or low temperatures, breathing in dust, smoke, fumes or powder.

Men's jobs more often than women's include carrying or moving heavy loads.

The higher the level of education, the less the exposition to the last factor (this also holds for standing upright).

Higher levels of education are also correlated positively with the following characteristics of work:

- complex tasks and learning new things;
- working with computers and Internet;
- dealing with customers, patients etc.

3.8. Correlations between different health problems

Backache and muscular pains in shoulders, neck, upper limbs and lower limbs correlate strongly with each other and somewhat less strongly with headache, eyestrain, injuries, overall fatigue and insomnia.

Overall fatigue, headache, anxiety, depression and insomnia often go together.

Insomnia is also correlated with cardiovascular diseases.

Stomach-ache is associated with injuries.

3.9. Correlations between different factors of the working environment

Loud noise, vibrations from hand tools or machinery, high and low temperatures, skin contact with chemical products, breathing in vapours (such as solvents and thinners), dust, fumes, powder, smoke (incl. tobacco smoke from other people); tiring or painful positions, carrying or moving heavy loads, standing upright, repetitive hand or arm movements — these all are correlated positively with one another and negatively with working with computers and Internet.

Vibrations and noise are correlated positively (though not very strongly) with precise quality standards.

Vibrations and high temperatures are correlated negatively (again not very strongly) with dealing with customers, patients, pupils etc.

Direct contact with materials that can be infectious is associated with contact with chemical products and breathing in vapours such as solvents and thinners as well as with lifting or moving people (such working conditions are often present in hospitals).

Tiring / painful positions are connected with stress at work.

Repetitive hand or arm movements are associated with monotonous tasks and precise quality standards.

3.10. Are most health problems work-related?

The detailed analysis made above reveals the impact of each factor on workers' health as part of the overall influence of work. The question if work as a whole has a strong influence on health is important in itself and serves as a base for all other inferences: its answer, if negative, will make the discussion useless. Work is commonly believed to have a strong influence on health, but this belief still needs to produce evidence.

Workers' answers to the Q67 question, "Does your work affect your health, or not?" provide some piece of information, but not all we need. Indeed, the three percentages (5%, 34%, 61%) tell us *how often* work affects health, not *how strongly* it does.

Health is also strongly affected by factors other than work, such as:

- age;
- conditions of life;
- regimen of diet;
- sports;
- social relations.

For example, older people often suffer from cardiovascular diseases. The regimen of diet, conditions of life, sports and social relations are also known to have a strong effect (both positive and negative) on health.

Therefore, it is important to know which health problems are caused by work and which are not. If many health problems are work-related, then work affects health strongly.

To settle it, consider the Q68 question, "How is your health in general?" Its correlation with the Q67 question, "Does your work affect your health, or not?" is presented in table 6.

Table 6
Q67 – Q68 Correlation

Q68 How is your health in general?	**Q67 Does your work affect your health, or not?**			
	Yes, positively	**Yes, negatively**	**No**	***Total***
very good	2 %	16 %	82 %	**24.3 %**
(fairly) good	6 %	39 %	55 %	**73.3 %**
bad	2 %	53 %	45 %	**2.2 %**
very bad	0 %	79 %	21 %	**0.2 %**
Total	**5 %**	**34 %**	**61 %**	**100 %**

The p-value returned by the χ^2- test is smaller than 10^{-10}, i.e. it is almost certain that there is a correlation between the two distributions.

Most workers whose health is good or very good think that work does not affect their health (55%, resp. 82%). Those workers whose health is bad or very bad generally find (53%, resp. 79%) that their work affects their health negatively.

If work did not have a strong influence on health, this polarization would be smaller.

The last statement is further supported by the following correlation ($p = 0.03$): the longer a worker is absent from work for reasons of health problems, the greater the probability that work affects his or her health negatively.

Only 4% of the workers who were absent from work for reasons of health problems reported that this was due to an accident at work. The last group is further divided as follows:

- About 29% had a *minor* health problem (up to 10 days of absence). Most of them thought that their work affected their health *positively*. Nobody reported a negative influence of work.
- About 71% had a *major* health problem (over 10 days of absence); 88% of them thought that their work affected their health *negatively*. Nobody reported a positive influence of work.

A strong polarization in workers' answers is noticed again. It suggests that most health problems are work-related.

To sum it up, there is strong evidence that most health problems are work-related.

Indeed, a lot of correlations were discussed in the previous sections. They can be used now as an explanatory basis for social phenomena or as a set of criteria to estimate efficiency of legal measures.

4. Conclusions

Work affects health very strongly. Actually, work (together with age) is one of the most important determinants of human health.

Overall fatigue, headache, eyestrain, backache, muscular pains — these are the most frequent health problems in Bulgaria. All of them are work-related.

Factors of the working environment that have a strong negative influence on health are: moving heavy loads or people, standing upright, repetitive hand or arm movements, contact with chemical products or infectious materials, breathing in smoke (incl. tobacco smoke), fumes, powder, dust or vapours such as solvents and thinners.

Working at night, working more than 10 hours a day and working at a very high speed more than 1/4 of the time affect health negatively.

Creating legal conditions for a safe and healthy working environment is a constant concern of every government. Employers are required to take preventive measures and employees are expected to strictly follow these regulations.

Special attention should be paid to avoid overstrain and protect workers exposed to the adverse factors listed above.

It is of prime importance that workers should be kept very well-informed about all health and safety risks and use their personal protective equipment whenever required.

Precise quality standards, modern technologies and new processes should be widely introduced where possible because of their strong positive influence on health.

5. Acknowledgements

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