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Research Article

Assessing stress levels among medical professionals in obstetric emergencies in a real clinical setting

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Abstract

Aim: The purpose of this study was to determine the level of stress and related factors experienced by teams of obstetricians and midwives working in a university obstetric clinic during obstetric emergencies, which would serve as a guideline for developing models for prevention, control, appropriate management, and team behavior in emergency conditions.

Materials and methods: The level of stress was determined using both objective and subjective methods. All study participants received an Empatica wristband for the objective assessment, which measures sympathetic nervous system activity and heart rate. The Stress Symptom Checklist—a tool evaluating physical and psychological symptoms—was used for the subjective assessment. The purpose of both methods was to determine the overall stress levels within the study cohort. Given the individual variability of stress experiences, we also examined the relationship between stress and personality types.

Results: Researchers observed that 45% of the sample of doctors and midwives had elevated stress levels. The most prevalent physical symptoms reported by participants included headache, insomnia, and fatigue. The most common psychological symptoms were anxiety, restlessness, and emotional overload.

Conclusions: Studying the leading stressors and applying strategies to reduce their intensity can improve the satisfaction of healthcare professionals and students in the field, as well as promote quality and safe care for the mother and the newborn in obstetric emergencies.

Keywords

midwives, obstetrician-gynecologists, occupational stress, simulation training, wearable devices

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Introduction

Working in health facilities that provide maternity care is associated with high levels of stress among employees for reasons such as the unpredictability of emergencies, long shift lengths, understaffing, etc. Exhausted and overworked staff may not be able to properly assess and adequately treat all women in need.[1] A higher incidence of post-traumatic stress disorder (PTSD) has been observed in health professionals who encounter and need to manage traumatic events in their work environment, as this risk is elevated among obstetricians.[2] Data from related literature indicate that techniques for coping with stress arising from clinical work have a positive effect on healthcare professionals, which is associated with greater safety and quality of work with patients.[3]

Aim

This study aimed to determine the level of stress and its related factors in a real working environment in a team of doctors and midwives in conditions of obstetric emergencies.

Materials and methods

Clinical teams consisting of a specialist/resident doctor and a midwife working in the Clinic of Obstetrics and Gynecology were the object of the study. They had given their consent to participate. The participants in the study were informed of their right to withdraw their consent at any time. The volunteers were given detailed information that their participation did not involve any psychological, physical, social, financial, or legal risks. All individuals who gave and subsequently withdrew their informed consent or had incomplete or missing data were excluded from the sample data published here. Participants did not receive any remuneration or other benefits for their participation in the study. This study is the first, exploratory phase of a larger three-phase research project. The goal of this phase is to identify the main patterns of stress and its associated factors in a real clinical setting, rather than to establish causal relationships.

To achieve the objectives of the study, the stress level was assessed using objective and subjective methods. A specially selected Empatica wristband was used to objectively assess stress levels in all study participants. The stress bracelet was equipped with sensors designed to collect high-quality data. This device combines EDA (electrodermal activity) and PPG sensors, allowing simultaneous measurement of sympathetic nervous system activity and heart rate. The bracelet has these sensors: the PPG sensor, which measures blood volume pulse (BVP) to find heart rate variability; the 3-axis accelerometer, which tracks motion-based activity; the EDA sensor (GSR sensor), which constantly measures changes in electrodermal activity; the infrared sensor (infrared thermopile), which detects changes in the temperature of the peripheral skin; and the Event Mark Button, which marks a specific event and makes it easier to interpret physiological signals.

The Stress Symptom Checklist was used for subjective assessment of stress levels. The checklist contains two sections: physical symptom checklist (29 symptoms) and psychological symptom checklist (23 symptoms). The purpose of the two checklists is to determine the level of stress in the study population by reporting how many of the symptoms listed have been observed in the past month. Subjects can complete the test periodically and monitor for rising levels of distress.

As contemporary theories increasingly emphasize the existence of individual differences regarding the experience of stress and ways of coping with it, the personality type-stress relationship, and therefore the influence that personality characteristics have on the experience of stress, were also examined. To this end, each participant completed the Glazer-Stress Control Life-Style Questionnaire, 'Type A Behavior – Type B Behavior,' along with the Stress Symptom Checklist to determine their personality type and lifestyle. The questionnaire is composed of 20 pairs of statements that are separated by numbers from 1 to 7.

A semi-structured interview was also conducted with the participants after each obstetric emergency. The aim of the interview was to differentiate the key points in the management of the emergency, and based on the overall results, to develop simulation scenarios with a high degree of accuracy.

The semi-structured interviews were analyzed through reflective thematic analysis according to the framework of Braun and Clarke[4-6], using a hybrid inductive-deductive approach. Primary coding was done inductively from the data, and subsequent clustering into themes was guided by the study objectives and the literature on occupational stress in healthcare. This enabled complete triangulation of the objective physiological indicators (Empatica wristbands), subjective stress questionnaires, and qualitative interviews.

The study was conducted between May 2023 and April 2024 at the Obstetrics and Gynecology Clinic of St George University Hospital. The researchers themselves conducted the study. IBM SPSS v. 23.0 was used for data processing.

Statistical analysis

- Descriptive statistics was used for quantitative data processing.
- Kolmogorov–Smirnov and Shapiro–Wilk tests were utilized in checking the data distribution normality.
- Alternative analysis was employed to summarize the quantitative dichotomous data and assess the relative frequency in percentages.
- The Mann–Whitney and Kruskal–Wallis methods were used to determine statistical significance.
- Cramer's V was utilized to measure the association or correlation between two variables

- Linear logistic regression was implemented to estimate if there is an association between the independent variable (risk factor) and the dependent variable (outcome)

Correlation analysis was used for quantitative variables, Cramer's V for categorical variables, and logistic regression was used to assess the likelihood of high stress levels in the presence of certain risk factors.

The critical value of significance used is α=0.05.

Results

The survey included 40 participants, with 24 obstetricians (60%) and 16 midwives (40%). Because there were only two resident doctors in the sample, they were conditionally assigned to the group of doctors. The sample's mean age was 44.55±12.72 years (minimum 30; maximum 71) (95% CI 40.43, 48.57). A salient disparity emerged when analyzing the age structure of the two groups under study. The mean age of obstetricians was 37.58 years (±8.89) (95% CI 33.83, 41.44), while midwives had a significantly higher mean age of 54.88 years (±10.40) (95% CI 49.33, 60.42). A significant difference was found between the two groups' means (doctors and midwives) based on age (p=0.000007). The respondents in the sample were divided into four age groups based on conditional criteria. The largest proportion of respondents were specialists in the 30–40 age group (47.5%), followed by the 51–60 age group (25%). The sample was predominantly female, with 34 subjects (85%) being female and a mere 6 subjects (15%) being male.

The aggregate professional experience for the entire sample was 20.50±14.16 years (95% CI 15.97, 25.03), based on a thorough examination of work years and experience. Once again, we found a statistically significant difference between the two groups under investigation—doctors and midwives (p=0.000006). The results of the study are presented in graphical form, accompanied by the mean, standard deviation, and number **(Figs 1, 2)**.

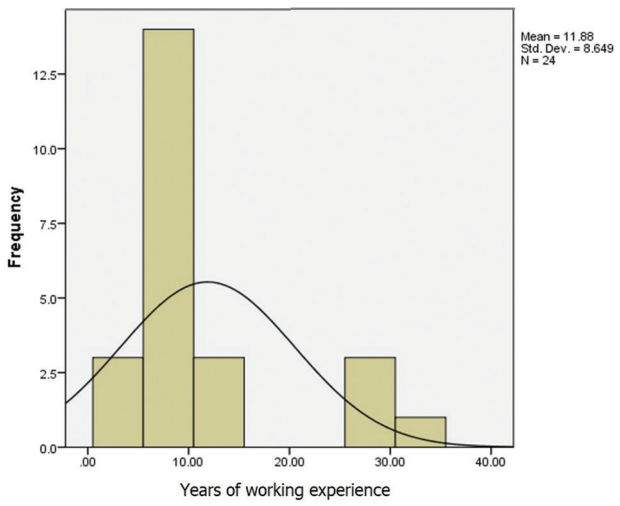

Figure 1. Years of professional experience in the obstetricians group.

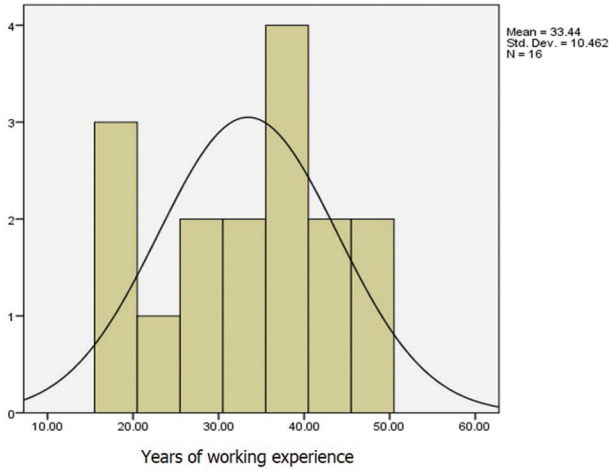

Figure 2. Years of professional experience in the midwifery group.

There were nine obstetric emergencies in a real clinical setting, where the subjective and objective levels of stress of the medical teams were reported and presented in tabular form **(Table 1)**.

Table 1. Distribution of obstetric emergencies in which the level of stress was reported

Emergency obstetric case	Number (n)	Percentage (%)
Third- and fourth-degree perineal tears	4	10%
Placental abruption	4	10%
Breech presentation delivery care	3	7.5%
Shoulder dystocia	4	10%
Severe perinatal (intrapartum) asphyxia	6	15%
Postpartum hemorrhage	9	22.5%
Eclampsia	4	10%
Deflexed head malpresentations	2	5%
Vacuum assisted delivery	4	10%
Total	**40**	**100%**

The average number of stress symptoms reported by the respondents was 14.65±6.82 (min 4; max 29) (95% CI 12.47, 16.83), which corresponds to a moderate to high level of stress. A higher total number of stress symptoms was observed in the group of doctors—15.79±6.43 (95% CI 13.07, 18.51), while in the group of midwives, the average total number of reported stress symptoms was 12.94±7.23 (95% CI 9.08, 16.79). 45% of the respondents had high and very high levels of stress **(Table 2)**. The higher level of stress in the group of doctors can be explained by the fact that the years of professional experience are significantly lower than in the group of midwives.

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Table 2. Reported levels of subjective stress in the studied groups

Level of subjective stress	Obstetricians *n* (%)	Midwives *n* (%)
Low	3 (12.50%)	7 (43.80%)
Moderate	5 (20.80%)	2 (12.50%)
High	13 (54.20%)	5 (31.30%)
Extremely high	3 (12.50%)	2 (12.50%)
Total	**24 (100%)**	**16 (100%)**

The proportion of reported physical symptoms was higher than the proportion of reported psychological symptoms. The mean of reported physical symptoms in the sample was 8.85±4.02 (95% CI 7.56, 10.14), while the mean of reported psychological symptoms was 5.80±3.26 (95% CI 4.76, 6.84). The most common physical symptoms were headaches, insomnia, and lack of energy **(Fig. 3)**, and the most common psychological symptoms were anxiety, fear, and emotional overload **(Fig. 4)**.

The analysis of the results showed a statistically significant relationship between years of professional experience and the level of reported stress symptoms (p=0.001; r=0.95). The strength of the relationship between the two variables was high (Cramer's V=0.757). This was also confirmed by linear regression analysis (Sig. F=0.005; Sig. T=0.0005). With increasing years of work experience and professional experience, the level of subjective stress decreased **(Fig. 5)**.

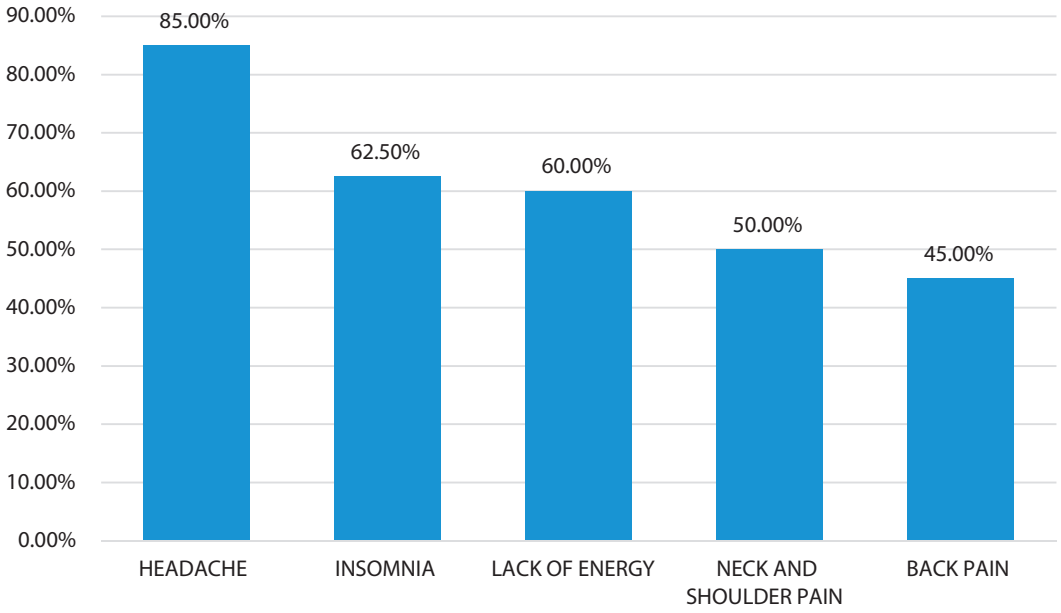

Figure 3. The most commonly reported physical symptoms in the sample.

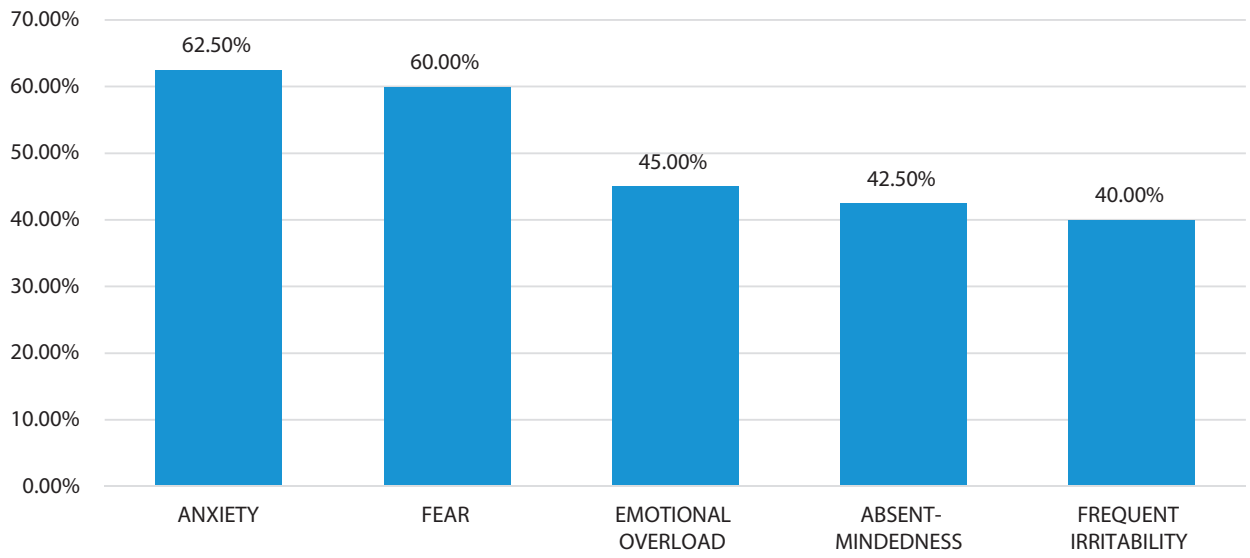

Figure 4. The most commonly reported psychological symptoms in the sample.

However, considering the small sample size and the potential impact of extreme values, the very strong correlation we found between the number of stress symptoms and the years of professional experience should be interpreted cautiously.

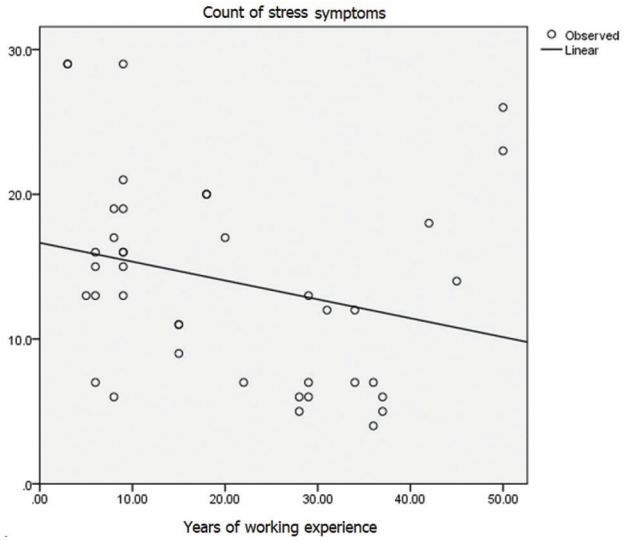

Figure 5. Linear regression analysis between years of service and total number of stress symptoms.

The data from the Glazer questionnaire show that type A2 is the most common type of stress control, followed by type AB, and the results are presented graphically **(Fig. 6)**.

It is interesting to note that type B1 or B2 stress control was not reported in the sample. Our study also confirms that Type A stress control is associated with high levels of occupational stress. As our sample did not report stress control type B, a comparison was made between type A and type AB. It turned out that the type of personal stress control likely relates to an individual's subjective level of perceived stress. The results show a statistically significant relationship between the level of stress and the type of stress control (p=0.01; r=0.37). It can be assumed that stress control type A is a risk factor for higher levels of perceived stress—OR=8.12 (95% CI 1.08, 61.32). High and very high levels of stress were observed in 22 (66.7%) of the subjects with stress control type A, whereas only one was reported for those with stress control type AB. **Table 3** shows the reported level of subjective stress according to the type of stress control (p=0.04; r=0.49).

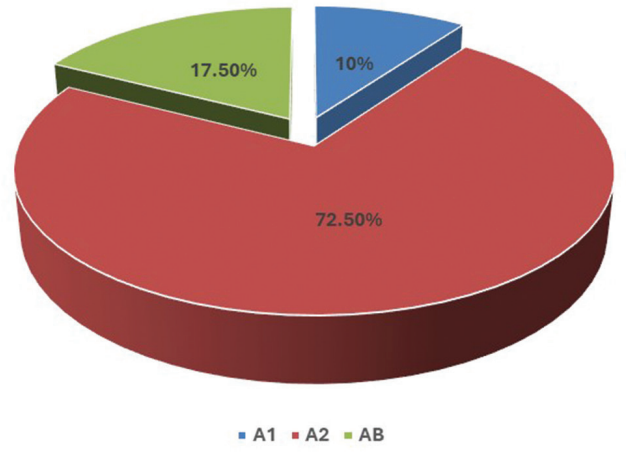

Figure 6. Type of stress control in the sample studied.

Table 3. The reported level of subjective stress according to the type of stress control

		Type of stress control		
		A1	**A2**	**AB**
		n **(%)**	***n*** **(%)**	***n*** **(%)**
Observed stress level	Low	1 (25.00%)	4 (13.80%)	5 (71.40%)
	Moderate	0 (0%)	6 (20.70%)	1 (14.30%)
	High	3 (75%)	14 (48.30%)	1 (14.30%)
	Extremely high	0 (0%)	5 (17.20%)	0 (0%)

The analysis of data from the semi-structured interview conducted with the participants after each obstetric emergency led to the formation of several main themes: clinical risk and fear of lethal outcome, uncertainty, systemic and organizational difficulties, and communication and team coordination, as well as human factors such as fatigue and decreased concentration. When analyzing the data, the following key points were taken into account:

- The most frequently reported fears caused by the obstetric emergency situation are the fear of complications for the mother and fetus; the fear of death; severe birth trauma; and, in general, the fear of the uncertainty of the outcome of the situation.
- The most frequently reported difficulties and problems in the process of managing an emergency situation are mainly related to staff shortage, additional aggravating medical conditions, difficulties in communication with team members, organizational problems, fatigue, and lack of cooperation of the woman in labor.
- The most commonly recommended measures for prevention and management of stress include improving communication and team roles, additional training and simulations, and ensuring sufficient and qualified staff, as well as introducing psycho-emotional support and recovery strategies. To calculate the level of objective stress, a set of numerical indicators were collected using Empatica wristbands **(Table 4)**.

Severe stress affects the autonomic nervous system (ANS), which regulates heart rate (HR), EDA, and thermal activity levels. HR and HRV (heart rate variability) are the most commonly used cardiac parameters for assessing stress. These parameters are imposed as a non-invasive way to measure the activity of the vagus nerve in certain conditions, including during sports training. A decrease in HRV has been reported as a predictor of side effects in disease

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Table 4. Mean values of the studied indicators with Empatica wristbands

	Mean	X±SD	X±SE	95% CI	Min	Max
ACC-X	23.56	15.61	2.47	18.97–28.95	−128	127
ACC-Y	5.88	15.47	2.45	0.93–10.83	−128	127
ACC-Z	24.64	16.67	2.64	19.31–29.97	−128	127
BVP	−0.0015	0.003	0.0005	(−0.0025) – (−0.0006)	−404.6	289.75
EDA	4.15	3.43	0.54	3.05–5.25	0.00	18.75
HR	100.19	10.99	1.74	96.67–103.70	48	184.62
IBI - 1	547.34	361.30	65.96	412.43–682.25	13.44	3209.72
IBI - 2	0.52	0.09	0.02	0.48–0.55	0.31	1.38
TEMP	27.87	1.90	0.30	27.26–28.47	18.43	31.95

ACC-X: Accelerometer along the X-axis; ACC-Y: Accelerometer along the Y-axis; ACC-Z: Accelerometer along the Z-axis; BVP: Blood volume pulse; EDA: Electrodermal activity; HR: Heart rate; IBI – 1: Inter-Beat Interval 1 (the timestamp at which a specific heartbeat was detected; IBI – 2: Inter-Beat Interval 2 (the exact duration of that specific inter-beat interval); TEMP: Skin temperature

states and associated with fatigue, stress, and even burnout effects during physical performance.

As it was not possible to measure the relevant indicators at rest in emergency conditions, a comparison was made of the values for various indicators, such as age, sex, occupational position, level of reported subjective stress, type of stress control, and type of emergency. The only statistically significant difference (p=0.0001) was reported for the IBI-2 tick interval (expressed in seconds (s)). It has been shown that values of this indicator below 0.7 s are observed in stressful situations and in pathological cardiovascular conditions.

On the basis of age, the following statistical differences were found between the groups studied **(Table 5)**. The non-parametric Kruskal–Wallis H analysis showed statistically significant differences in BVP, EDA, and HR.

The linear regression analysis revealed a relationship between age and electrodermal activity (multiple R=0.451) **(Fig. 7)**. With increasing age, electrodermal activity decreases in stressful situations (Sig. F=0.004; Sig. T=0.0005).

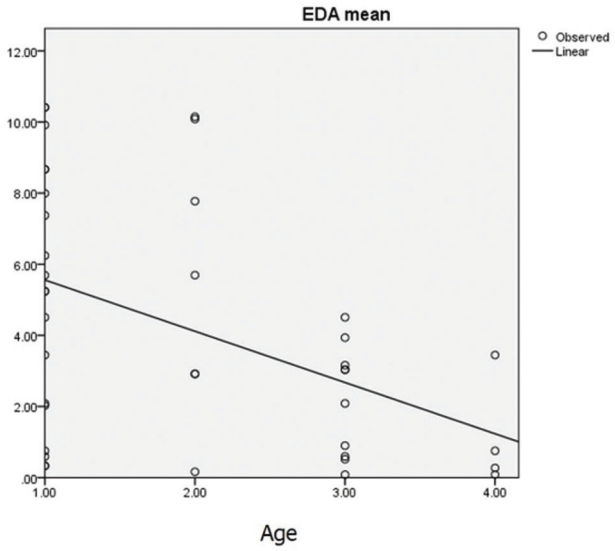

Figure 7. Linear regression analysis between age group and electrodermal activity.

Table 5. Mean values of the indicators studied by age group

Age group / Variable	31-40 years	41-50 years	51-60 years	> 60 years	*P*
	X±SD	X±SD	X±SD	X±SD	
ACC-X	27.63±8.63	25.43±22.48	16.10±21.23	23.57±7.71	NS
ACC-Y	6.46±16.73	2.09±13.99	5.97±15.67	9.55±15.91	NS
ACC-Z	22.16±15.95	21.56±13.55	26.32±20.55	37.63±12.44	NS
BVP	−0.0005±0.001	−0.002±0.004	−0.002±0.004	−0.001±0.001	**0.04**
EDA	5.26±3.94	5.67±3.86	2.18±1.57	1.14±1.56	**0.03**
HR	102.69±10.90	92.05±8.83	97.47±6.68	109.31±15.41	**0.02**
IBI - 1	421.06±234.77	691.30±403.18	641.67±362.66	825.33±739.18	NS
IBI - 2	0.48±0.07	0.62±0.03	0.57±0,11	0.50±0.08	NS
TEMP	27.30±2.10	28.88±1.15	28.06±1.87	28.32±1.48	NS

ACC-X: Accelerometer along the X-axis; ACC-Y: Accelerometer along the Y-axis; ACC-Z: Accelerometer along the Z-axis; BVP: Blood volume pulse; EDA: Electrodermal activity; HR: Heart rate; IBI – 1: Inter-Beat Interval 1 (the timestamp at which a specific heartbeat was detected; IBI – 2: Inter-Beat Interval 2 (the exact duration of that specific inter-beat interval); TEMP: Skin temperature

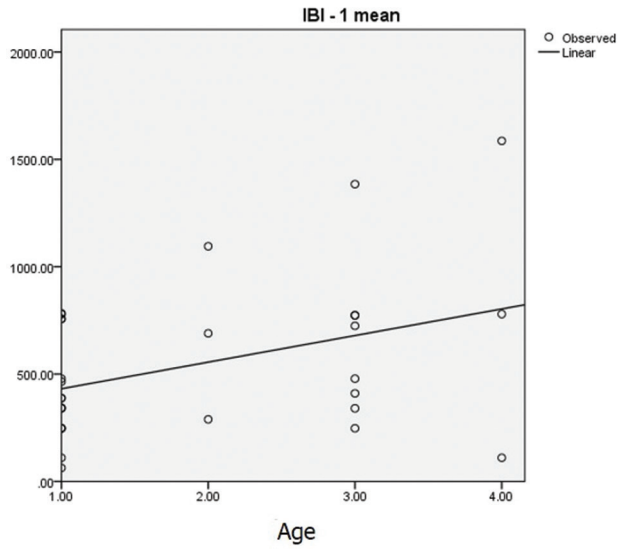

Figure 8. Linear regression between age group and cycle interval IBI 1.

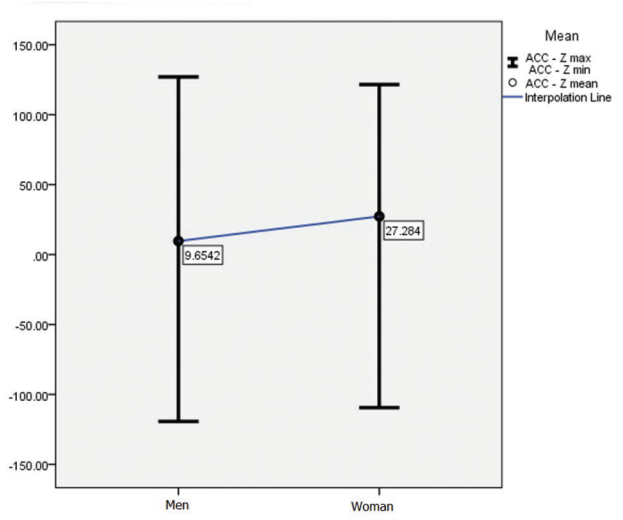

Figure 9. Comparison of ACC Z values by sex.

A statistically significant relationship was also found between the values of IBI 1 (time [relative to the initial time] of the detected tick interval expressed in seconds (s)) and age (multiple R=0.381) **(Fig. 8)**. With increasing age, the time between cycles also increases (Sig. F=0.03; Sig. T=0.02).

No significant differences were found between the sexes for the indicators studied, with the exception of arm tension on the Z axis (ACC-Z) (p=0.01). Men had a lower ACC-Z value of 9.65±10.36 (95% CI 1.22, 20.53) (min −6.40; max 23.17), while women had a value of 27.28±16.25 (95% CI 21.61, 32.95) (min −5.92); max 59.32) **(Fig. 9)**.

When the indicators were analyzed according to the professional positions (doctor and midwife), only one significant difference was found again, this time in the EDA of the subjects. Non-parametric analysis of variance (Mann–Whitney U test) showed (p=0.003) that the electrodermal activity of doctors was higher — 5.48±3.49 (95% CI 4.01, 6.95) (min 0.08; max 10.41), compared to that of midwives – 2.16±2.22 (95% CI 0.97, 3.34) (min 0.08; max 7.77).

The analyses carried out in relation to the reported subjective level of stress and the type of stress control in the participants did not show any significant differences (p>0.05).

In order to identify the obstetric emergencies that cause the highest level of stress and discomfort in workers, a comparative analysis of the measured indicators was carried out. Statistically significant differences were found in the measurement of arm tension on the x-axis (ACC-X) – (p=0.02); EDA – (p=0.04) and the time of the detected stroke interval (IBI 1) – (p=0.05). Comparison of the other indicators showed no significant differences (p>0.05).

Discussion

The European Union (EU) indicates that work-related stress is the second most common work-related problem after musculoskeletal disorders. The EU defines stress as "a set of neuroendocrine, immunological, and emotional processes and responses".[7] Events that can seriously compromise a patient's condition are common in medicine and can have a negative impact on healthcare providers. Obstetricians and midwives may experience the consequences of secondary traumatic stress, with symptoms such as guilt, anxiety, depression, etc.[8]

In this study, we used a combination of subjective and objective stress measures. For objective assessment, we used wearable devices (Empatica wristbands). The available data in the literature show that the use of such devices is suitable for detecting stress, based on data collection through analysis of the physiological signal received from the wearable device.[9]

Due to the unpredictable nature of obstetric emergencies, it was not possible to record individual physiological indicators at rest beforehand. In this context, comparison between subgroups (by age, professional role, level of perceived stress and type of emergency) was used as a pragmatic alternative for interpreting physiological data.

This approach does not allow for a precise assessment of individual reactivity, but it allows for the identification of patterns of relatively higher or lower physiological stress between different professional and demographic groups.

Our study showed that a large proportion of participants experienced high or very high levels of stress symptoms. Analysis of the semi-structured interviews showed that the most frequently experienced stress in obstetric emergencies was related to the high risk for the mother and fetus, the fear of a lethal outcome, and the unpredictability of the development of the situation.

The main difficulties identified by the participants are grouped into three main areas: systemic and organizational constraints (lack of staff, poor organization), team communication and coordination, and human factors such as

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fatigue, decreased concentration, and difficulties in interacting with the mother. The most frequently recommended measures for prevention and management of stress include improving communication and roles in the team, additional training and simulations, ensuring sufficient and qualified staff, and introducing psycho-emotional support and recovery strategies. The availability of effective programs to improve the emotional well-being of health workers is important in reducing symptoms of secondary traumatic stress.[8] Prolonged stress is associated with the development of burnout symptoms, which is thought to be high among obstetricians and midwives.[10,11] A study of stress among nurses and midwives conducted in Poland shows that high levels of occupational stress can lead to an intention to leave the work environment.[12] According to Urbańska et al.[13], longer professional experience may be associated with the development of adaptive mechanisms for coping with stress. This correlates with our data, according to which the level of subjective stress experienced decreases with increasing years of work experience. The wide confidence intervals in logistic regression, however, reflect the limitations of the small sample size and require conservative interpretation of the effect size. The integration of subjective and objective indicators shows that they do not always overlap completely. While subjective questionnaires reflect experiences such as anxiety, fatigue, and emotional overload, physiological indicators record the autonomic response of the body in real time.

Higher electrodermal activity in doctors, combined with higher subjective stress levels, suggests that psychological and physiological stress are more often superimposed in them. In midwives, lower physiological values, despite the presence of subjective stress, may reflect better physiological adaptation associated with longer professional experience.

Studies have shown that obstetric emergencies often have negative outcomes for both mother and baby, but that a large proportion of complications are preventable. Training staff in simulated obstetric scenarios to establish routine practice would be of great help. In some programs, such training is recommended or even mandatory. Typically, participants report feeling more confident in dealing with emergency situations after training, but there is still insufficient evidence from real-life hospital settings.[14] However, there is strong evidence that simulation training can reduce stress.[15]

Simulation training is an important part of obstetric emergency training. It significantly improves patient outcomes.[16] Simulation training cannot replace clinical experience, but it can improve job readiness.[17] This is especially true when it comes to relatively rare situations. After analyzing and evaluating the data from this study, as well as a consultation with the study participants, three simulation scenarios were developed regarding the obstetric emergencies – shoulder dystocia, management of birth with breech presentation, and uterine hypo- and atony (causes of postpartum hemorrhage).

Limitations of the study

This scientific study was limited in terms of sample size due to the conditions under which it was conducted. It was a part of a scientific research project carried out over a specific period of time. The time frames were predetermined before the start of the project and could not be changed. The project was carried out within the framework of a single technical observation unit – St. George University Hospital, Plovdiv. Only participants who had given their written informed consent to participate in the study were included. Emergency obstetric situations are relatively rare, and their occurrence and development cannot be predicted. It should also be noted that the specific design of the study did not allow for an in-depth examination of stress that could be caused by external factors (personal life, family environment, etc.). Again, due to the specific design, we do not have the baseline values of the biometric indicators that were monitored. The specific age structure of the teams working in the medical facility led to significant differences in the average age and professional experience of the subgroups studied.

Future research perspectives

Identifying the major stressors and implementing strategies to reduce their intensity can improve the satisfaction of health professionals and students training in the specialty, as well as promote quality and safe care for the mother and newborn in the setting of an obstetric emergency. The assessment and analysis of stress levels in medical teams during obstetric emergencies in clinical and simulation settings is the basis for the development of guidelines for stress prevention, control, and appropriate management.

We believe that our study will contribute to the development of high-fidelity simulation scenarios and training programs that could be incorporated into the curricula of both undergraduate and postgraduate students. The development of a model for prevention and management of stress in medical teams is also envisaged.

Conclusions

The mean number of stress symptoms reported in the subjects indicates a moderate to high level of stress. A slightly higher total number of stress symptoms was observed in the obstetrician group. High and very high levels of stress were observed in 45% of all the doctors and midwives studied. With increasing years of professional experience, the level of subjective stress decreased.

This study is part of a scientific project, the first phase of research. The overall objective of this scientific project is

to distinguish between levels of stress in clinical and simulation settings, as well as the effectiveness of simulation training for its control, rather than stress itself. Studying the leading stressors and applying strategies to reduce their intensity can improve the satisfaction of healthcare professionals and students in the field, as well as promote quality and safe care for the mother and the newborn in obstetric emergencies.

Appendix

The second and third phases of the scientific study

For an objective assessment of stress levels, a specially selected Empatica wristband will be used for all study participants. The stress wristband is equipped with sensors designed to collect high-quality data. It is a wrist-worn device that combines EDA and PPG sensors, allowing simultaneous measurement of sympathetic nervous system activity and heart rate.

For subjective assessment of stress levels, the Stress Symptom Checklist and Howard Glazer's Stress Control: Type A – Type B questionnaire (used in phase 1 of the study) are still used. A semi-structured interview with the participants will also be conducted after each emergency obstetric situation.

This will be followed by analysis and evaluation of the data from the three phases and the development of a model and guidelines for the prevention and control of stress among medical teams in emergency obstetric situations.

The steps outlined in the second and third phases aim to overcome the limitations of the first phase as much as possible.

We believe that the implementation of all the steps envisaged in this project, as well as the in-depth analysis of the data, would contribute to the improvement of training programs and the higher quality of training for future medical professionals.

Written information form for the healthy volunteers in the study

Research objective

The current study aims to investigate the stress levels among medical teams during obstetric emergencies in both clinical and simulation settings.

Expected benefits

- Studying the leading stressors and implementing strategies to reduce their intensity, which may improve the satisfaction of health specialists and students being trained in the specialty, as well as promote high-quality and safe care for the mother and newborn during obstetric emergencies.
- Developing guidelines for the prevention, control, and models of adequate stress management.
- Developing algorithms for team behavior in emergency conditions.
- Creating highly accurate simulation scenarios and training programs that could be integrated into the curricula of students, as well as into the postgraduate training system.

Risks and confidentiality

Participation in the study does not carry psychological, physical, social, economic, or legal risks.

The personal information received will be treated confidentially, used solely for the purposes of the study, and will not be made publicly available.

Participation in the study is voluntary, and any participant can withdraw at any time.

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Additional information

Ethical statement

- The authors declared that no clinical trials were used in the present study.
- The authors declared that no experiments on humans or human tissues were performed for the present study.
- The authors declared that they obtained written informed consent for the scientific activities in this project from all subjects involved in the study. The signed informed consent forms are deposited at the Medical University of Plovdiv and available for review upon request.
- This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Medical University of Plovdiv.
- The authors declared that no experiments on animals were performed for the present study.
- The authors declared that no commercially available immortalized human and animal cell lines were used in the present study.

Conflict of interest

The authors have declared that no competing interests exist.

Artificial Intelligence (AI) use

The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI. No AI tools were used in the preparation of this manuscript.

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Author contributions

Conceptualization: MS and EU; methodology: MS and KV; software: KV, ST, and MV; validation: YI and KY; formal analysis: KY and PP; investigation: MS, MV, and MSV; resources: ZN; data curation: MS; writing—original draft preparation: ZN and KI; writing—review and editing: MS, EU, and ST; visualization: MV; supervision: KY and PP; project administration: ST; funding acquisition: PP and MSV; translation and correction: KI.

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Data availability

The original contributions presented in this study are included in the article material. Further inquiries can be directed to the corresponding author.