MEDICAL UNIVERSITY

„Prof.Dr.Paraskev Stoyanov“ – Varna

FACULTY OF PUBLIC HEALTH

Department of Hygiene and Epidemiology

Implementing an occupational health and safety management system at SBAGAL"Prof. Dr. D. Stamatov" Varna

D-r Zlatina Pandelieva

DISSERTATION FOR AWARDING OF THE SCIENTIFIC AND EDUCATIONAL DEGREE "DOCTOR"

Scientific specialty – "Hygiene (incl. Occupational health, communal, school, radiation, etc.)"

Scientific supervisors:

Prof. Dr. Teodora Dimitrova,
MD Prof. Dr. Tsonko Paunov, MD Varna,

Varna, 2025

The dissertation contains a total of 151 pages, is illustrated with 13 tables, 53 figures and 3 appendices. The bibliography includes 207 titles.

The study was carried out at SBAGAL "Prof. Dr. D. Stamatov" EOOD, Varna.

The dissertation was discussed at a meeting of the departmental council of the Department of Hygiene and Epidemiology at the Medical University - Varna and directed for defense before a Scientific Jury.

The dissertation defense will be held on June 26th 2025 at 13:00 o'clock at.....

Content

Abbreviations used

EU – European Union
EEA – European Economic Area
PEP – Post-exposure prophylaxis
PPE – Personal protective equipment
HAIs - Healthcare-Associated Infections
CO2 – Carbon dioxide
MSD – Musculoskeletal disorders
OSHA Occupational Safety and Health Administration
Occupational Safety and Health Administration, an agency of the U.S. Department of Labor
OSH - safe and healthy work
IAQ - indoor air quality
GDP - Gross Domestic Product

I. Introduction

The European health and social care sector is a key element in ensuring the health and well-being of European citizens, including the workforce. This sector is among the largest in the European Union (EU), employing approximately 3% of the EU workforce and generating around 11% of GDP expenditure in Europe, according to Eurostat data from 2020. Employees in the sector are distributed not only in hospitals, but also work in care homes, medical practices, other healthcare institutions, and in patients' homes. All European countries are currently facing serious challenges related to the health and social care workforce. Activities related to the identification of these challenges and the planning of effective policies in response are needed. Health workers face a variety of risks from the complex working conditions in the work environment. They are subjected to high levels of stress, which can lead to poor mental and physical health. These risks arise in a wide variety of health-related professions. They include biological agents, related to exposure to various infectious organisms due to the risk of skin exposure or risks of needle stick or sharp injuries, chemical agents, represented by various chemicals - surface disinfectants, chemical sterilants, hazardous and aerosol drugs, anesthetic gases, etc. A separate group is represented by antineoplastic agents used for chemotherapy of malignant tumors and cytotoxic drugs used in the treatment of cancer and non-cancer patients who are present in health facilities. Psychosocial risks are associated with high levels of stress and burnout, common among healthcare workers due to the intensity of their work and the high demands and responsibilities they face at work. These include long working hours, shift work, hazardous work environments, and daily exposure to human suffering and death.

II. Objective and Tasks

Objective

To identify the priority risks and opportunities for improving the safety and health work conditions in the Specialized Hospital for Obstetrics and Gynecology "Prof. Dr. D. Stamatov" EOOD Varna.

Tasks

1. To perform a literature review of occupational health risks in a hospital for treatment

2. To create a "Questionnaire for involving employees in the risk assessment process"

3. To assess the priority health risks of employees in the specialized hospital for active treatment in the post-covid period with the participation of employees

4. To assess the risk factors arising from the characteristics of the work process in the specialized hospital for active treatment

5. To study the organizational and psycho-emotional risks in the workplace and their relationship with the performance indicators, individual characteristics and lifestyle of employees

6. To assess the risk of exposure to surgical smoke and to formulate recommendations for health promotion and prevention in an operating room for obstetrics and gynecological treatment.

III. Material

1. Object of study

Subjective and objective assessment of risk factors arising from the work process and the work environment in specialized obstetrics and gynecology hospital “Prof.dr.D.Stamatov”Varna.

The study was launched after receiving a resolution from the Research Ethics Committee (REC) with Protocol Decision No. 5/17.10.2024.

In summary, the criteria for admission and inclusion in the study are:

✔ professionals over the age of 18;

Through informed consent, respondents are informed of the following:

✔ No significant risks or inconveniences associated with the respondents' participation in the study have been identified.

✔ No information about the respondents' identity is collected and will not be processed.

✔ The data collected through the study will be used in the development of a methodology for identifying, assessing and preventing risk factors in the workplace.

All specified and described components of the research design in the dissertation work guarantee their effectiveness and successful implementation.

IV. Methodology

All methods and procedures related to the conduct of this study were carried out by the dissertation author.

1. Documentary methods

A significant number of available sources in Bulgarian, Russian, English and French were analyzed for the creation of this dissertation work, including publications, articles, books and textbooks related to the topic under consideration. For this purpose, the available electronic databases of Scopus, PubMed, Web of Science, Medscape Pediatrics, ScienceDirect and the publicly available analyses, manuals and audio-visual materials of OSHA are used

2. Sociological methods

2.1. Qualitative sociological methods Observation and description of the organization of work, the presence of the so-called "simple forms of work" (assigning tasks that do not correspond to the professional capabilities of the worker - risk of burn-in), extensive forms of work (unnecessary repetition of the same and repetitive activities by different people with loss of working time), lack of control over the activity and overload (risk of burn-out)

2.2. Quantitative sociological methods

A Questionnaire for the inclusion of workers in the risk assessment process was developed for the study, including the following main areas:

• Subjective assessment of risks arising from the work process

• Risks related to the working environment - biological agents and surgical smoke

• Lifestyle

3. Instrumental study of indoor air quality indicators – 10 PM, 2,5 PM and carbon dioxide with a portable sensor model BQ30 of the Trotec GmbH brand

4. Statistical methods

The data were analyzed with the IBM SPSS v.25 statistical package

The following statistical methods are used in data analysis:

✔ Method of statistical grouping of data – the features are arranged according to their type in variational, interval, categorical, power and dynamic statistical series.

✔ Descriptive methods

Descriptive statistics includes statistical methods for collecting, tabulating and summarizing data in order to present information. Descriptive analysis is based on non-parametric tests.

✔ Method of statistical evaluation When testing hypotheses, the significance level of the null hypothesis is determined according to established practice as alpha = 0.05.

* Analysis of variance – when comparing continuous and interval indicators, due to the design of the study, paired t-test, independent t-test and one-way ANOVA are used.

* Non-parametric analysis – for the analysis of categorical features, cross-tabulation and Pearson's $\chi 2$ (chi-square) criterion are used when dealing with ordinal categorical features. They are used to search for significant differences in the frequency of factors distributed in different groups or categories. Statistical significance in non-parametric tests is assumed at $p \leq 0.05$. In

addition, mean values, standard deviations (SD), minimum and maximum values, 95% confidence intervals (CIs) and odds ratio (OR) are also used in the descriptive analysis. The information is summarized in MS Excel, and the statistical analysis is performed using IBM SPSS Statistics v.25. The results obtained are assessed as statistically significant when the p-value < 0.05, in which case the null hypothesis is rejected.

5. Graphical methods

In order to illustrate and make the statistical information accessible, part of the results of the study are presented in tables and figures.

V. Results

Demographic description of the sample

The survey included 61 from workers in SBAGAL. The average age is 44.3±13.58 years. The professional groups are mainly doctors and midwives. The average total experience of the studied group is 20.75±12.7 years, and the experience in the specific medical institution is on average 10.03±8.8 years. The majority of the individuals included in the survey were married – 35 individuals or 57.4%. This was followed by the groups of single individuals – 12 individuals or 19.7% and divorced individuals – 7 individuals or 11.5%.

Gender

Gender influences the distribution of employees in SBAGAL by groups depending on individual characteristics of the employees, work process factors and lifestyle elements. Females predominate in

both the most experienced and the least experienced groups, while males predominate in group with 10 to 15 years of experience (χ-square 10.030 at $p<0.05$)

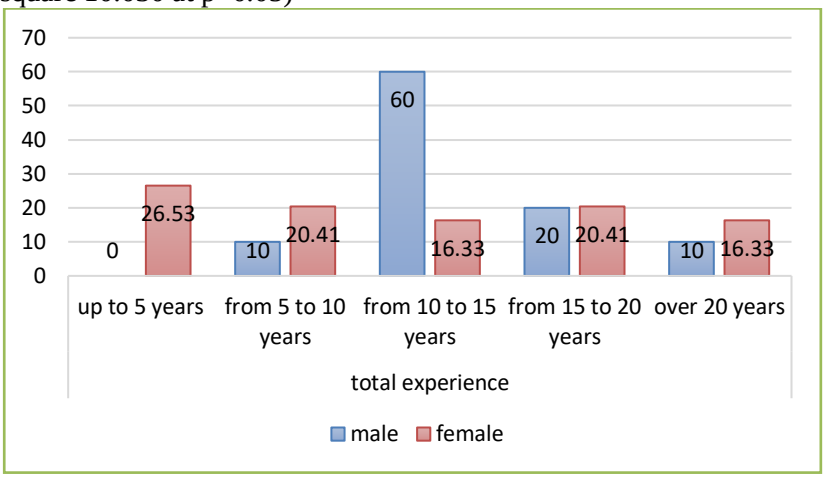

Fig.1 Gender distribution according to groups of total experience

36.36% of women walk every day and only 12.5% of men. (χ-square 13.586 at $p<0.005$). But none of the women share about daily sports activity, while one of the men (10%) is an active athlete. A quarter of the doctors do not walk, and 40% do not play sports. (χ-square 10.965 at $p<0.05$)

Protection against blood-borne diseases is a priority in the workplace for 40% of men and 55.10% of women. None of the women were ever completely negligent. (χ -square 11.193 at $p<0.05$)

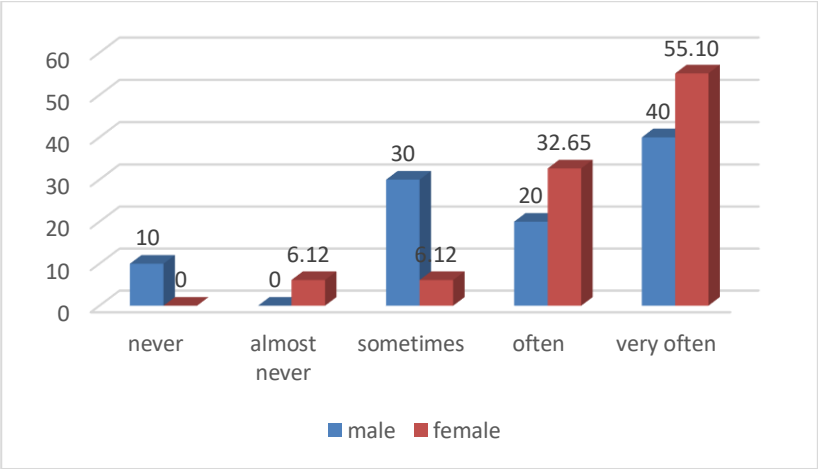

Fig.2 Gender distribution according to groups by declared position "Protection against blood-borne diseases is a priority in the workplace"

Occupational safety measures are most intensively monitored by 50% of men and 44.90% of women included in the risk assessment survey.

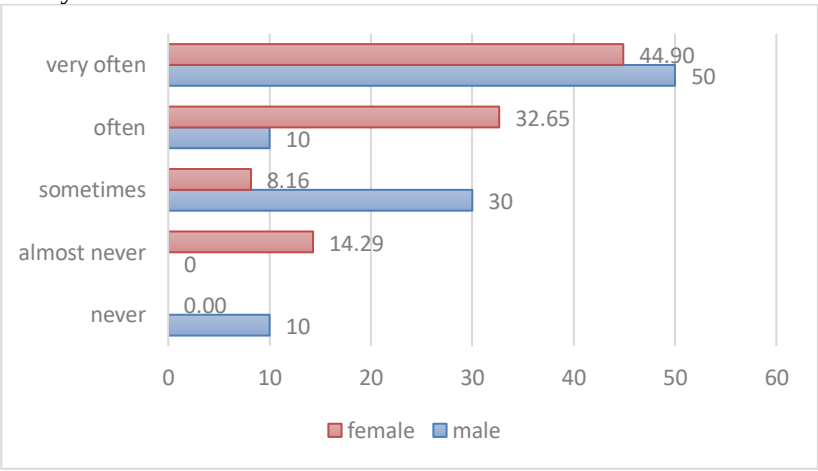

Fig.3 Gender distribution according to groups by declared position "At my workplace, proper compliance with occupational safety measures is monitored"

Age groups

Age groups influence the distribution of respondents by level of psycho-emotional stress and work capacity.

Age affects the distribution of groups with awareness of responsibility for materials. Workers between 40 and 50 years of age are mainly concerned about material damage in the event of possible errors at work (12 respondents or 100% of the age group), and the oldest workers over 60 years of age are least aware of it - 16 people or 28.1% of the group. (χ -square 16.326 at $p<0.05$)

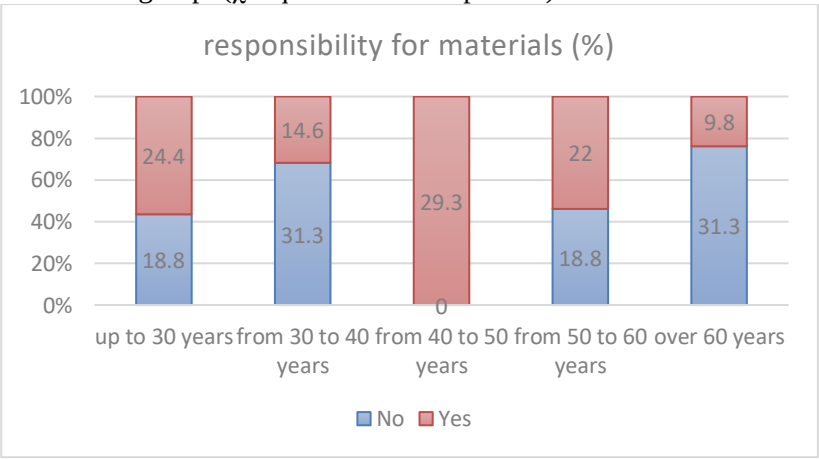

Fig.4 Distribution of age groups by declared perceived responsibility of their work for material damage (%)

The age of the workers influences their distribution in the groups by perceived overload with technical tasks. A feeling of overload with administrative work is shared by 11 people or 91.7% of people aged

between 30 and 40 years and only three or 30% of the oldest workers over 60 years. (χ-square 16.326 at $p<0.05$)

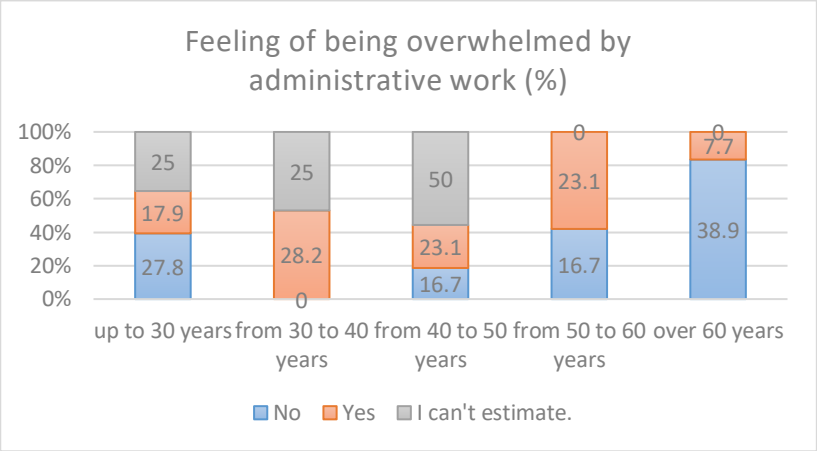

Fig.5 Distribution of age groups by declared feeling of being overloaded with administrative tasks (%)

The age of the workers has an effect on their distribution in the groups confirming the fact that excessive administrative activity shifts the focus of the doctors from their direct duties. The largest group of people between the ages of 30 and 40 again shares a reduced emphasis on medical and health care - 11 people or 91.7% compared to only 1 or 10% of the oldest workers over 60 years old. (χ-square 25.637 at $p<0.005$)

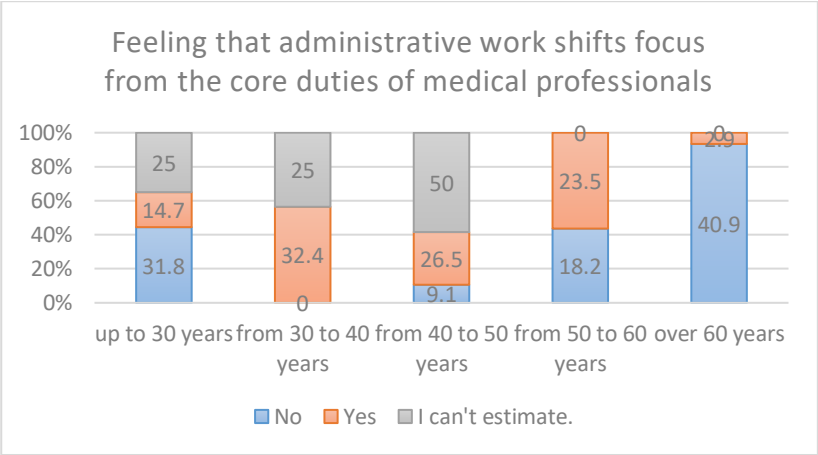

Fig.6 Distribution of age groups by declared feeling of shifting focus from core medical work to administrative tasks (%)

The age characteristics of the workers affect their distribution by degree of self-declared work ability index. In the youngest group under 30 years of age, 7 individuals or 53.8% have the highest very good work ability index, followed by 6 or 42.9% of those aged between 40 and 50 years and only two or 22.2% of the oldest over 60 years. (χ-square 22.334 at $p<0.05$)

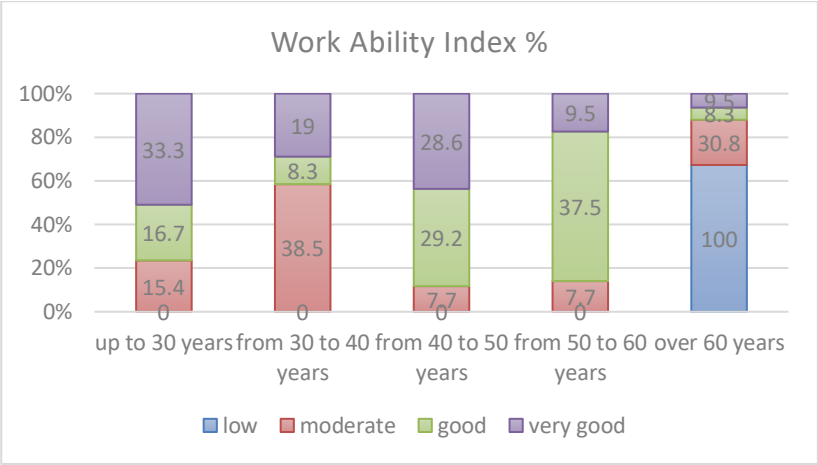

Fig.7 Distribution of age groups by work ability index (%)

Professional groups

The distribution of professional groups of doctors and midwives in different proportions is statistically validated according to the perceived and self-declared responsibility for people. The importance of the mistakes made as responsible for life is declared by 21 (100% of doctors), 29 or 93.5% of midwives and 5 or 55.5% of respondents working in administrative units. (χ -square 14.846 at $p<0.005$)

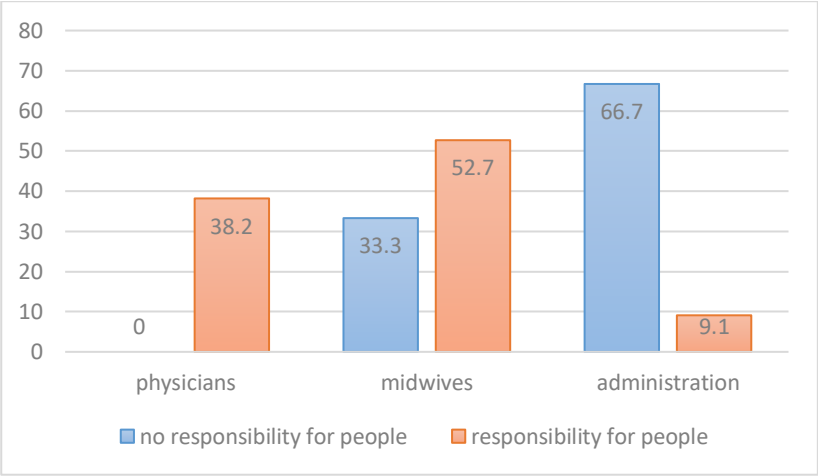

Fig.8 Distribution of professional groups by declared perceived responsibility of their work for people's lives (%)

Total work experience

The different duration of total work experience affects the distribution of medical specialists in statistically significant different ratios according to organizational indicators of the work environment.

The different duration of total work experience affects the distribution of medical specialists in statistically significant different ratios according to the declared validity of the statement that there is good communication between all team members and the hospital executive team. Such a practice with a frequency of "Very often" is reported by 7 or 50% of workers with 15 to 25 years of experience and 5 or 45.5% of workers between 25 and 35 years of age. At the same time, two or 15.4% of the most inexperienced and 5 or 45.5% of those with experience between 5 and 15 years of age note that this does happen "Never". (χ-square 26.509 at $p<0.05$)

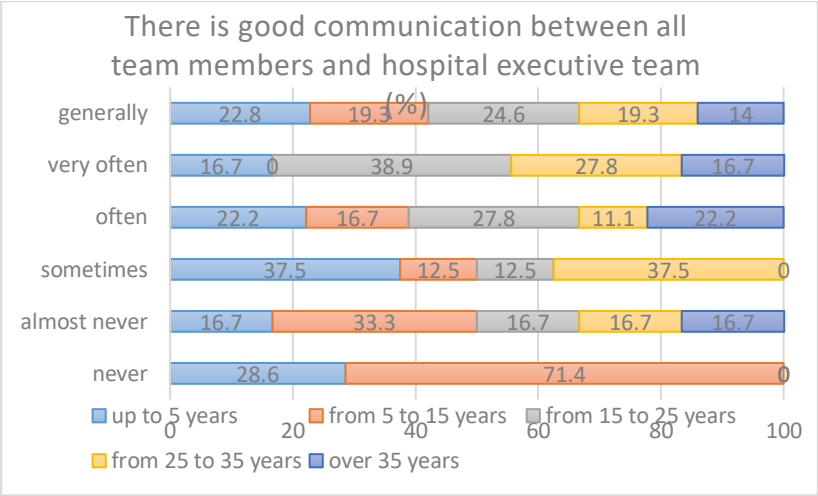

Fig.9 Distribution of groups by total work experience in relation to the declared provision of good communication between all team members and hospital executive team (%)

The difference of gender distribution in the groups by total work experience is also statistically significant. Women predominate in the most inexperienced group – 13 or 100% with experience up to 5 years. While men predominate in the group with total experience from 15 to 25 years – 6 people or 60% of men. In all groups by experience, women predominate. (χ-square 10.030 at $p<0.05$)

Professional experience

The different duration of professional experience at SBAGAL affects the distribution of medical specialists in statistically significant different ratios according to some studied indicators of the working environment, mainly related to biological and toxins exposures.

The different duration of professional experience in SBAGAL affects the distribution of medical specialists in statistically significant different ratios of concern for transmission of infectious agents through surgical smoke. Awareness of this risk is shared by all

groups based on accumulated professional experience in the medical facility. The most negligent are those with experience from 5 to 15 years – 10 individuals or 62.5%. In the more experienced groups, no one shares such negligence. (χ-square 13.312 at $p<0.05$)

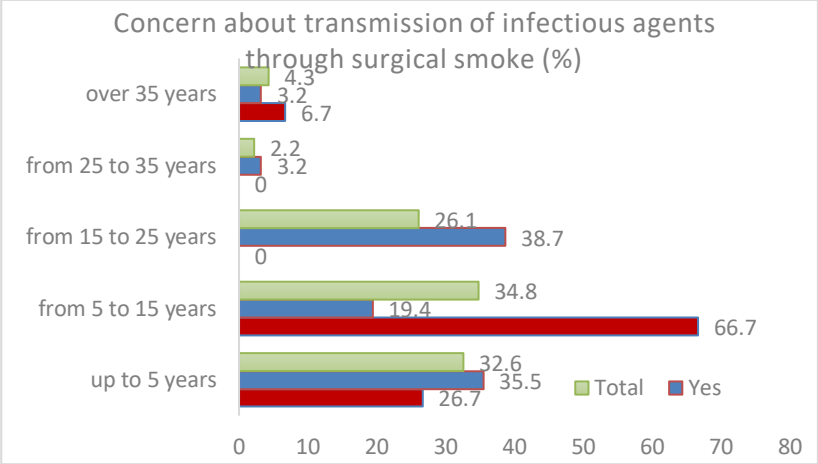

Fig.10 Distribution of groups according professional experience by declared concern for possible transmission of biological agents through surgical smoke (%)

The duration of professional experience also significantly affects the distribution into groups based on concern for the content of carcinogens in surgical smoke. Again, the youngest and most inexperienced: one or 6.7% of those with up to 5 years of experience and 7 individuals or 43.8% of those with 5 to 15 years of experience, compared to none of the more experienced groups, declared a lack of concern about the possible carcinogenic potential of smoke emitted during electrosurgery in the operating room. (χ -square 12.514 at $p<0.05$)

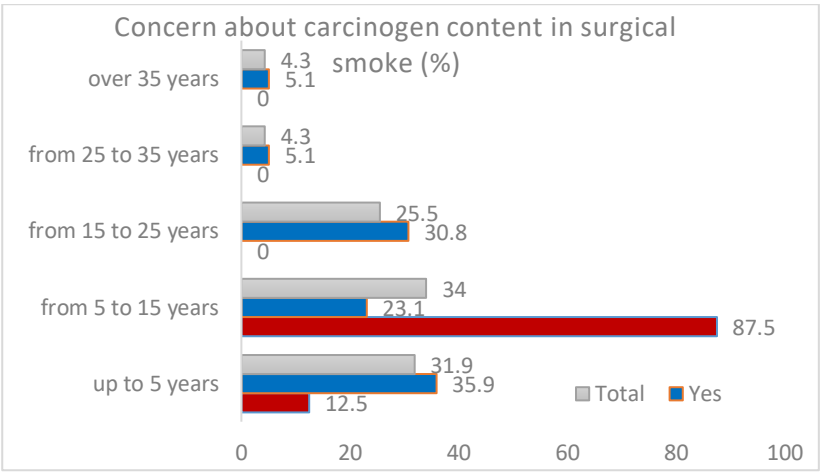

Fig.11 Distribution of special training groups by declared concern for carcinogenic potential of electrosurgical smoke (%)

Sleep disorders are more frequently reported by those in the groups with shorter specialized experience in the obstetrics and gynecology hospital. The most inexperienced with up to 5 years of experience and those with 15 to 25 years of experience most often report this problem compared to none of the most experienced with over 35 years of experience. (χ -square 9.657 at $p<0.05$)

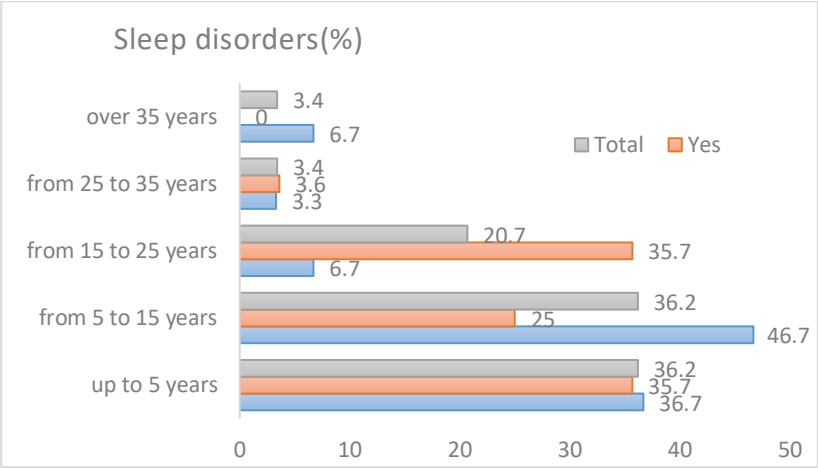

Fig.12 Distribution of groups of special experience in sleep disorders (%)

In contrast to the previous results, the most inexperienced medical specialists in the field of special obstetrics and gynecology are the largest groups in strictly adhering to the restriction not to accept food and drinks in places with a risk of blood-borne infections. The habit of "never" to do so is indicated by 2 or 9.5% of the most inexperienced, 3 or 15% of those with 5 to 15 years of experience and 4 or 33.3% of those who have worked between 15 and 25 years. The more experienced never follow this rule (χ -square 28.462 at $p<0.05$)

The accumulated specialized experience is statistically significant reflected on the distribution of workers by group and the declared frequency of using a protective mask in cases with an increased risk of blood and biological fluids splashing into the mouth. In all groups of specialized experience, the majority declare very frequent practice regarding this preventive measure against blood-borne infections in the workplace (χ -square 9.562 at $p<0.05$).

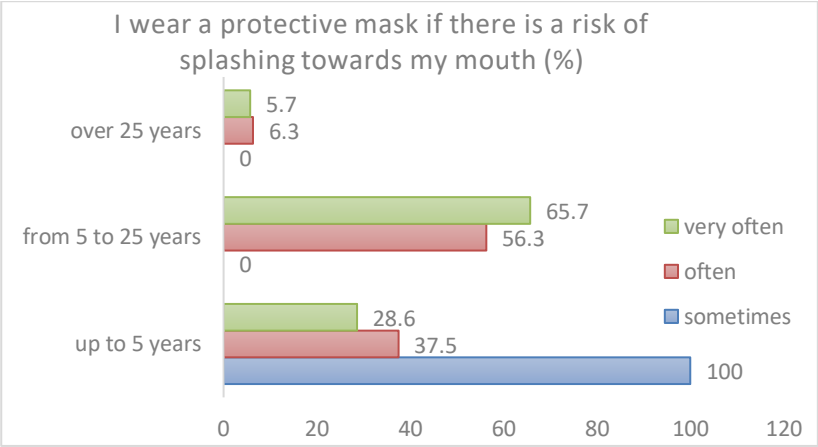

Fig.13 Distribution of special experience groups by frequency of wearing a protective mask at risk of blood and biological fluids splashing into the mouth (%)

Priority health risks to workers from emerging biological agents in the post-COVID period

Fourty-seven or 77% of the surveyed workers assess the working environment as risky. Among those recognized as priorities, biological agents are the most frequently cited sources of occupational risk. Table 1

Priority risk factors at work place	Number	%
I cannot evaluate	**32**	**52.5**
Biological agents	**14**	**23.0**
Organizational risks (staff shortages, time deficits, extended work shifts)	**9**	**14.8**

Psycho-emotional tension	**6**	**9.8**
Total	**61**	**100.0**

Occupational safety and prevention of blood-borne infections

In the subjective assessment of the provision of safe working conditions, the preventive measures for providing disposable gloves (44 workers or 73.3%) and sharps containers (41 workers or 70.7%) are the most convincing among the groups of respondents. The answer “Very often” according the maintenance of hygiene is confirmed by 36 workers or 61% of workers. Thirty-five workers or 59.3% also provide answer “Very often” according the compliance with all steps to minimize health hazards and 31 workers or 52.5% of workers on priority protection from blood-borne infections. The least common measures are communication between team members and the hospital executive team and communication of risk and its management options. For these two practices, 8 employees (13.6%) indicated "never" as the answer.

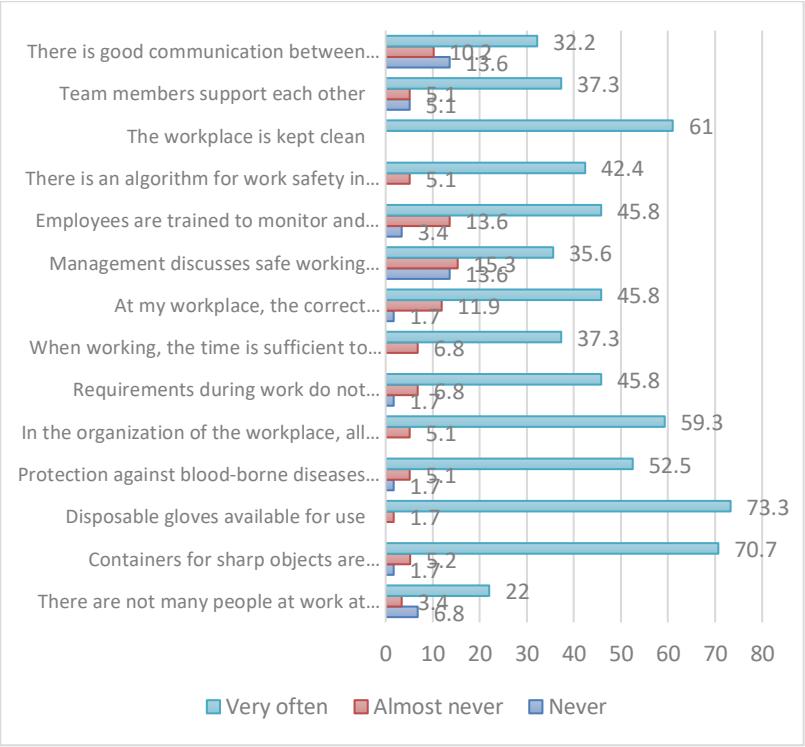

Fig.14 Distribution of responses regarding the subjective assessment of ensuring safe working conditions

Among the declared support for compliance with workplace safety measures, the leading groups are those who very often support the disposal of sharp objects in a container (51 workers or 86.4%), cleaning all contaminated surfaces from spilled liquids with disinfectant (50 workers or 84.7%), taking special care when using cutting tools (49 workers or 84.5%), washing hands after removing gloves (48 workers or 82.8%), and wearing gloves when drawing blood or applying an i.v. line (46 workers or 78%). More than half of the surveyed workers at the specialized Obstetrics and Gynecology hospital very often cooperate with all these measures. The preventive practices with the lowest declared support are not closing used

needles (19 workers or 32.8%), wearing protective glasses when there is a risk of splashing into the eyes (16 workers or 27.6%), and not consuming food and drinks in areas with a risk of contact with blood or body fluids (7 workers or 12.1%).

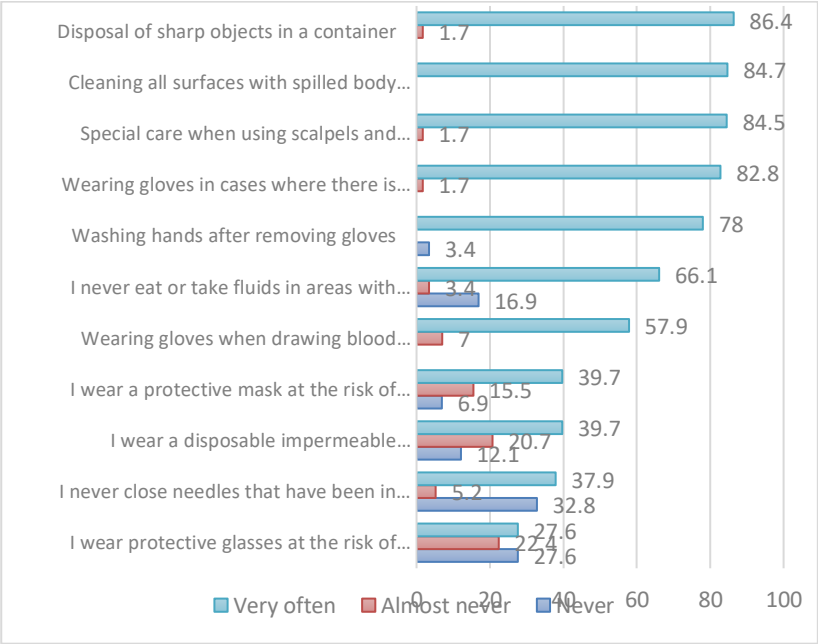

Fig.15 Distribution of responses regarding the subjective assessment of assistance in complying with workplace safety measures

Ergonomic risks

High physical activity at work is indicated by 17 people or 27.9%. The majority of workers who participated in the survey – 42 or 68.9 indicate full-body movement during more than half of the working time.

Organizational risks and work capacity level

Work Ability Index
According to the work ability index score, the majority of the surveyed workers show good (19 or 38.8%) and very good levels (16 or 32.7%)

The distribution of respondents in the categories of work ability index - low, moderate, good and very good is influenced by risk factors related to the characteristics of primarily mental work and work with people, as well as organizational aspects of the workplace. An influence is also found on habits for the prevention of biological exposures and elements of lifestyle such as physical activity and sleep quality.

The distribution of respondents in the work ability index categories - low, moderate, good and very good is influenced by such risk factors as the assessment of the work environment as risky. The groups of individuals who are aware of their work as risky are larger in the groups with moderate (10 individuals or 83.3%), good (23 individuals or 95.8%) and very (13 individuals or 61.9%) good work ability index, while those with low working capacity lack such awareness. (χ-square 11.822 at $p<0.005$).

The lack of mental stress at work as a risk factor is reported by 1 person or 12.5% with a moderate and 7 or one third of the persons with a very good work ability index. In the groups with a low index, all indicate the presence of mental stress. (χ-square 11.309 at $p<0.05$).

Awareness of responsibility for human life as a risk factor of the work task is inherent to all employees at SBAGAL with a very high work ability index. This is a well-accepted characteristic of medical

activity and is not typical for any of the employees who self-identified with a low work ability index (χ-square 11.740 at $p<0.01$)

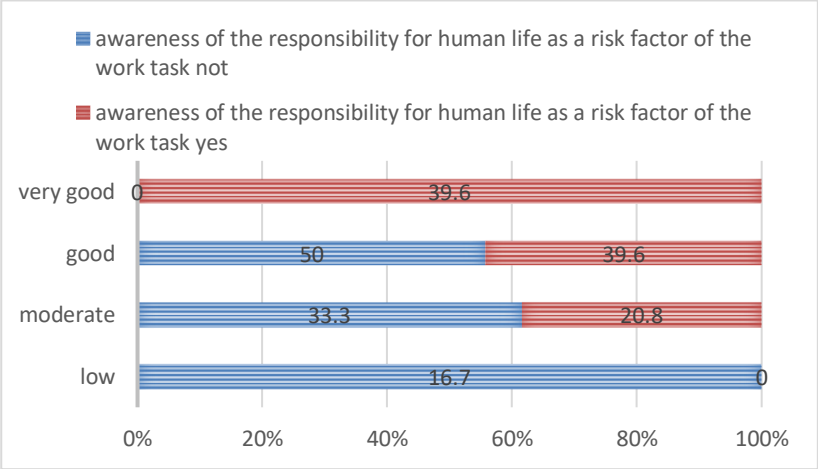

Fig.16 Distribution of work ability index groups by awareness of responsibility for human life as a risk factor of the work task (%)

Emotional stress at work is declared by all persons with a moderate level of working capacity (12 or 100%) and the majority of persons with good (23 or 95.8%) and very good working capacity (16 or 76.2%). There is a significant correlation between the work ability index and the distribution of emotional stress as a risk factor in the work process (χ-square 13.073 at $p<0.005$).

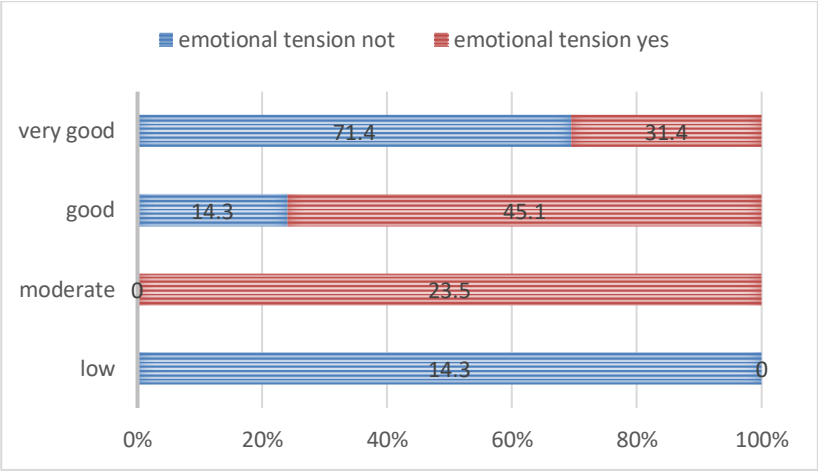

Fig.17 Distribution of work ability index groups by subjective feeling of emotional tension at the workplace (%)

The assessment of the adequacy of the preventive worklplace safety program for managing risks in the workplace due to exposure to surgical smoke is also significantly influenced by the work ability index among the surveyed workers. The largest group confirming the adequacy of this program is represented by individuals with very good working capacity – 8 individuals or 40%. None of the respondents with low and moderate levels of working capacity found the planned measures adequate. The employees' confidence in the implementation of adequate risk management programs in the work environment is a factor influencing the increase in the subjective work ability index. This result is further evidence of the possibilities of occupational health interventions to increase the motivation and well-being of employees. (χ-square 11.462 at $p<0.05$)

The frequency of coffee consumption is statistically significantly different in the groups working with different work ability indices. The most numerous group is the group of daily consumption of this

tonic drink among medical specialists with a very good – 20 persons or 95.2% and a good work ability index – 20 persons or 83.3%. (χ-square 16.791 at $p<0.05$)

Walking for at least 30 minutes daily is most common among individuals with a good (8 individuals or 44.4%) and moderate (5 individuals or 41.7%) work ability index. (χ-square 16.956 at $p<0.05$)

Sleep disorders were found in 16 or 66.7% of individuals with a good work ability index compared to only 6 or 28.6% of those with a very good one. (χ-square 8.202 at $p<0.05$)

The subjective feeling of good organization of work for health and working capacity prevention is found in a significantly larger proportion of persons with very good and good working capacity. The majority of persons with a very good work ability index – 14 or 66.7% and 15 or 65.2% of those with good indicate the highest possible degree of compliance with all steps to minimize health hazards in the organization of the work process. (χ-square 21.518 at $p<0.05$)

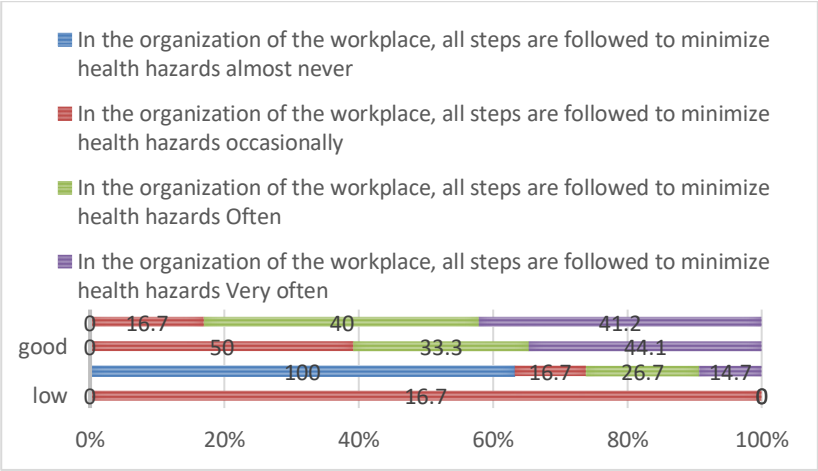

Fig.18 Distribution of work ability index groups according to the assessment of the degree of compliance with all possible steps to minimize health hazards in the organization (%)

The lack of unnecessary crowding of many people at the same time at the same workplace (good time organization) is confirmed as a regular practice by 9 individuals or 42.8% with a very good work ability index and 3 or 23.1% of those with a moderate work ability index. (χ-square 21.199 at $p<0.05$).

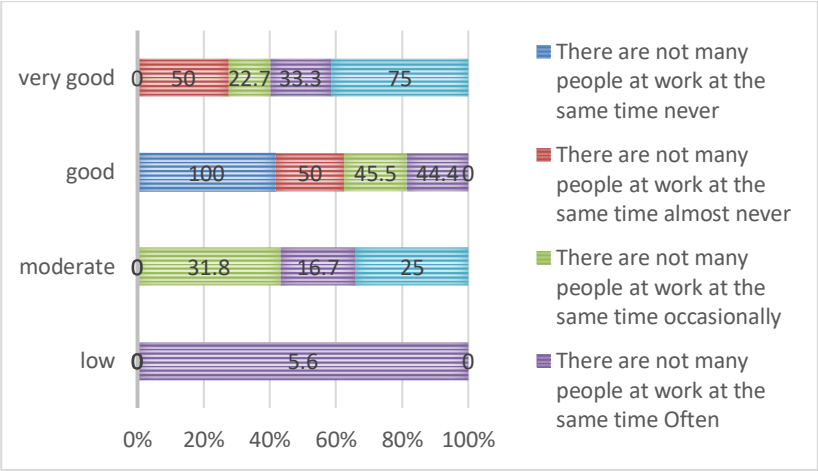

Fig.19 Distribution of work ability index groups by frequency of gathering of many people at the same time at the same workplace (%)

The highest frequency of wearing a protective mask in case of a risk of splashes to the mouth is shared by the largest groups of individuals in good (12 or 50%) and very good (8 or 38.1%) working capacity versus none in low and (4 or 30.7%) in moderate working capacity. (χ-square 21.788 at $p<0.05$)

The youngest age group up to 30 years old – 7 individuals or 53.8%, followed by those between the ages of 40 and 50 years old – 42.8%, present the highest relative share of individuals wirh very good WAI compared to the group oflowest work ability index, which includes only representatives of the oldest participants in the study. (χ-square 22.334 at $p<0.05$)

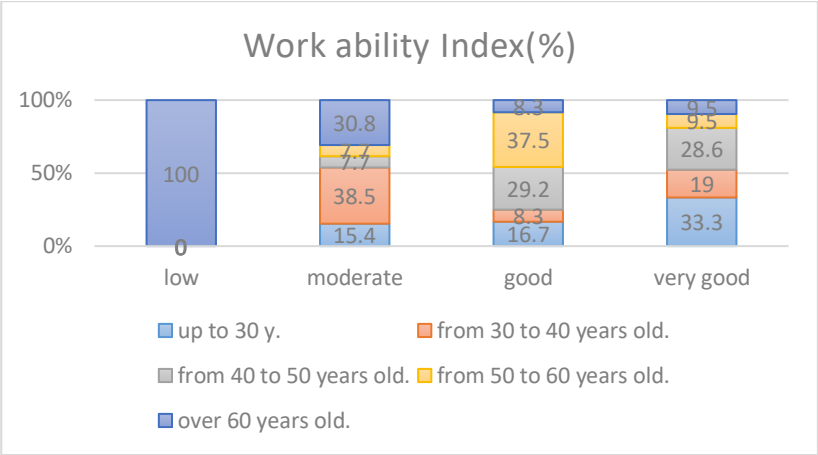

Fig.20 Distribution of work ability index groups by age (%)

Psychoemotional risks in the workplace and the possibilities for implementing an adequate preventive program for mental health

Mental stress at work was mentioned by 52 medical professionals or 85.2%. Everyone works with high concentration of attention, and responsibility for human life is mentioned as a perceived risk by 55 or 90.2% of them. Emotional stress was mentioned by 52 or 98.4% of the respondents. It is associated with aggression in the workplace for 10 or 16.4% of medical specialists, for 25 or 41% it is due to the perceived great responsibility for the consequences of possible mistakes, and for 31 or 50.8% of medical professionals due to a deficit of time in making decisions. For 23 or 37.7% of respondents, the leading cause of high psychoemotional tension is conflicts in the workplace.

According to the subjective assessment of psycho-emotional stress at work on a scale from 1 to 10, the average value of the medical specialists participating in the study was 7.68±0.3.

In a state of hypostress are 2 people or 3.4%, in eustress – respectively 19 people or 32.2%, and in hyperstress – 38 or 64.4%. The levels of perceived stress are of medium (18 people 30%) and high degree (42 people 70%). The average value for the entire studied group is 28.96±0.6.

The professional group influenced the distribution of individuals by levels of subjective stress assessment. Ninety percent of doctors self-assessed themselves as hyperstressed compared to 54.8% of midwives. (χ-square 10.407 at $p<0.01$).

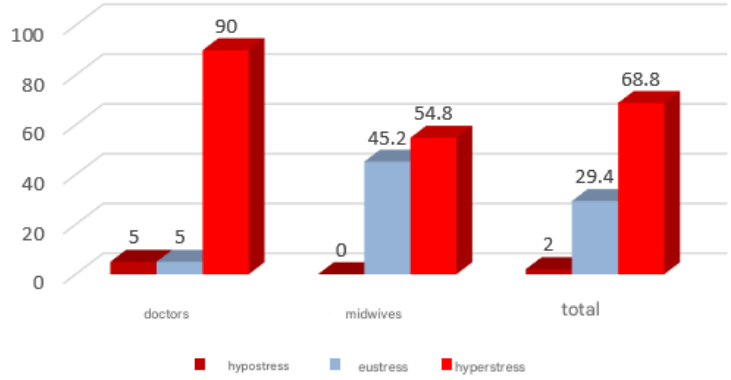

Fig.21 Distribution of doctors and midwives according to groups of self-assessment of stress on a ten-point scale

Aggression was reported by 4 individuals from the groups of doctors (19%) and midwives (12.9%), with no statistically significant difference in distribution.

The distribution of respondents in the levels of subjectively assessed stress as hypo-, eu- and hyperstress is influenced by such risk factors

of the work process related to both the psychoemotional tension of mental work and the severity of physical exertion among those working in the specialized hospital. Awareness of the risk of making fatal mistakes was found in 21 individuals or 55.3% in hypostress compared to 4 or 21% in eustress. (χ-square 7.593 at $p<0.05$)

The subjective assessment of the effectiveness of the surgical smoke evacuation system is statistically significantly different in the groups according to the level of stress. Half of the individuals in eustress (53.8% - 7 people) perceive it as reliable compared to only 9 or 26.5% of those in hyperstress. (χ-square 14.801 at $p<0.05$)

The feeling that administrative work shifts the focus from the main duties of the doctors is shared by 27 (73%) of the individuals in hyperstress compared to only 6 (31.6%) of those in eustress. (χ-square 14.363 at $p<0.01$)

Concerns about long-term negative health effects in the respiratory system from exposure to surgical smoke also influenced the distribution of workers in the hypo-, eu- and hyperstress groups. Respiratory negative effects were reported by 36 (73.5%) of those in hyperstress compared to 28 (82.3%) of those in eustress. (χ-square 4.497 at $p<0.05$)

The assessment of the work environment as risky was given by 34 or 91.9% of individuals in high stress compared to 12 or 63.2% of those in optimal stress levels. (χ-square 14.257 at $p<0.005$)

Individuals with high levels of stress report emotional challenges of the profession significantly more often. This characteristic of their work is shared by 37 (97.4%) of individuals with high risk levels of stress compared to 13 (72.2%) of their colleagues with optimal levels of stress at work. (χ-square 10.086 at $p<0.01$)

The feeling of a lack of an adequate program of preventive measures for managing workplace risks from exposure to surgical smoke was shared by 16 (45.7%) of the individuals in hyperstress compared to 4 (25%) of those in eustress (χ-square 11.387 at $p<0.05$)

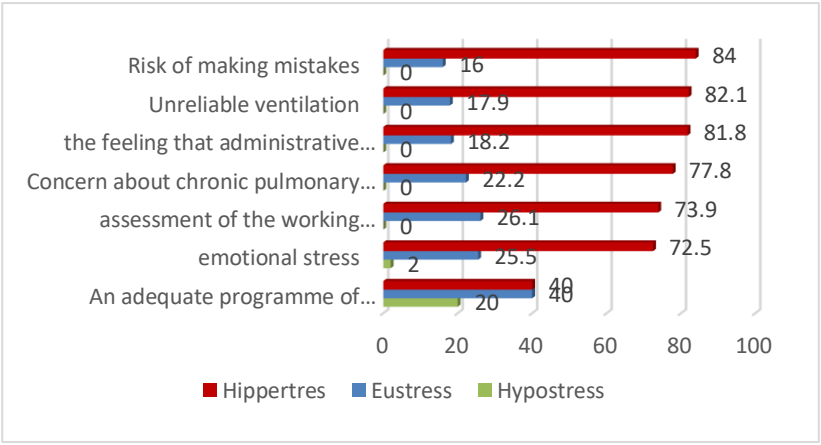

Fig. 22 Influence of occupational risk factors on the distribution in the groups according to the subjective assessment of stress

Stress levels are also influenced by the energy expenditure at work. Fourteen of the respondents in a state of hyperstress and three of those in eustress were determined to have a very high workload. (χ-square 15.518 at $p<0.05$).

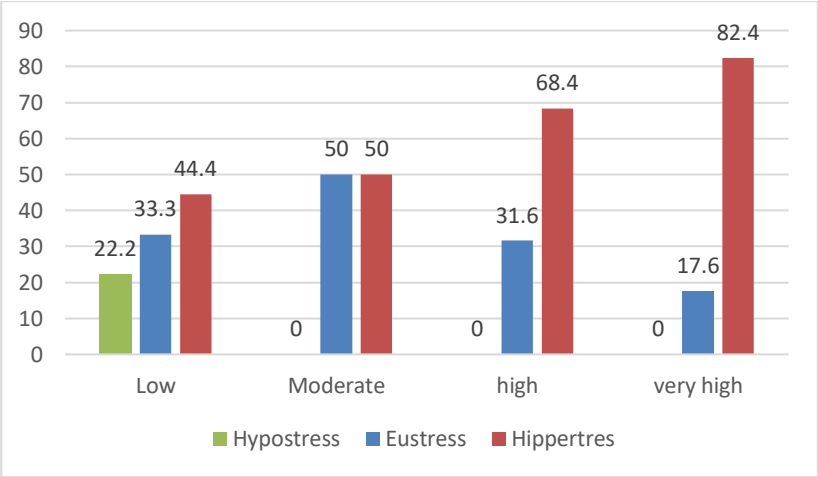

Fig.23 Influence of the level of physical activity at the workplace on the distribution in the groups according to the subjective assessment of stress

Also statistically significantly larger are the groups of workers with whole body movement and large muscle groups for more than half of the working time at higher levels of stress. This is the work of 30 or 78.9% of people with hyperstress and 11 or 57.9% of those in eustress. (χ-square 19.856 at $p<0.005$)

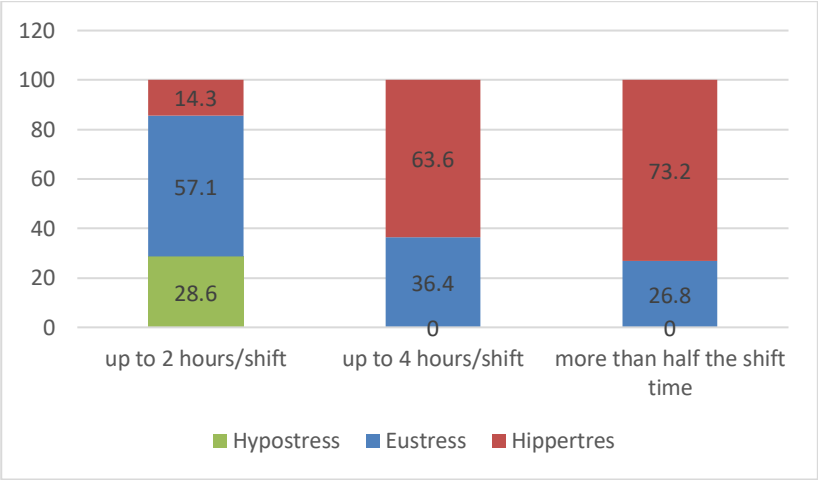

Fig.24 Influence of the duration of the total physical load of the large muscle groups on the distribution in the groups according to the subjective assessment of stress

According to our expectations in connection to the literature review, we establish statistically proven relations of psychoemotional tension to sleep disorders. With a normal duration of night sleep are all persons in eustress. In those in hyperstress, sleep is shorter than 5 hours in 7 or 18.4%. (χ-square 13.9 at $p<0.01$)

The duration of the profesional experience in this medical institution is a factor influencing the distribution of the groups with hypo-, eu- and hyperstress. More than half of the most inexperienced (12 individuals or 57.1%) are in a state of eustress, and those with over 20 years of experience are in a state of hyperstress (3 individuals or 75%) (χ-square 10.459 at $p<0.05$).

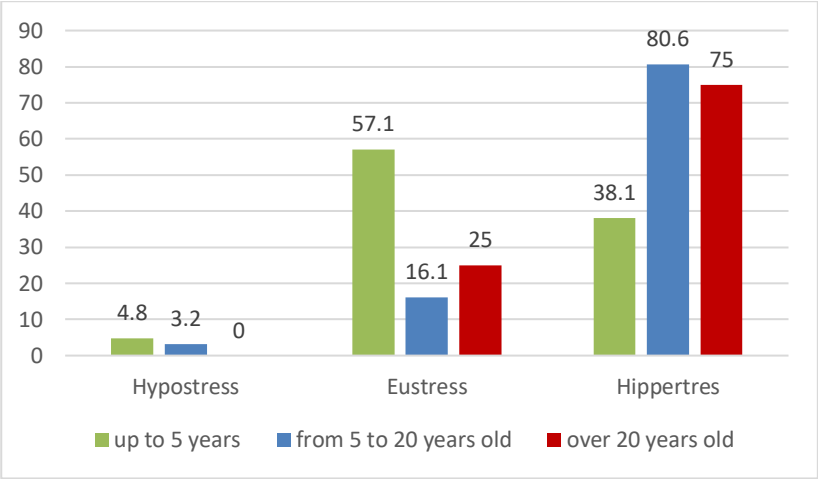

Fig.25 Influence of the duration of profesional experience on the distribution in the groups according to the subjective assessment of stress

Levels of perceived stress

The distribution of respondents in the categories of perceived stress as low, moderate and high is influenced by such risk factors as the assessment of the work environment as risky. The majority of individuals with high – 36 or % and with moderate 11 or % perceived stress are from the group of those aware of the risk at work. (χ-square 5.501 at $p<0.05$)

Awareness of responsibility for human life as a risk factor of the work task is indicated by 40 or 95% of individuals with high levels of perceived stress and 14 or 77.8% of those with moderate levels. (χ-square 4.268 at $p<0.05$)

We again found a feeling of being overloaded with administrative work significantly more often among the group with high levels of

perceived stress – 32 individuals or 76.2% compared to 7 or 38.9% of those with moderate perceived stress. (χ-square 7.720 at $p<0.05$)

The frequency of tea consumption (χ-square 6.877 at $p<0.05$) and insomnia (χ-square 5.876 at $p<0.05$) as lifestyle elements also statistically significantly differ in representation in the groups working according to the levels of perceived stress. With high levels of perceived stress, 26 or 83.9% had insomnia compared to only 16 or 55.2% of workers without sleep disorders.

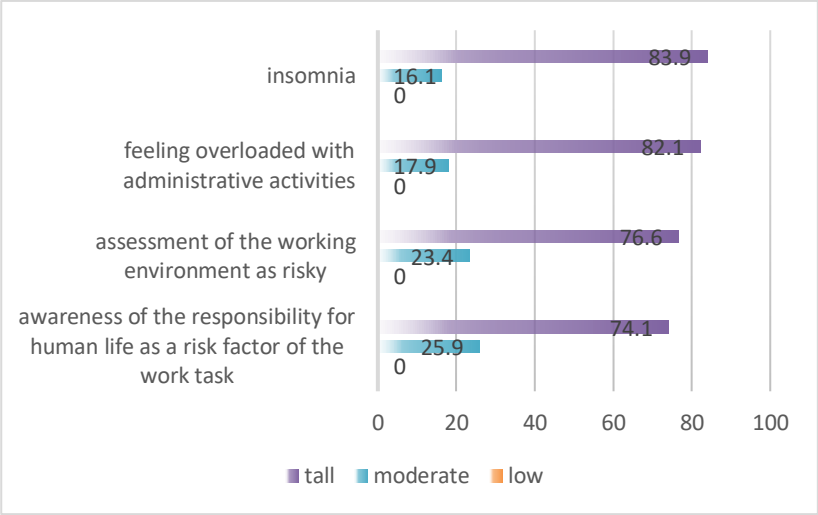

Fig.26 Distribution of groups according to the level of perceived stress by significant risk characteristics of the work process and lifestyle

The frequency of walking as an indicator of leisure time shows significant differences in the distribution of the groups surveyed according to the level of perceived stress. All physicians who indicated that they never walk are in the group with high levels of perceived stress. It is striking, however, that those who walk at least

30 minutes every day are also in the majority with high levels of perceived stress – 15 or 88.2% (χ-square 9.503 at $p<0.05$)

Risk assessment for exposure to surgical smoke

The majority of those exposed to surgical smoke never use a surgical mask - 23 people or 46.9%, and a highly effective one is never used by 37 people or 78.7%.

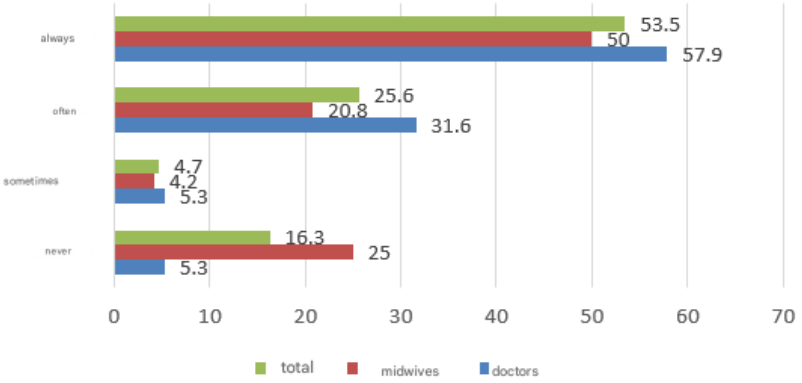

Fig.27 Distribution of physicians and midwives according to the habit of using a surgical mask

At the same time, 41 or 82% of individuals are concerned about the content of carcinogenic substances in surgical smoke, and 33 or 67.3% - about the potential risk of transmitting infectious diseases through it.

The top priority for occupational health and safety when working with electrosurgical intsruments is indicated by 21 or 42% of medical professionals.

Description of carbon dioxide, PM 2.5 and PM10 levels

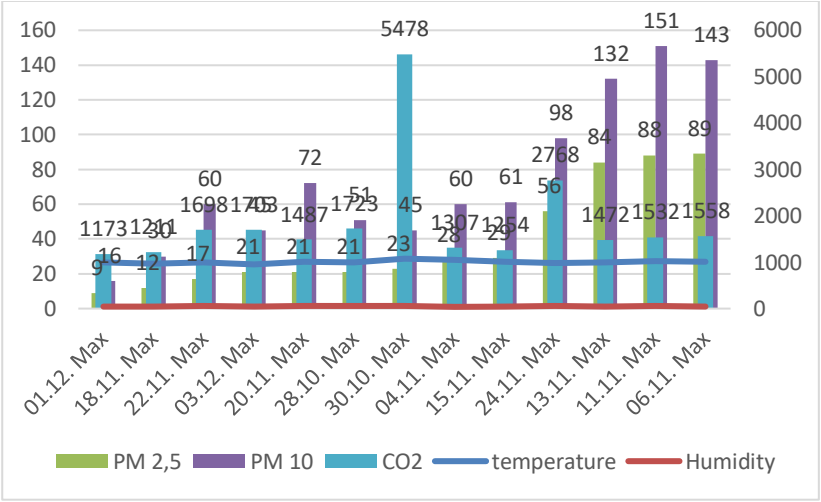

Fig.28 Dynamics in the average values of the monitored parameters

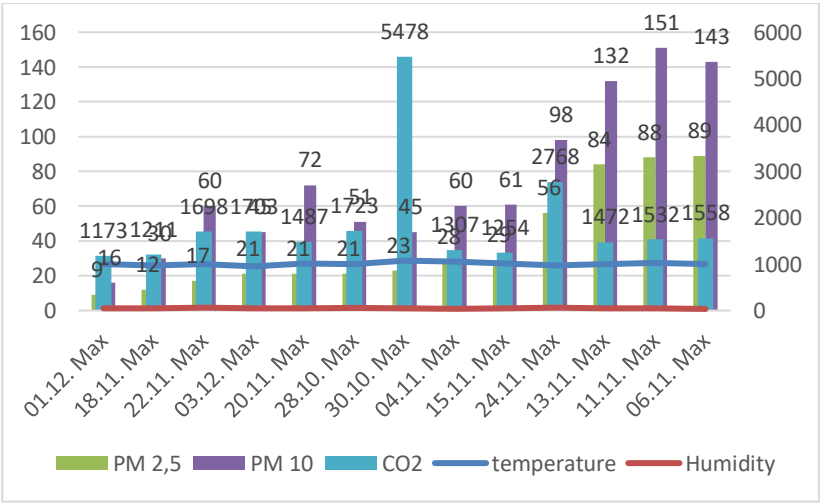

Fig.29 Dynamics in the maximum values of the monitored parameters

Dynamics during the intervention

The use of electrosurgical instruments in the operating room leads to significantly higher values of all three monitored indoor air quality indicators. Significantly higher values are the values of particulate matter in both sizes, as well as carbon dioxide concentrations as an indirect indicator of possibly increased values of all chemical pollutants during surgical interventions. Fig.30-32

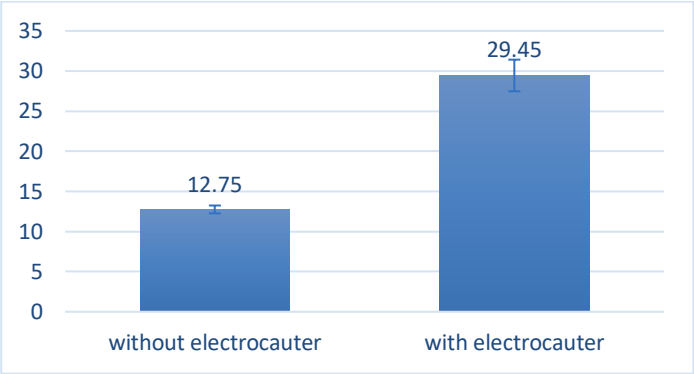

Fig.30 Comparison of average PM2.5 values depending on the use of electrocautery ($p<0.01$)

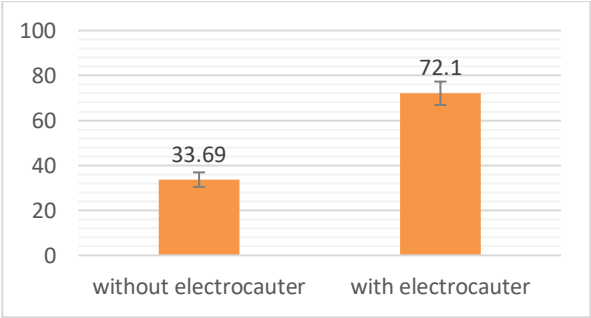

Fig.31 Comparison of mean PM10 values depending on the use of electrocautery ($p<0.01$)

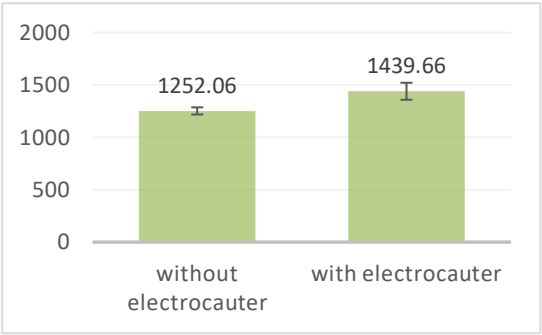

Fig.32 Comparison of average CO2 values depending on the use of electrocautery ($p<0.01$)

The type of surgical intervention has an impact on the dynamics of pollutants. In identically sized operating rooms on the same operating day, monitoring of particulate matter concentrations in both sizes shows higher levels in cesarean section surgery, reaching and maintaining higher levels compared to gynecological surgery.

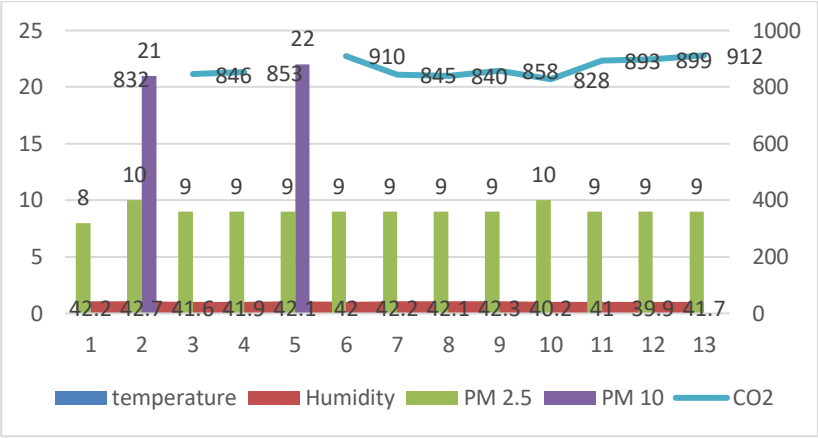

Fig.33 Dynamics of indicators in the use of electrocautery in gynecological surgery, large surgical room ($p<0.01$)

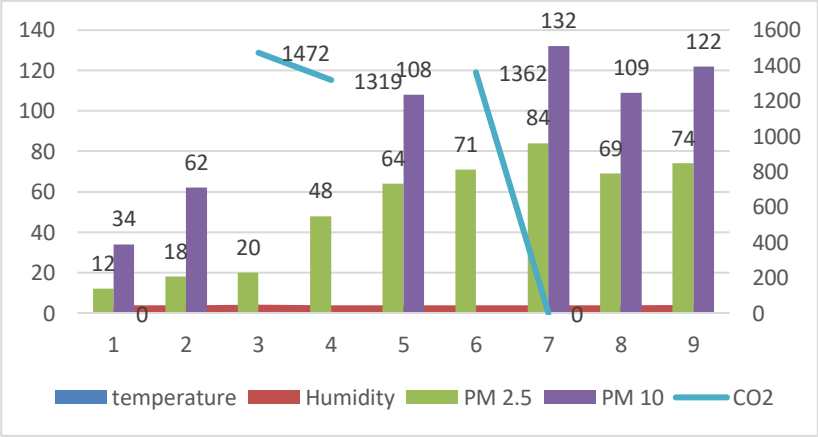

Fig.34 Dynamics of indicators in the use of electrocautery in obstetric surgery in a large operating room ($p<0.01$)

The average value of 2,5 mm particulate matter in the obstetric operation was statistically significantly higher than those during the gynecological operation in a large room on November 13.

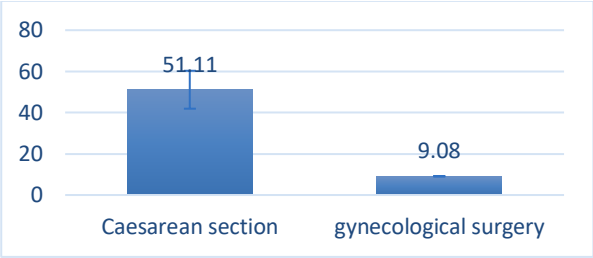

Fig.35 Comparison of the average values of PM 2.5 depending on the type of operating using an electrocautery ($p<0.01$)

The results are the same when comparing the average values of the concentrations also of 10 mm particulate matter. Again, significantly higher values are found in obstetric surgery.

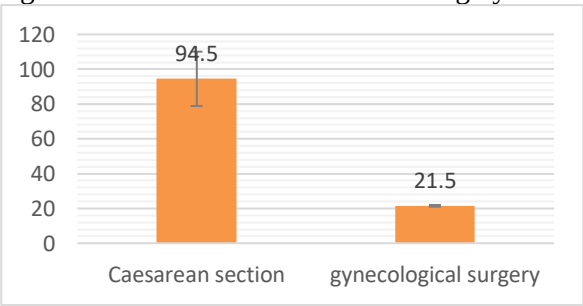

Fig.36 Comparison of mean PM10 values depending on the type of surgery using electrocautery ($p<0.01$)

The carbon dioxide concentration as a mean value for the entire surgery during the cesarean section reaches higher values than during gynecological surgery.

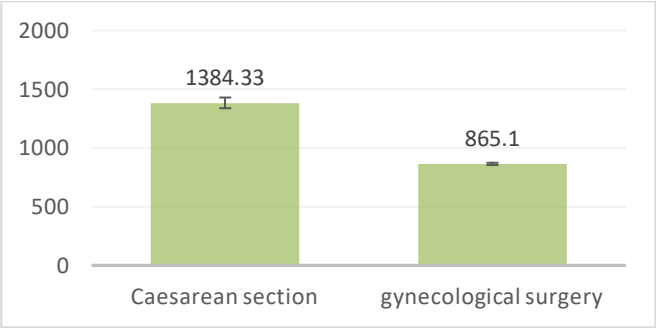

Fig.37 Comparison of average values of CO2 depending on the type of surgery using electrocautery ($p<0.01$)

Table.2 Comparison of average values of monitored pollutants depending on the size of the operating room (air volume)

Indicator	Type of surgery	Operation room	Mean	error	Confidence
P2.5	Without electrosurgery	small	16	0.56	p<0.05
		large	10.74	0.48	
	With electrosurgery	small	13.86	0.49	p<0.05
		large	37.62	2.55	
P10	Without electrosurgery	small	42.71	4.86	p<0.05
		large	26.67	3.62	
	With electrosurgery	small	40.91	4.91	p<0.05
		large	80.98	5.82	
CO2	Without	small	1494.	39.31	p<0.05

	electrosurgery		7		
		large	1136.5	13.44	
	With electrosurgery	small	1900	240	p<0.05
		large	1338	46	

All monitored air quality indicators in the operating room show statistically significantly different average values depending on the volume of the operating room. The large operating room allows for sufficiently good air quality during operations without the use of electrosurgical techniques. The average values of 10 µm particulate matter, 2.5 µm particulate matter and carbon dioxide concentrations are significantly lower in operating rooms with a larger area.

When using electrosurgical instruments, however, the volume of the room is a significant enough factor to reduce carbon dioxide concentrations alone. Regardless of the larger size of the operating room and the respectively larger volume of air, the use of electrosurgical instruments leads to statistically significantly higher values of particulate matter in operating rooms with a larger area.

Peak level comparisons

When comparing the maximum values of the monitored indoor air quality indicators registered during surgical interventions, we find statistically significantly higher values of 2,5 particulate matter in obstetric operative deliveries compared to gynecological interventions. The trend for higher levels of 10 PM and higher concentrations of carbon dioxide, despite the differences in values, is not statistically proven.

Table.3 Comparison of peak maximum values achieved for monitored pollutants depending on the type of intervention

Indicator	Type of operation	average	Error	Confidence
P2.5	Obstetrics	24.83	4.32	p<0.05
	Gynecology	10	0	
P10	Obstetrics	55.13	12.14	P>0.05
	Gynecology	21		
CO2	Obstetrics	1306.73	115.81	P>0.05
	Gynecology	828		

In operations using electrosurgery, the values of the studied air pollutants in the operating room are higher compared to interventions without the use of electrocautery. 2,5 PM in electrosurgery reaches an average of 24.41 mg/m3 compared to the significantly lower average peak values from all monitored operations without electrosurgery of 13.79 mg/m3 at $p<0.05$.

We compared the maximum peak values of 10 PM in 10 surgical interventions without electrosurgery and 17 operations using electrosurgery. The average peak value of 71±10.8 mg/m3 was significantly higher with electrosurgery compared to 36.8±7.5 mg/m3 without electrosurgery.

The average peak value reached during 21 monitored operations using electrosurgery for carbon dioxide was 1936.71 ppm compared to the significantly lower average peak value from 10 operations without electrosurgery – 1279.8 ppm.

Table.4 Comparison of peak maximum values achieved for monitored pollutants in surgery with or without electrosurgery

Indicator	Type of Operation	average	error	Confidence
P2.5	Without electrosurgery	13.79	1.03	p<0.05
	Without	24.41	3.78	

	electrosurgery			
P10	Without electrosurgery	36.8	7.5	P<0.05
	Without electrosurgery	71	10.8	
CO2	Without electrosurgery	1279.8	78.1	P<0.05
	Without electrosurgery	1936.71	297.64	

VI. Discussion

According to the results of the study, the level of subjective assessment of the work environment as risky is statistically significantly influenced by demographic factors such as gender, age, general and special experience in the Specialized Obstetrics and Gynecology Hospital "Prof. Dr. D. Stamatov" Varna.

A study published in December 2024 analyzed the influence of demographic factors such as gender, age, education, and work experience on the choice of stress coping strategies in an organizational setting. The results showed that these factors play a significant role in preferences for emotional, cognitive, and behavioral coping with stress. For example, gender emerged as a key determinant of differences in the need for emotional support and expression of emotions, while age influenced the readiness for positive reframing and behavioral engagement.

A study published in December 2024 analyzed the influence of demographic factors such as gender, age, education, and work experience on the choice of stress coping strategies in an organizational setting. The results showed that these factors play a significant role in preferences for emotional, cognitive, and behavioral coping with stress. For example, gender stands out as a

key determinant of differences in the need for emotional support and expression of emotions, while age influences the readiness for positive reappraisal and behavioral engagement. Although there is no specific research focused on the influence of demographic factors on the subjective assessment of risks in the work environment in obstetrics and gynecology hospitals, available research in related fields suggests that such factors may have a significant impact on the perception of stress and job satisfaction. Additional research specifically targeting obstetrics and gynecology hospitals is needed to confirm these assumptions.

Workers identify as risk factors of the work process – ergonomic, organizational and psycho-emotional characteristics of work and biological agents of the environment. This result is supported by a number of data in the existing Bulgarian and international literature. Medical professionals often perform tasks that involve prolonged standing, repetitive movements and working in uncomfortable postures, which can lead to musculoskeletal problems. These ergonomic loads are recognized as significant risks in the healthcare sector. Job insecurity, work-life intrusion, work intensity without sufficient breaks, lack of social support, high workload and time pressure are psychosocial risks that can lead to stress and emotional exhaustion among medical professionals and reduce employee efficiency. The results of the study of the work ability index among the staff of the specialized obstetrics and gynecology hospital show a relation to risk factors arising from the characteristics of the work process such as the subjective assessment of workplace risk, self-assessment of mental strain and the level of perceived stress. Coping with emotional challenges by doctors and midwives is proven to be an opportunity for effective prevention of negative health consequences. The demanding work schedules with long workloads and long shifts in obstetrics and gynecology practice often contribute to high levels of stress and burnout. Work-life balance is another discussed protective factor regarding negative health effects as a consequence of the complex action of workplace risks in obstetrics and gynecology practice and in healthcare in general.

The COVID-19 pandemic has increased stress and anxiety levels among obstetrics and gynecology healthcare workers due to fears of infection, adherence to isolation and patient care in isolation settings, increased workload and the need for personal protective equipment. Nurses are also exposed to greater mental stress than other healthcare professionals due to the additional burden required of them to develop ever higher levels of skills to keep up with advances in medical technology.

Stress levels and self-perceived poor mental health are more often associated with errors at work in the past 12 months. The level of poor health among health professionals negatively affects the quality of patient care. Many studies of health workers have shown that accidents are significantly more common among health workers whose shifts are longer than 12 hours, and poor mental health as a result of fatigue in nurses is a cause of medical errors, such as errors in administering medications or patient identification, injuries at work, fatigue related to safety violations, motor vehicle accidents on the way to work. Accidents are significantly more common among healthcare workers whose mental health status is poor than among those with good mental health. Healthcare professionals are at risk of contact with infectious agents, which requires strict adherence to safety protocols and the use of personal protective equipment.

The available literature confirms that ergonomic, organizational, psycho-emotional factors and biological agents are key risks in the work environment of obstetric and gynecological hospitals. Understanding and managing these risks is essential to ensure safe and healthy working conditions. Understanding and managing these risks is essential to ensuring safe and healthy working conditions.

The type of surgical intervention influences the dynamics of pollutants in the air of the operating room. The use of electrosurgical instruments in the operating room leads to significantly higher values of all three monitored indoor air

quality indicators –2.5 μm particulate matter, 10 μm particulate matter and carbon dioxide.
Workplace policies to improve the mental well-being of healthcare workers should include at least three key elements: infection control and prevention, provision of necessary personal protective equipment, and a preliminary plan and readiness to deal with emerging nosocomial infections.

VII. Conclusions

The subjective assessment of the level of psycho-emotional stress in the workplace in healthcare, and in particular in obstetrics-gynecology and neonatology practice, adequately meets the goals of occupational medicine for monitoring the risk factors that cause it and arise from the work process and the work environment.

Risk factors arising from the characteristics of the work process in the specialized obstetrics and gynecology hospital significantly affect the level of work ability of medical specialists. The subjective assessment of a risky work environment significantly affects the work ability indices, the self-assessment of mental tension and the level of perceived stress among the staff. The work ability index depends on both the level of awareness of mental stress in the workplace and the handling of emotional challenges by doctors and midwives.

Awareness of the high responsibility for the lives of patients influences the distribution of personnel in the groups with low work capacity, hyperstress and high level of stress perception. The professional groups of doctors and midwives show an influence on the registered levels of stress, responsibility for people and materials. Doctors more often self-identify as hyperstressed and with a high awareness of responsibility for people, while midwives more often declare concern about the high material responsibility.

Physical activity at work, both in terms of duration and class of muscle movements, affects levels of self-reported stress and indirectly on well-being at work.

The women on the staff of the specialized obstetrics and gynecology hospital work with more intense physical activity, exhibit higher precision in protecting against blood-borne diseases and in observing the rules for preventive safety measures at work.

The habits of not consuming food and drinks in areas with a risk of contact with blood and body fluids, as well as the regular use of a protective mask in case of risk of splashing to the mouth, depend on the experience of medical specialists. At the same time, they influence the distribution of the studied contingent by levels of work ability.

Professional experience in a particular medical facility influences staff concerns about potential risks in surgical smoke. More experienced workers are more aware of and less careless about the potential for transmission of infectious agents and carcinogenic substances in operating room smoke when performing electrosurgery than those who are more recently trained..

An opportunity for prevention in the workplace is to increase staff awareness of health and safety issues during electrosurgical interventions. The subjective assessment of an insufficiently effective surgical evacuation system and concerns about remote negative health effects in the respiratory system from exposure to surgical smoke statistically significantly affect the distribution of staff in the hypo-, eu- and hyperstress groups.

Organizational factors of work mainly influence the work ability index and self-reported levels of hyperstress. Compliance with all steps to minimize health hazards in the organization and the lack of crowding of many people at the same time in the same workplace (good time organization) improve the level of work capacity of employees at SBAGAL Varna.

The feeling of monotony and overload with administrative work, as well as the shift of focus from the main duties of the medical profession, increases with age and the accumulation of experience in the chosen profession. The result is also worrying that it is precisely the technical and administrative tasks that overload and definitely increase the levels of perceived stress.

Communication within teams and between team members and the management of the medical facility is more often reported reliably among those with longer experience.

The methodology for assessing perceived stress, applied among workers in an SBAGAL hospital, provides a comprehensive assessment of subjective stress levels, including modifying factors from lifestyle in addition to those from the professional environment.

The work capacity of medical professionals can be reliably assessed by determining the work ability index. The occupational health specialist can use the work ability index to determine its level at a specific time and propose the necessary measures for its improvement, both at the individual and group level.

The distribution among groups by work ability index is reliably influenced not only by risk factors at the workplace, but also by elements in the employees' lifestyle. Physical activity in leisure time, such as sports and walking, has a reliable prophylactic role, both in increasing work capacity and in the level of perceived stress at the workplace. Conversely, high levels of perceived stress, self-reported hyperstress, low work capacity and short special experience are associated with sleep disorders.

The use of electrosurgical instruments in the operating room leads to significantly higher values of all three monitored indoor air quality indicators. Significantly higher values are the values of particulate matter in both sizes, as well as carbon dioxide concentrations as an indirect indicator of possibly increased values of all chemical pollutants during surgical interventions

The type of surgical procedure has an impact on pollutant dynamics. In identically sized operating rooms on the same operating day, monitoring of particle concentrations in both sizes shows higher levels in cesarean section surgery, reaching and maintaining higher levels than in gynecological surgery.

The average value of 2.5 particulate matter during obstetric operations is statistically significantly higher than those during gynecological operations in a large volume room.

All monitored indicators of air quality in the operating room show statistically significantly different average values depending on the volume of the operating room.

When using electrosurgical instruments, however, the volume of the room as a factor is a significantly enough to reduce the concentrations of carbon dioxide alone. Regardless of the larger size of the operating room and the correspondingly larger volume of air, the use of electrosurgical instruments leads to statistically significantly higher values of particulate matter in operating rooms with a larger area.

When comparing the maximum values of the monitored indoor air quality indicators recorded during surgical interventions, we find statistically significantly higher values of 2.5 particulate matter in obstetric operative deliveries compared to gynecological interventions. The trend for higher levels of PM with a size below 10 μm and higher concentrations of carbon dioxide, despite the differences in values, is not statistically proven.

In operations using electrosurgery, the values of the studied air pollutants in the operating room are higher compared to interventions without the use of electrocautery.

When comparing the maximum peak values of PM with a diameter of less than 10 μm and carbon dioxide during surgical interventions

with and without electrocautery, we find a significantly higher average peak value when using electrosurgery.

VIII. Conclusions and recommendations for health promotion and prevention of negative effects related to workplace risks among employees of Specialized Hospital for Obstetrics and Gynecology for Active Treatment

The literature review identifies ergonomic, organizational, psychological risks, as well as biological and toxicological agents as priority risk factors in working conditions in specialized hospitals for obstetric and gynecological active treatment..

Emerging biological agents in the post-COVID period increase the subjective sensitivity of workers to the well-known risks of hemotransmissible and multidrug-resistant nosocomial infectious agents.
The management of biological risks in healthcare, including obstetrics and gynecology, should include:
• Use of personal protective equipment (PPE), such as gloves, masks, goggles and gowns;
• Strict hand hygiene and surface disinfection protocols;
• Isolation of patients with suspected infection;
• Vaccination of personnel against hepatitis B and other airborne infections, such as influenza;
• Adequate prevention programs to limit exposure to electrosurgical fumes for operating room workers.

The mental stress at the workplace of obstetricians-gynecologists and midwives is influenced by the subjective feeling of risk to one's own health at work, the level of physical and emotional strain, the awareness of the risk of making fatal mistakes, the feeling of

adequacy of the preventive measures taken and the relative share of administrative commitments. Experience and sufficient time for rest show a tendency for a protective effect regarding the negative health effects of stress at work. The management of these risks should provide for confidential counseling for employees and provide more autonomy to workers in the decision-making process.

Occupational health and safety in a specialized obstetrics and gynecology hospital is ensured through a comprehensive assessment and management of both physical and chemical risks, taking into account ergonomic challenges and a mandatory program of preventive measures including:

• provision of specific ergonomic equipment

• Noise control by reducing unnecessary alarms, using soundproofing materials and ensuring quiet periods in intensive care units.

• Prevention of slips and falls through regular maintenance of floors, use of anti-slip materials and training of staff on safety.

• Radiation protection by providing adequate personal protective equipment (PPE), limiting exposure and regularly monitoring radiation levels.

• Use of patient handling aids, such as hydraulic lifts or mobile platforms;

• Training staff on proper lifting and handling techniques to reduce strain on muscles and joints;

• Improving the working environment by providing sufficient space for movement and adjusting the height of work surfaces to allow staff to work in comfortable positions.

• Use of personal protective equipment (PPE), including gloves, masks and specialized protective aprons, when working with cytotoxic drugs and disinfectants;

• Regular ventilation of work areas, especially where chemicals are handled;

• Train staff on proper chemical use and safe work techniques

• Recommend the use of engineering controls that include optimal ventilation systems, airflow controls, and effective filtration systems. Studies have shown that unidirectional vertical airflows are more effective at reducing levels of bacteria-carrying particles in operating rooms than horizontal airflows

The data from this study should be used by all stakeholders, including workers, employers, health managers at various levels, obstetricians and gynecologists, and midwives, both in hospital and outpatient practice for workplace health prevention.

The data from this study should be used by occupational health services in the development of a Bulgarian methodology for identifying, assessing and managing risks at healthcare workplaces.

IX. Contributions of the dissertation paper of an original nature:

1. Workplace risk is assessed in a specialized hospital for active obstetric and gynecological treatment in Bulgarian practice.

2. For the first time in Bulgaria, a complex methodology for subjective assessment of mental health in the workplace in healthcare is created and applied.

3. Air quality monitoring in an operating room during electrosurgery is approved at the national level.

4. An author's Questionnaire for the inclusion of workers in the risk assessment process for specific workplaces in SBAGAL is created.

5. A systematic analysis of the subjective and objective assessment of work environment parameters in an obstetric and gynecological operating room is applied.

6. For the first time, a four-dimensional design of the study of the levels of neuropsychiatric strain in healthcare is applied through the Work Ability Index, Perceived Stress Questionnaire, Self-Assessment Questionnaire for Work Environment and Lifestyle.

X. Publications and contributions on the topic of the dissertation

Publications:

Dimitrova T., Pandelieva Zl., Risk management for the health of operating room workers when using electrical instruments, (2025) Journal of the Union of Scientists - Varna. Medicine and Ecology Series. Online First

Pandelieva Zl., Feeding the infant, Medical Magazine, (2022), 2, 24-26

Pandelieva Zl., Krasimirova M., Radoslavova E., Clinical case of a newborn with staphylococcal skin infection – SSS syndrome, Reproductive health, in print

Participations:

Dimitrova T., Pandelieva Zl., "Management of health risks for operating teams when exposed to surgical smoke", report Jubilee Scientific Conference 75 years of MU - Plovdiv "Medicine of the Future", 29-31.10.2020

Dimitrova T., Pandelieva Zl., Risk management for the health of workers in the operating room when using electrical instruments, Final Conference "Science in the Service of Society", October 25, 2024

Krumova D., Yotova V., Georgieva R., Pandelieva Zl., Zlateva T., Dynamics in the frequency of MHV births in a maternity hospital in the city of Varna for the period 2019-2020, Proceedings of the XVI National Congress of Pediatrics with International Participation, 2024