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EDITORS' NOTE

Dear Readers!

We present to you the first issue of the "Central European Nursing Review" - a new, peer-reviewed, interdisciplinary journal in the field of medical sciences and health sciences, published by the Nursing Department of the Józef Gołuchowski University of Applied Sciences.

The main aim of the journal is to be a forum for the exchange of scientific thought for medical communities representing various fields of medicine and health sciences, such as medicine, nursing, physiotherapy, obstetrics, pharmacy and others. The journal is also meant to contribute to greater integration of the medical community not only in the country, but also on the international arena. Our intention is to publish original papers, case reports, review and review articles, recommendations and materials recognized by the Editorial Board as valuable in terms of the content.

In the first issue you will find selected articles dealing with issues such as: professional burnout of a group of paramedics, violence against women in terms of their health and knowledge of non-medical communities in the field of principles and skills of cardiopulmonary resuscitation. As part of the exchange of international scientific experience, presented are also scientific articles from the field of molecular medicine that deal with the impact of opioids on the functioning of cardiomyocytes based on experimental studies of the impact of SARS CoV-2 infection on the occurrence of pre-eclampsia in pregnant women.

We are convinced that the multidisciplinary profile of our journal will enable each of the readers to find something interesting in it – namely those who are looking for new information in the field of their scientific interests as well as those who are willing to expand them and are looking for new challenges and directions of research, and are also interested in publishing their scientific achievements in our journal.

Monika Borek
Editor-In-Chief

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THE HEALTH OF WOMEN EXPERIENCING VIOLENCE[6]

Abstract:
Introduction. *Health is one of the most important aspects of human life. Throughout history, the concept of health has been defined in various ways. In contemporary (especially medical) literature, health is often explained using the World Health Organization (WHO) definition. According to its authors, it is a state of physical, mental and social well-being, and not only the absence of disease or disability [1]. Health is often associated with prosperity, happiness, success, strength, and beauty [2]. However, it acquires*

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a different meaning in the situation of its loss, which occurs quite often among women who experience violence [3-5]. ***Aim.*** *The aim of the research was to search for a relationship between experiencing violence and: - subjective assessment of health condition; - understanding the concept of "health".* ***Material and method.*** *The research was conducted among 610 women, including 305 experiencing violence by their husband or partner and 305 who did not. The research was carried out by the method of diagnostic survey with the use of the proprietary questionnaire and the standardised List of Health Criteria (PL: LKZ).* ***Results.*** *The BMI was calculated on the basis of the anthropometric data (weight and height) of the examined women. According to the WHO division, the correct value was noticed in 342 (56.1%) people, overweight in 169 (27.7%), obesity in 68 (11.1%), and underweight in 31 (5.1%).The subjective assessment of health in the test group ranged from 0 to 10 (Me 6; Q_1 5; Q_3 8) points, and in the control group from 1 to 10 (Me 8; Q_1 6,5; Q_3 9) points.208 respondents (34.1% of all respondents) confirmed having undergone treatment for various chronic diseases while 402 (65.9%) did not. The most common symptoms in the study group were: neurosis (45; 36.9% of this group), depression (36; 29.5%), heart disease (30; 24.6%) and arterial hypertension (27; 22.1%). Whereas in the control group – arterial hypertension (37; 43.0%), diseases of the thyroid gland (18; 20.9%), heart (8; 10.5%) and respiratory diseases (8; 9.3%). The highest average health ranks in the study group were: feel happy most of the time (1.5148), feel no physical ailments (1.2164), be able to solve your own problems (1.1967), be able to enjoy life (0.9439) and have all body parts functioning (0.8885). However, in the control group these are: feel happy most of the time (1.2721), have all parts of the body functioning (1.0951), take care of rest, sleep (1.0888), eat properly (0.9574) and be able to enjoy life (0.8689).* ***Results.*** *1. Women experiencing violence at the hands of their husband / partner have a lower assessment of their own health (compared to others), and many of them are treated for neurosis, depression, heart disease and high blood pressure. 2. Female victims understand "health" as a condition, a characteristic, and / or process, and those who do not experience it as a condition, as a characteristic, and / or result.*

Keywords:
violence, health.

Introduction

Health is one of the most important aspects of human life. Throughout history, the concept of health has been defined in various ways. The first

attempts to explain it appeared in ancient Greece. The philosophers of the time defined health as a balance between man and the environment, his soul and body, and the natural origin of the disease. One of the first was Aristotle, who initiated a holistic approach to health. According to Hippocrates, health is general well-being, good only in a subjective perception. The opposite definition was given by Descartes, who created the biomedical model of health. In the available literature on the subject, he has dominated the world of medical sciences for many years [6-8].

In contemporary (especially medical) literature, health is often explained using the World Health Organization (WHO) definition. According to its authors, it is a state of physical, mental and social well-being, and not only the absence of disease or disability [9]. This definition indicates a relationship between maintaining good physical condition and maintaining mental balance [6]. It focuses on health and its strengthening, and not on the disease. Nevertheless, with the development of medical knowledge, it is still undergoing some modifications.

More than forty years ago, the former Minister of Health of Canada, Lalonde, published his definition of health, in which he described it as a positive balance sheet of interactions, clearly emphasising that each person is largely responsible for their health, through their lifestyle and their health behaviour [10]. He also presented the main factors affecting health, including:

- lifestyle (50% of health);
- living environment (20%);
- biological factors (genes, inheritance) – 20%;
- health care organisation, which has the least impact – only 10%.

Lalonde's breakdown of health determinants remains valid. This is evidenced by the fact that some contemporary authors refer to it [7].

The understanding of health in everyday life may differ from the accepted scientific concepts and may differ from person to person. The overall health self-assessment is a component of the self-image of "I", and the diverse terminology of this concept results from the ability to fulfil specific social roles (e.g., age, gender, social situation). It turns out, however, that for most people being healthy means not experiencing any symptoms of a disease and the ability to fulfil social roles. However, he takes a different view in the event of health loss or chronic disease [7].

Health is often associated with prosperity, happiness, luck, success and beauty [2]. It acquires a different meaning in the situation of losing it, which is quite common among women experiencing violence at the hands of their husband / partner [3-5].

The phenomenon of violence among women experiencing it is difficult to estimate for various reasons. Many of its victims reveal the problem only in

situations of a direct threat to life and / or health [3-5]. The incomplete scale of the phenomenon, updated every year in our country, is presented through the statistics available on the website of the Police Headquarters [11]. For many women who experience violence, tragedies take place at home, often without any witnesses being present. It is not uncommon for these women to be dependent on their husbands / partners for various reasons. On their part, they experience all kinds of violence, ranging from physical, mental, economic, sexual or neglect. Often not in one form, but in a different combination [3,4]. As a further consequence, it often affects not only their negative health effects [3-5, 12-13].

Aim

The aim of the research was to search for a relationship between experiencing violence and:

- subjective assessment of health condition;
- understanding the concept of "health".

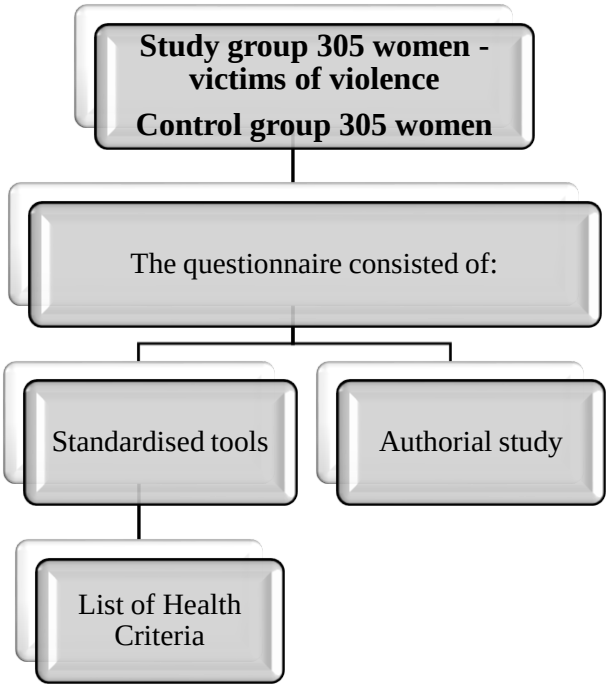
Material and methods

The research was conducted among 305 women experiencing violence by their husband or partner and a control group of 305 women who did not experience it.

The research used the method of diagnostic survey. The research tool was the original questionnaire, which contained questions about sociodemographic data and the subject of research, i.e., types of experienced violence by the husband / partner. The second questionnaire used contained a standardised tool, i.e., the List of Health Criteria (LKZ).

The diagram of the research tools discussed above is presented graphically in Figure 1 below.

Fig. 1. Diagram of the research tool for women (control group), including victims of violence (study group).



Source: own study.

Before starting the research, the respondents were informed about the purpose of the research as well as how to fill in the questionnaires. The research was voluntary and anonymous. It is worth adding that no respondent refused to participate in this research.

The collected results were analysed statistically and descriptively. The values of the analysed parameters, measured on the nominal scale, were characterised by the number and percentage, while on the quotient scale by the arithmetic mean and standard deviation, median, lower and upper quartiles, minimum and maximum values. The Chi-square test was used to assess the existence of differences or relationships between the analysed measurable parameters. A significance level of $p < 0.05$ was adopted in the study, indicating the existence of statistically significant differences or relationships. The database and statistical analysis were carried out on the basis of IBM SPSS Statistics (version 25) computer software.

List of Health Criteria (Polish: Lista Kryteriów Zdrowia LKZ) consists of 24 statements identifying the positive elements of the various dimensions of

physical, mental and social health. The examined person marks their preferences, which of the statements are important in the assessment of health, and among the selected statements, the most important in their opinion. In the next step, they select the five most important criteria in order to finally rank the selected criteria from the most important, which is assigned 5 points, to the least important, which is assessed with 1 point. The tool is designed to test adolescents and adults, both healthy and ill. Statements define health as: purpose, state, process, property, and result. The average examination time does not exceed 10 minutes [14].

Body Mass Index (BMI) was used to assess the body mass of the respondents, which was calculated using the formula [15]: BMI = body weight (kg)/ [height (m)]^2

BMI is your body weight in kilograms divided by your height in meters squared. The body weight classification is based on WHO, presented in Table 1.

Table 1. Classification of body weight depending on the BMI [15]

Classification	BMI [kg/m^2]
Underweight	< 18,5
Norm	18,5 – 24,9
Overweight	25,0 – 29,9
Obesity I^o	30,0 – 34,9
Obesity II^o	35,0 – 39,9
Obesity III^o	> 40

Source: own study.

Results

The age in the study group ranged from 21 to 75 years (Me 42; Q_1 35; Q_3 50)*. In the control group from 19 to 70 years (Me 45; Q_1 32; Q_3 50). The differences between these groups were not statistically variable (p = 0.323).

BMI was calculated on the basis of the anthropometric data (weight and height) of the examined women. According to the WHO division, the correct value was noticed in 342 (56.1%) people, overweight in 169 (27.7%), obesity in 68 (11.1%), and underweight in 31 (5.1%). The differences between the study groups are shown in Table 2.

Table 2. BMI values

BMI	**Study group**		**Control group**	
	n	**%**	**n**	**%**
Underweight n=31; 5,1%	18	5,9	13	4,3

Correct value n=342; 56,1%	183	60,0	159	52,1
Overweight n=169; 27,7%	79	25,9	90	29,5
Obesity n=68; 11,1%	25	8,2	43	14,1
Chi-square=7,971; p=0,047				

Source: own study.

The numerical distribution of data significantly differentiated the study groups (p = 0.047) in favour of the study group.

Subjective assessment of the current health condition of the respondents was made on a scale of 0 to 10 points. The results of the statistical analysis of the collected material are presented in Table 3.

Table 3. Subjective health assessment

Group	M	SD	Min	Max	Q1	Me	Q3
Study	6,39	2,03	0,00	10,00	5,00	6,00	8,00
Control	7,40	1,71	1,00	10,00	6,50	8,00	9,00
Total	6,90	1,94	0,00	10,00	5,00	7,00	8,00
t=-6,635; df=591; p<0,001							

M – average, SD – standard deviation, Min. – minimal value, Max. – maximum value, Q1 – lower quartile, Me – median, Q3 – upper quartile.

Source: own study.

The subjective assessment of health in the test group ranged from 0 to 10 (Me 6; Q_1 5; Q_3 8) points, and in the control group from 1 to 10 (Me 8; Q_1 6,5; Q_3 9) points. The differences between these groups were statistically significant (p <0.001), in favour of the control group.

208 respondents (34.1% of all respondents) confirmed having undergone treatment for various chronic diseases, while 402 (65.9%) have not. The differences in the frequency of these responses, taking into account the division into groups, are presented in Table 4.

Table 4. Treatment of chronic diseases

Undergone treatment for chronic diseases	Study group		Control group	
	n	%	n	%
Yes n=208; 34,1%	122	40,0	86	28,2
No n=402; 65,9%	183	60,0	219	71,8

Chi-square=8,937; p=0,003

Source: own study.

The differences in the frequency of the declared treatment of chronic diseases were statistically significant (p = 0.003) in favour of the study group.

With regards to chronic diseases, the respondents gave a total of 352 responses, including 236 (67.0%) in the study group and 116 (33.0%) in the control group. Due to the fact that they were repeated many times, the collected material was arranged and collected into 11 groups. These were: diseases of the heart, kidneys, liver, respiratory system, thyroid gland, arterial hypertension, diabetes, osteoporosis, neurosis, depression and others. In the study group, the most common symptoms were: neurosis (45; 36.9% of this group), depression (36; 29.5%), heart disease (30; 24.6%) and arterial hypertension (27; 22.1%). Whereas in the control group: arterial hypertension (37; 43.0%), diseases of the thyroid gland (18; 20.9%), heart (8; 10.5%) and respiratory diseases (8; 9.3%). The least frequent in the groups were: diseases of the kidneys (3; 2.5%) and liver (8; 6.6%); neurosis (2; 2.3%) and depression (2; 2.3%). The group "other" includes such diseases as: inflammation of the appendages, sinuses, joints, endometriosis, allergy, migraine, addiction to psychoactive substances and drugs.

List of Health Criteria

The mean average weights of health-related statements among all respondents in the study and control group are presented in Tables 5 and 6, respectively.

Table 5. Mean Average Weights of Health Claims – Study Group

For me, being healthy means...	Medium Rank	The definition of health
live to old age	0,8131	purpose
feel happy most of the time	**1,5148**	state
be able to get along well with other people	0,5934	process
know how to solve your own problems	**1,1967**	process
eat properly	0,6414	result
take care of rest, sleep	0,7311	result
drink little or no alcohol	0,4557	result
not smoke tobacco	0,6262	result
have the correct body weight	0,1776	result
take medications only in exceptional circumstances	0,2885	property

have a good mood	0,5672	property
feel no physical discomfort	**1,2164**	property
be able to work without tension and stress	0,5230	process
not to get ill, at most, occasionally from the flu, indigestion	0,4787	property
have healthy eyes, hair and skin	0,2164	property
be able to adapt to changes in life	0,6393	process
be able to enjoy life	**0,9439**	stan
be responsible	0,2557	purpose
be able to control your feelings and drives	0,2131	process
have all parts of the body in working order	**0,8885**	property
accept yourself, know your abilities and shortcomings	0,7566	purpose
have a job, various interests	0,2557	result
feel well	0,7344	state
almost never have to see a doctor	0,5016	property

Source: own study.

Table 6. Mean Average Weights of Health Claims – Control Group

For me, being healthy means...	Medium rank	The definition of health
live to old age	0,8295	purpose
feel happy most of the time	**1,2721**	state
be able to get along well with other people	0,7336	process
know how to solve your own problems	0,7902	process
eat properly	**0,9574**	result
take care of rest, sleep	**1,0888**	result
drink little or no alcohol	0,1738	result
not smoke tobacco	0,4441	result
have the correct body weight	0,5049	result
take medications only in exceptional circumstances	0,2928	property
have a good mood	0,2754	property
feel no physical discomfort	0,8557	property
be able to work without tension and stress	0,6787	process
not to get ill, at most, occasionally from the flu, indigestion	0,7738	property
have healthy eyes, hair and skin	0,2787	property
be able to adapt to changes in life	0,6525	process
be able to enjoy life	**0,8689**	state
be responsible	0,2426	purpose

be able to control your feelings and drives	0,1541	process
have all parts of the body in working order	**1,0951**	property
accept yourself, know your abilities and shortcomings	0,7672	purpose
have a job, various interests	0,3816	result
feel well	0,5541	state
almost never have to see a doctor	0,3082	property

Source: own study.

The highest medium ranks (weights) in the study group are: feel happy most of the time (1.5148), feel no physical ailments (1.2164), be able to solve your problems (1.1967), be able to enjoy life (0.9439) and have all body parts functioning properly (0.8885). However, in the control group these are: feel happy most of the time (1.2721), have all parts of the body functioning properly (1.0951), take care of rest, sleep (1.0888), eat properly (0.9574) and be able to enjoy life (0.8689).

Discussion

Normal BMI values were found more often in the study group (60%) than in the control group (52.1%). The opposite was true for overweight and obesity (analogous – 25.9% and 8.2% and 29.5% and 14.1%). On the other hand, six more women in the test group than in the control group were underweight. Comparing this data with the literature, it was difficult not to notice that the knowledge about the impact of violence on the nutritional status of women is quite limited. Some authors found a relationship between violence by a partner (especially physical) and a tendency for a higher BMI in victims of violence, as compared to those who did not experience it [16-18].

Others, on the other hand, argued that overweight and obesity in women experiencing violence may be related to the quite frequent occurrence of depressive mood in their case. They saw the causes of weight gain in the difficulty of coping with stress and alleviating negative emotions through excessive consumption of high-energy food [16, 19]. They also looked for a relationship between depression and limited physical activity of women, as well as paying less attention to what they eat and in what amounts [18]. Other authors presented a completely different position on the relationship between the experience of violence and the body weight of the victims [20]. In their relationships, women exposed to partner violence tend to have a lower BMI compared to others.

Incorrect body weight, especially excessive body weight, is associated with the appearance of various somatic and psychosocial problems, including an increased risk of premature death [21]. Information on the health of the

women participating in the research came only from their statements and their subjective assessments. It was impossible to find medical records, especially of the victims of violence for various reasons.

The collected material shows that over one third (34.1%) of the respondents were treated due to illness, and even several different chronic diseases. The differences between the groups were statistically significant ($p = 0.003$), in favour of the women in the test group who provided more of them. In the control group, arterial hypertension was the most frequent (43%), followed by thyroid disease (nearly 21%), heart and respiratory diseases (over 10% and 9%, respectively). It was different in the study group. The most common symptoms were neurosis (nearly 37%) and depression (30%). Then heart disease (25%) and hypertension (over 22%). No similar comparative studies have been found in the available literature. Most of the publications dealt with mental health. Some authors have presented their reviews on the relationship between the violence towards women and the occurrence of anxiety and / or depression [13,22,23] or post-traumatic stress disorder [22-24]. Other results of studies were conducted only among women experiencing violence [25-27], and still other results of comparative studies between the study and control groups [28, 29]. Regardless of the type of study, all authors agreed that violence against women has a negative impact on their health, including their mental health.

The results of the List of Health Criteria used in the research showed the preferences of women related to the defining categories of health, i.e., to what extent it is understood as a purpose, state, property, result and process. Differences between the studied groups were established on the basis of rank ordering of statements according to these criteria.

The highest ranks among all of the surveyed women were attributed to the following statements: feel happy most of the time, be able to solve your problems and have all body parts in good working order. In the group of women experiencing domestic violence: feel happy most of the time, be able to enjoy life; not feel any physical ailments, have all parts of the body functioning properly and be able to solve your problems. Whereas in the control group: to be happy most of the time, to be able to enjoy life; have all parts of the body functioning properly and take care of rest, eat properly. The highest rank values (weights) in the study group were found in relation to health understood as a state, and then as a process and a property. In the control group, as a state, and then as a property, the result. Significant differences between these groups concerned only the definitional property of the result ($p = 0.023$). In the case of other properties, they were insignificant ($p > 0.05$).

No similar research, conducted among abused women, was found in the available literature. In the material of Juczyński (the author of the List of Health Criteria), who studied a group of 82 adults, this was different. The utmost

importance was attributed to health as a state and purpose towards which we are aiming. Health as a process, property or result took further places [14].

Conclusions

Based on the research, the following conclusions were drawn:

1. Women who experience violence by their husband have a lower assessment of their health (compared to others), and many of them are treated for neurosis, depression, heart disease and high blood pressure.
2. Female victims understand "health" as a condition, a state, and / or process, and those who do not experience it as a condition, a state, and / or result. The first, the highest rank is assigned to the statements: feeling happy most of the time, not feeling any physical ailments, being able to solve your problems, and the second to being happy most of the time, having all parts of the body functioning properly, taking care of rest, sleep.

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CHANGES IN THE MITOCHONDRIAL APPARATUS OF CARDIOMYOCYTES UNDER THE INFLUENCE OF OPIOID IN THE EXPERIMENT[6]

Abstract:
This scientific work presents a theoretical summary and a new solution of the scientific task to establish peculiarities of the structure and some biochemical parameters of blood and organs of white rat's myocardium under normal conditions and under the prolonged effect of an opioid. The experiment was carried out on 53 male white rats 130-210 gr. body weight. The animals were divided into the 3 groups – experimental group (30 animals), control group (18

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animals) and 5 animals to study the norms before the experiment. Application of the optical and electron microscopy confirmed, that the white rat's myocardium is formed by muscle fibers that branch out and intertwine between themselves thus forming a peculiar reticulum. Myofibrils in their turn consist of a chain of sarcomeres restricted by Z-lines, each containing 2-3 mitochondria of all the 3 types. The first signs of impairment of the myocardium microstructure are noticeable after 7 days of nalbuphine injections to the white rats. During the following 35 days of the experiment pathological changes increase and are manifested through impairment of the well-defined structure of the myocardium, fragmentation of the muscle fibers, evident perivascular swelling, diffuse sclerosis; the small caliber vessels are characterized by the evident hyperemia with the "sludge syndrome" observed in the lumens of microvessels.

Keywords:
myocardium, microvasculature, white rat, mitochondria, nalbuphine.

Introduction

Nalbuphine hydrochloride is a nonscheduled potential analgesic, which belongs to the group of agonist-antagonist opioid receptors, widely used in different branches of medicine (1). The increasing popularity of nalbuphine in our country is due not only to its efficiency as a pain-killer and accessibility as a nonscheduled drug but because of using with non-medical purpose too (2). The data about an abuse potential of nalbuphine and social and medical problems, related to these questions, were frequently raised up in the literature. Drug addiction has been widely spreading in Ukraine in the last decade. According to the WHO there were about 400 000 injection drug users in Ukraine. Each year the number of drug users in Ukraine increases by 8-9 %. The negative is the fact that 70-75% of the drug addicts are young people under 25 years of age (3-5). The group of opioid analgesics is widely used these days in cases of chronic pain syndrome. Narcotic analgesics are traditionally prescribed and produce a positive effect on the pain syndrome of the wounded in the battlefield. The wide use of narcotic substances, their growing distribution and the spread of drug addiction necessitates a detailed study of the effect of opioids on the human organism. However, most of the findings are based on the clinical use of the drugs without a sufficient experimental study, especially regarding the morphological changes, which is totally unacceptable. Taking into consideration professional literature one can come to conclusion, that there is a whole range of unresolved problems concerning the morphological restructuring of the myocardium under the effect of the opioid.

Still insufficiently studied remain the issues of macro-, micro- and ultrastructural peculiarities of the myocardium microvasculature. This is why the study of morphological changes in the myocardium and its microvasculature under the effect of opioids in the experiment remains to be exceptionally topical. On another hand, numerous data demonstrated different side effects, caused by a long-term nalbuphine administration, including morphological changes of different organs (6-10). Heart, brain, liver, and kidney, are first organs, aimed by opioids in a case of a long-term administration (11-13). In particular, well-expressed changes in rats heart microstructure under the routine light microscopy, as well as changes of biochemical parameters were revealed in our previous studies (14, 15). With the purpose of better understanding the key mechanism of these changes, the transmission electron microscopy was planned as the next stage of our project. The disturbance of microcirculation and cardiomyocytes dystrophy were market previously as are the key moments in heart pathology as consequences of nalbuphine administration. But pathophysiology of these changes remains uncertain. Thus, the current study aimed to evaluate the long-term effect of nalbuphine hydrochloride on rats heart ultrastructure, in particular, to obtain a new data about heart, vessels endotheliocytes and cardiomyocytes changes, using electron microscopy and scanning electron microscopy.

Aim of the study

Aim of the study: to establish histological and ultramicroscopic peculiarities of the structure and microvasculature of the myocardium of the white rat in physiologically normal state; to determine morphological changes in the microvasculature and structural organization of the white rat's myocardium under the effect of an opioid on the microscopic level; investigate morphological changes in the microvasculature and structure of the white rat's myocardium under the effect of an opioid on the ultrastructural level; carry out stereological analysis of the changes in angioarchitecture and quantitative parameters of the white rat's cardiomyocytes under the effect of an opioid on the micro- and ultrastructural levels

Material and methods

The experiment was carried out on 53 male white rats 130-210 gr. body weight. The animals were divided into the 3 groups – experimental group (30 animals), control group (18 animals) and 5 animals to study the norms before the experiment. The experiment was conducted in accordance with the provision of the European Convention for the protection of the vertebrate animals used for the experimental and another scientific purpose from

24.11.1986 and the approved by Ethical Committee or Institutional Animal Care and Use Committee Approval, protocol №3 from 20.03.2015. The animals of the experimental group were daily injected by nalbuphine hydrochloride according to scheme what were proposed by Onysko and co-authors (16) with weekly dose increasing from 8 mg/kg body weight to 35 mg/kg body weight. Control group animals were injected daily by 0,5 ml saline. Heart samples (less than 1 mm in each direction) were taken at the end of every week after the intraperitoneal injection of sodium thiopental (25 mg per 1 kg body weight). After immediate fixation in 2,5 % buffered glutaraldehyde, the samples were prepared for the electron microscopy following standard procedure (17,18). For studying and photographing of the samples a microscope UEMV – 100K was used at an accelerating voltage of 75 kV and magnification range x2000-x15000.

Volume fraction (volume density) of mitochondria was calculated as $Vv(m) = V(m)/V(c)$, were $V(m)$ – volume of mitochondria, $V(c)$ – volume of cardiomyocyte cytoplasm. The volume of mitochondria and volume of cardiomyocyte cytoplasm were estimated using Stepanizer stereology tool v.1.0 with points test system.

For the analysis of the sample distribution, the histogram analysis, indicators of excess and asymmetry, as well as q-q plot analysis were performed. Since the data we obtained were differed from the normal distribution, the results were presented as Me (25%, 75%), where Me is a median, 25% - 25th percentile, 75% - 75th percentile, in addition to the general table indicates the interquartile range (IQR) of the obtained data. The Mann-Whitney U-test was used to check the significance of the difference between the control and experimental animal groups. The level of significance was set at $p < 0.05$

LibreOffice Calc v.5.2.2.2 spreadsheets were used for initial analysis and drawing of data in the form of tables and graphs. Microsoft Office Excel 2007, the software InVivoStat ver.3.0 and SofaStat v.1.4.6 were used for statistical analysis.

Results

By application of the optical and electron microscopy confirmed, that the white rat's myocardium is formed by muscle fibers that branch out and intertwine between themselves thus forming a peculiar reticulum. The myocardium muscle fibers formed by mono- or binuclear cardiomyocytes that in their cross-section have a rectangular form are contractile cardiomyocytes, formed by the bundles of located in parallel myofibrils restricted by sarcolemma. Myofibrils in their turn consist of a chain of sarcomeres restricted by Z-lines, each containing 2-3 mitochondria. Cardiomyocytes are

interconnected with the aid of the intercalated disks. Fissures between cardiomyocytes are filled with the loose connective tissue with the nerves and microvasculature components presented by arterioles, precapillary arteriole, capillaries of somatic, non-fenestrated type, postcapillary venules and venules. Aside from the contractile (typical) cardiomyocytes there is distinguished another type of the myocardium cells – conductive (atypical) cardiomyocytes, that form the heart conduction system, and the secretory cardiomyocytes.

For the first time regularities have been explained of the morphological changes in the white rat's myocardium under the prolonged effect of the opioid. In the course of injecting nalbuphine during 42 days there are observed ultrastructural changes in the myocardium and its microvasculature.

After 7 days of the experiment there were detected edemas between the bundles of cardiomyocyte myofibrils, between the neighboring cardiomyocytes, occasional destructive changes in mitochondria, a moderate edema in cytoplasm of endotheliocytes; in microvessels – platelet-erythrocytic sludges, nuclei of endotheliocytes with the signs of apoptosis; presence of cardiomyoblasts which indicates a restorative processes in the myocardium. After 14 days of the experiment there are observed growing changes in the myocardium structural organelles, specifically, there was found a vacuolar degeneration, separation of sarcolemma and myofibrils, marginal location of chromatin in the nucleus, invagination of the nuclear membrane; perivascular edema, presence of spreading masses of blood plasma in the vessels' lumen, deformation of endotheliocyte luminal surface. After 28 days it was found, that sarcolemma is disassociated, destroyed in some places, cardiomyocytes' nuclei translucent, mitochondria partially destroyed, Z-lies and M-lines destroyed, myofibrils fragmented, intercalated disks torn; pathologic folds on the luminal surface of endotheliocytes, erythrocytes with their change form and size. On the 42-nd day of the experiment there was found an expansion of the intercellular space, mosaic damages of cardiomyocytes where along with the preserved cardiomyocytes there are present destroyed sarcolemmas with villous deformation, destroyed mitochondria, Z-lines and M-lines, capillaries' walls are swollen, delaminated, endothelial contacts damaged.

By application of the optical and electron microscopy confirmed, that 3 types of mitochondria are distinguished in sarcoplasm of cardiomyocytes: type 1 mitochondria of elongated form that have a relatively large volume and a well-developed complex of cristae; type 2 mitochondria of round form that, compared with type I mitochondria have a smaller volume and a smaller number of cristae; type 3 mitochondria of a very small volume but with a great number of cristae. On the 7th day of the experiment rats of the experimental group showed a tendency towards the increase of the packing density index of all types of cardiomyocyte mitochondria. After 7 days of the experiment the white rats of the experimental group showed a tendency towards the increase of

the volume fraction of mitochondria to 24.44 (19.75; 27.84) % (the control group showed 17.44 (12.16; 25.00) %) with this index growing mainly owing to type 1 mitochondria. After 14 days of the experiment index of the volume fraction of mitochondria grew up to 26.74 (18.18; 31.87) % with the greatest growth, compared with the control group, of type 3 mitochondria index. After 28 days of the experiment destruction of mitochondria had led to a drop of the indices of the volume fraction of mitochondria to 19.48 (12.74; 28.7) %. Such a drop occurred mainly owing to the abrupt fall of the ratio of type 1 mitochondria. After 35 days the volume fraction of the type 1 and type 2 mitochondria fell to 12.5 (9.09; 15.58) % and 5.49 (2.34; 8.12) % respectively. The volume fraction of type 3 mitochondria attained its maximum during the experiment and made up 5.68 (3.23; 12.7) %.

Table 1. The volume fraction of the mitochondria (all types) of the white rat`s heart cardiomyocyte during 42 days of nalbuphine administration

Groups	Me	25%	75%	IQR	U test	p value
control	17.44	12.16	25	12.84		
7 day	24.44	19.75	27.84	8.09	140	0,078
14 day	26.74	18.18	31.87	13.69	132	0,029
21 day	21.69	15.29	36.36	21.07	169	0,21
28 day	19.48	12.74	28.7	15.96	133	0,58
35 day	16.09	12.5	23.21	10.71	157	0,90
42 day	16.13	7.97	26.82	18.85	139	0,72

Me – median, 25% - 25th percentile, 75% - 75th percentile, IQR – interquartile range, U-test – Mann-Whitney U test exact value.

Source: own study.

Tab. 2. The volume fraction of the mitochondria (type I) of the white rat`s heart cardiomyocyte during 42 days of nalbuphine administration

Groups	Me	25%	75%	IQR	U test	p value
control	10.94	6.94	16.30	9.36		
7 day	16.00	10.71	19.15	8.44	155	0,17
14 day	16.28	12.79	20.45	7.66	146	0,068

21 day	19.59	10.59	33.33	22.74	130	0,025
28 day	13.33	6.66	23.03	16.38	130	0,52
35 day	12.50	9.09	15.58	6.49	151	0,75
42 day	12.50	6.71	17.88	11.17	149	0,98

Me – median, 25% - 25th percentile, 75% - 75th percentile, IQR – interquartile range, U-test – Mann-Whitney U test exact value.

Source: own study.

Tab. 3. The volume fraction of the mitochondria (type II) of the white rat`s heart cardiomyocyte during 42 days of nalbuphine administration

Groups	**Me**	**25%**	**75%**	**IQR**	**U test**	**p value**
control	5.68	3.49	6.9	3.41		
7 day	6.74	3.57	10.59	7.02	118	0,53
14 day	7.69	4.83	10.38	5.55	111	0,17
21 day	2.69	2.06	7.35	5.29	55	0,09
28 day	5.02	3.49	7.02	3.53	76	0,51
35 day	5.49	2.34	8.12	5.77	71	0,60
42 day	6.95	2.50	10.22	7.73	67	0,80

Me – median, 25% - 25th percentile, 75% - 75th percentile, IQR – interquartile range, U-test – Mann-Whitney U test exact value.

Source: own study.

Tab. 4. The volume fraction of the mitochondria (type III) of the white rat`s heart cardiomyocyte during 42 days of nalbuphine administration.

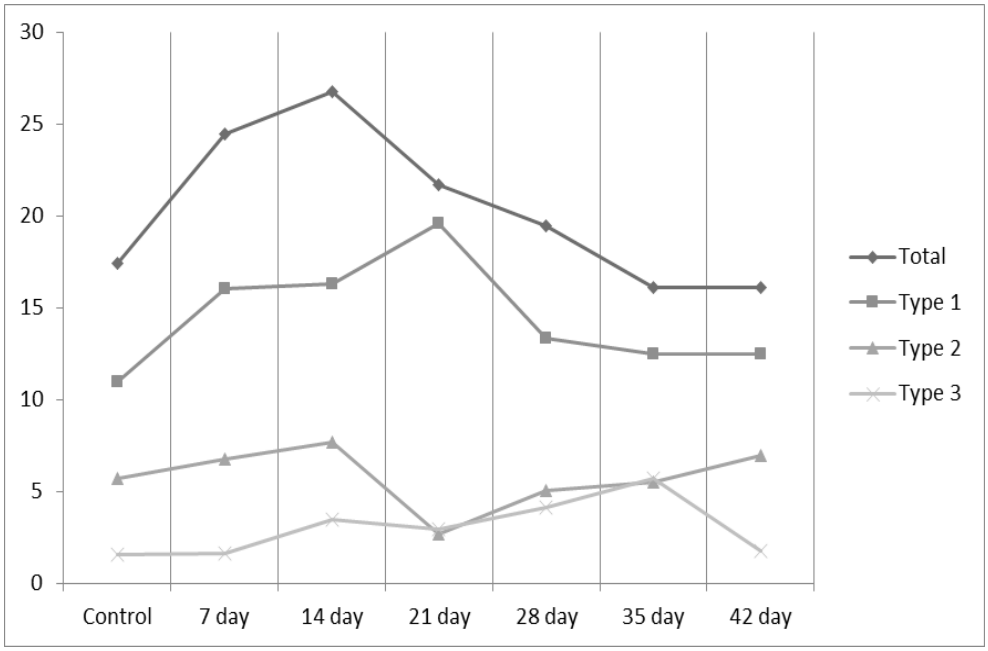
Groups	**Me**	**25%**	**75%**	**IQR**	**U test**	**p value**
control	1.58	1.28	3.49	2.21		
7 day	1.64	1.15	2.05	0.9	72	0,55
14 day	3.49	2.22	4.55	2.33	54	0,025

21 day	2.94	1.26	3.97	2.71	31	0,74
28 day	4.12	2.49	7.93	5.44	13	0,041
35 day	5.68	3.23	12.79	9.56	14	0,049
42 day	1.77	1.08	3.96	2.89	22	0,52

Me – median, 25% - 25th percentile, 75% - 75th percentile, IQR – interquartile range, U-test – Mann-Whitney U test exact value.

Source: own study.

Fig. 1. The volume fraction of the mitochondria of the white rat`s heart cardiomyocyte during 42 days of nalbuphine administration.



Source: own study.

The first signs of the disorders in the myocardium microstructure are noticeable after 7 days of nalbuphine injections to the white rats. During the following 35 days of the experiment pathological changes grow and are manifested through impairment of the well-defined structure, fragmentation of the muscle fibers, evident perivascular edema, diffuse sclerosis; the small caliber vessels are characterized by the evident hyperemia with the “sludge

syndrome" observed in the lumens of microvessels. Diffuse polymorphous infiltration is visualized of perivascular spaces by lymphocytes, macrophages and neutrophils.

Scanning electron microscopy of the white rat's heart in the course of the experiment showed changes in the relief of the interior surfaces of the heart chambers: shortened microvilli at the initial stages of the experiment and their absence, laminiform formations at the later stages. Deposits of fibrin strings, various erythrocytic figures and cholesterol crystals have been found on the interior surfaces of the heart chambers. Endotheliocytes are distributed chaotically, their form and sizes changed, endothelial contacts widened, plasmalemma of some endothelial cells forms processes with numerous microprocesses and microbubbles on their surfaces, the entire surface is covered with activated platelets and accumulations of altered erythrocytes (echinocytes, spherical, cupola-shaped, annular). Characteristic is the formation of erythrocytes and microthrombi sludges.

Having made the conclusions based on the results of our experimental study we can say that in case of drug intoxication typical is an acute disorder of microcirculation, signs of cardiosclerosis and fibrillation of atriums. Dystrophic damages of cardiomyocytes occur rather often. This permits us to speak of the narcogenic cardiomyopathy.

Discussion

Thus, the pathophysiology of these changes, caused in the rat's heart by the nalbuphine administration, can best be described as a mitochondrial and microcirculatory distress syndrome with parenchymal cells apoptosis development. The key point in the pathophysiology is the changes in mitochondria caused by POL system disturbance because of opioid administration. Opioid group's agents caused different changes in the POL system and the mechanism of these processes depending on the chemical structure of the particular drug (19-21). A critical level of mitochondria changes because of the POL system disturbance can initiate parenchymal cells apoptosis, which was revealed as the changes in cardiomyocytes nuclei morphology. The most researched compound from the opioid group is the morphine. But the experimental morphine administration more often caused rat's heart lipid dystrophy, as one of the most prominent sign, whereas nalbuphine caused swelling and the pattern of dystrophy. The local fat-storing vacuoles also observed at the ultrastructural level in a case of nalbuphine administration, but it does not lead to the well-expressed dystrophy, as in a case of morphine administration (12). Thus, these indicate that they have a different mechanism of POL system disturbance and pathology development. Moreover, we can suggest, that nalbuphine has an ability to block the peroxide because of

"scavenger" syndrome, similar to that was found in morphine in-vitro. It is only one way to explain why the increase of nalbuphine's doses does not lead to dramatic changes any at the microstructural, neither at the ultrastructural level.

The practical value of the obtained results

The obtained results of micro- and ultrastructural study of the myocardium and its microvasculature under the effect of 6 weeks long injections of the opioid are important not only for the morphologists, but for the clinicians as well. The obtained results allow us to extend the view of and resolve the issue of the effect of an opioid on the structure of the heart and its microvasculature, which creates the morphological basis for understanding pathogenesis and, subsequently, for determination of the optimal methods of diagnosing, prevention and treatment of cardiac diseases of patients, who had to use opioids for the prolonged periods of time, and that of the drug users.

Conclusion

The nalbuphine administration causes well-expressed changes on the ultra-structure of the rat heart. First of all, it's manifested as changes in the mitochondria shape, size and cristae design and numbers. Besides, there were changes in the nuclei of parenchymal cells – they becoming uneven in shape, with chromatin margination and fragmentation, what can indicate the beginning of apoptosis. Moreover, changes in the structure of microvascular flow occur – changes in the endothelial lining of heart microvessels, occlusion of the coronary vessels, erythrocytes and platelets aggregation to the luminal surface of endoteliocytes.

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ASSESSMENT OF NURSES' KNOWLEDGE OF FIRST AID[4]

Abstract:
Introduction*. In the event of sudden cardiac arrest, professionalism in the rescue effort is essential. Every factor of the undertaken actions is important to save human life. Medical personnel should demonstrate special ability to perform basic and advanced life support. Human life depends largely on this group. They should constantly improve their knowledge and skills to improve the quality of resuscitation activities.* ***Aim of the study.*** *To assess the state of knowledge of basic and advanced life support. among medical personnel working in hospital departments with different specificities.* ***Material and methods.*** *The study was conducted in the Warmian-Masurian Voivodeship in 3 hospitals in surgical and conservative departments as well as anesthesiology and intensive care unit. The participants of the study were 100 nursing staff. The survey questionnaire consisted of 25 questions.* ***Results.*** *Based on the analyzed studies, it can be concluded that the level of knowledge in basic and advanced life support among nursing staff is average. Higher level of knowledge was distinguished by persons who completed a specialist course: "Cardiopulmonary Resuscitation" and specialization in nursing.*

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Keywords:
nursing, BLS, ALS, sudden cardiac arrest

Introduction

The paper presents an assessment of the nurses' knowledge of first aid and emergency medical procedures. It is an interesting issue mainly because it is the respondents, by reason of their profession, often find themselves in situations in which someone's health and life may be endangered. Their knowledge may indirectly contribute to the success of rescue operations on the street, but also in their workplaces.

Basic life support in adults is aimed at restoring cardiovascular function.

The subject of resuscitation actions is the injured person, whose life is endangered, and the dying process has started in one of the systems affecting his life, starting from the respiratory system, cardiovascular system or the central nervous system [1]. The success of an emergency response depends on many factors, the key being: the time from cardiac arrest to successful resuscitation, knowledge, skills and organization of actions of a rescuer, as well as the potential viability of the injured person [1, 2, 3].

Material and methods

The study was carried out in 3 hospitals in the Warmińsko-Mazurskie Voivodship in surgical, conservative, anesthesiology and intensive care departments. The study participants included 100 nursing staff. The study was conducted from December 2019 to April 2020.

A diagnostic survey method was used in the study. The research tool was the author's survey questionnaire.

The survey questionnaire consisted of 25 questions, 9 of which were demographic, and the remaining 16 related to knowledge of basic and advanced life support.

All statistical calculations were performed using IBM SPSS 23 statistical package and Excel 2016 spreadsheet.

Qualitative variables were presented by counts and percentages, and quantitative variable was characterized by arithmetic mean and standard deviation. The significance of differences between more than two groups was tested using the Kruskal-Wallis test (Bonferroni post hoc tests were used when significant differences were obtained), and between two groups using the Mann-Whitney U test and Student's t test. In all calculations, $p \leq 0.05$ was used as the level of significance.

The aim of the study is to assess the knowledge of basic and advanced life support (BLS, ALS) of medical staff working in hospital departments with different specificities.

Results

A total of 100 nursing staff participated in the study. This included 66 women and 34 men. Most respondents were aged 20-25 years and the least were aged over 50 years.

The largest number of respondents had the short work experience. The largest number of people who responded were those with a bachelor's degree. The majority of those completing the questionnaire work in surgical departments.

There are few respondents with specialization in nursing. Among the nurses with a specialization, the largest number graduated from conservative nursing.

Table 1. Statistical summary

Age of the respondents	**N**	**%**
20-25	35	35,0
26-30	22	22,0
31-40	18	18,0
41-50	18	18,0
over 50 years old	7	7,0
Seniority		
0-4	53	
5-10	18	
11-20	12	
over 20 years	17	
Education		
medical high school	4	
vocational study	3	
Bachelor's degree	63	
Master's degree	30	

Source: own study.

Table 2. Statistical summary

Specialization	

Anesthetic and intensive care nursing	7
Surgical nursing	9
Emergency nursing	2
Internal medicine nursing	11
no specialization	71

Source: own study.

Table 3. Statistical summary

Departments	N
Surgical department	45
Internal medicine department	36
Department of Anesthesiology and Intensive Care	19

Source: own study.

Analysis of the results

Is the level of knowledge of medical personnel about the principles of BLS and ALS management sufficient?

To determine the level of knowledge, the number of points from the questions determining the level of knowledge in each question was summed up, and then descriptive statistics were calculated for the new variable thus created. The data is presented in the table below.

Table 4. Statistical summary

Descriptive statistics	**N**	**Min**	**Max**	**M**	**SD**	**K-S**	**P**
Level of knowledge	100	5	17	**12,93**	2,78	1,20	0,112

Source: own study.

The scores that could be obtained in the questionnaire measuring the level of knowledge ranged from 0 to 17. The lowest result obtained by the respondents was Min = 5 and the highest was Max = 17. The mean result was M = 12.93 with the standard deviation SD = 2.78. The mean result obtained indicates the average level of knowledge of the respondents. The distribution of the results is consistent with the normal distribution, which is confirmed by the Kolomogorov-Smirnov normality test (K-S (100) ¬ = 1.20; p> 0.05).

Does the gender of medical personnel influence the level of knowledge about the principles of BLS and ALS management?

The parametric Student's t-test was used. The analysis showed a relationship between the variables t (98) = 3.19; p <0.05. Men had a significantly higher knowledge of the knowledge of BLS and ALS principles than women.

Table 5. Statistical summary

Knowledge level vs gender	N	M	SD	t	Df	P
Woman	66	12,31	2,38	3,19	98	**0,002**
Man	34	14,11	3,15			

Source: own study.

Does the age of medical personnel affect the level of knowledge about the principles of BLS and ALS management?

The non-parametric Kruskal-Wallis test was used. The analysis did not show correlations between the variables. The age of respondents did not differ in the level of their knowledge H (4) = 7.36; p> 0.05.

Table 6. Statistical summary

Knowledge level vs age	N	M	SD	H	Df	P
20-25	35	12,25	2,81			
26-30	22	14,31	1,75			
31-40	18	12,88	2,92	7,36	4	0,118
41-50	18	12,77	3,15			
over 50 years old	7	12,42	3,15			

Source: own study.

Does the seniority of medical personnel affect the level of knowledge regarding the knowledge of the principles of BLS and ALS?

The non-parametric Kruskal-Wallis test was used. The analysis showed a relationship between the variables. The further analysis by means of multiple comparisons showed that, statistically significantly, the respondents with 5 to 10 years of work experience have a higher level of knowledge about the knowledge of BLS and ALS principles than the respondents working for over 20 years H (3) = 10.37; p <0.05. There were no significant differences p> 0.05 between the other groups.

Table 7. Statistical summary

Knowledge level vs work experience	N	M	SD	H	Df	P
0-4	53	12,60	2,49	10,37	3	**0,016**
5-10	18	14,27	2,53			
11-20	12	13,83	3,43			
over 20 years old	17	11,88	2,95			

Source: own study.

Does the education of medical personnel affect the level of knowledge about the principles of BLS and ALS management?

The non-parametric Kruskal-Wallis test was used. The analysis showed no relationship between the variables. The education of the surveyed respondents does not differentiate their level of knowledge H (3) = 4.40; p> 0.05.

Table 8. Statistical summary

Knowledge level vs education	N	M	SD	H	Df	P
Medical high school	4	12,25	2,75	4,40	3	0,221
Vocational study	3	12,66	4,93			
First-cycle studies	63	12,55	2,80			
Second-degree studies	30	13,83	2,43			

Source: own study.

Does the workplace of medical personnel affect the level of knowledge about the principles of BLS and ALS management?

The non-parametric Kruskal-Wallis test was used. The analysis showed a relationship between the variables. Further analysis by means of multiple comparisons showed that, statistically significantly, the highest level of knowledge about the knowledge of BLS and ALS principles was experienced by the respondents working in the Department of Anesthesiology and Intensive Therapy than those working in the surgical ward and internal medicine ward H (2) = 7.97; p <0.05. There were no significant differences p> 0.05 between the other groups.

Table 9. Statistical summary

Knowledge level vs workplace	N	M	SD	H	Df	P
Surgical department	45	12,53	2,31			
Internal medicine department	36	12,41	3,18	7,97	2	**0,019**
Depart. of anesth. and int. care	19	14,36	2,67			

Source: own study.

Does having the title of specialist in the field of nursing affect the level of knowledge about the principles of BLS and ALS management?

The non-parametric Mann Whitney U test was used. The analysis showed a relationship between the variables $Z = 2.43$; $p < 0.05$. A statistically significant higher level of knowledge was presented by people who had the title of specialist in the field of nursing.

Table 10. Statistical summary

The level of knowledge vs having the title of a specialist	N	M	SD	Z	P
Yes	29	14,03	2,36	2,43	**0,015**
Not	71	12,47	2,83		

Source: own study.

Does having a specialist course: "Cardiopulmonary resuscitation" affect the level of knowledge about the principles of BLS and ALS management?

Student's parametric t-test was used. The analysis showed a relationship between the variables $t(98) = 2.58$; $p < 0.05$. Significantly higher knowledge about the knowledge of BLS and ALS principles was found in the respondents who had completed the specialist course.

Table 11. Statistical summary

Knowledge level vs having a specialist course	N	M	SD	t	Df	P
Yes	55	13,56	2,82	2,58	98	**0,001**
Not	45	12,15	2,55			

Source: own study.

Discussion

Knowledge of basic and advanced life support should be a priority among healthcare professionals. These activities are essential procedures that have a decisive impact on human life during sudden cardiac arrest. Nursing staff must pay particular attention to updating knowledge of BLS and ALS in their work. A nurse is expected to do more than just call an ambulance. She should assess and prioritize and provide first aid in a competent and informed manner. The main aim of the procedure will be to protect life, then reduce suffering and prevent further injuries.

The study analyzes the level of knowledge of basic and advanced life support among nursing staff working in the departments of surgery, internal medicine, anesthesiology and intensive care. A total of 100 nurses participated in the study. The respondents included 66 women (66%) and 34 men (34%). Most people participating in the diagnostic survey were in the age range from 20 to 25 years. The smallest number of respondents was in the age group over 50.

The study found that the level of knowledge of the nursing staff in the field of basic and advanced life support was at an average level. The most difficult question for the respondents was: Whether it was possible to charge the paddles during chest compressions? Men presented a higher level of knowledge on resuscitation procedures than women. Based on the statistical analysis, the age of respondents did not affect the level of knowledge about BLS and ALS procedures.

The highest level of knowledge is represented by respondents working in hospital departments with 5 to 10 years of work experience. Low levels of first aid knowledge were observed among persons with seniority of more than 20 years. This may be because young people are more likely to take advantage of various forms of postgraduate education to improve their professional competence. Considering the place of work of the respondents, persons working in the department of anesthesiology and intensive care were distinguished by the highest level of knowledge in basic and advanced resuscitation procedures. The respondents who completed the specialist course in cardiopulmonary resuscitation demonstrated higher knowledge of the BLS and ALS principles. Age and higher education did not differentiate the level of knowledge in the field of basic and advanced life support.

Improving competences, including obtaining a specialist title in nursing, significantly improves the quality of knowledge of basic and advanced resuscitation procedures. This group made the fewest mistakes when completing the questionnaire. Similar study was conducted in 2019 by the Medical University of Warsaw on: "The level of knowledge of nursing staff about basic life support ". The research method used in the study was a questionnaire consisting of 19 questions. It was conducted among nurses from

various clinical departments. The study group consisted of 109 people [4]. Most of the respondents were over 40 (51.5%). The smallest group consisted of nursing staff aged 36-40 years (6.9%). The respondents were diverse in terms of education: 19 had graduated from medical high school, 11 had completed medical school, 37 had a bachelor's degree in nursing, 34 had a master's degree. Among the respondents, 13 had completed or were in the process of specialization [4]. The results of the study show that the respondents had sufficient about management algorithms, but insufficient knowledge of the use of external defibrillators.

Our study shows that the knowledge of respondents about cardiopulmonary resuscitation is at an average level. Higher levels of knowledge of the BLS and ALS principles were found among respondents who completed the specialist course in cardiopulmonary resuscitation. Age and higher education did not differentiate the level of knowledge of basic and advanced life support.

Conclusions

1. Nurses' knowledge of resuscitation activities is average.
2. Men showed a higher level of knowledge about performing life support.
3. The age of the surveyed medical personnel does not differentiate their knowledge of basic and advanced life support.
4. The seniority influences the level of knowledge of basic and advanced life support among the respondents. The highest level of knowledge was demonstrated by people with work experience between 5 to 10 years.
5. Education did not differentiate the level BLS and ALS knowledge among the surveyed nursing staff.
6. The highest level of knowledge was demonstrated by nurses working in the anesthesiology and intensive care unit.
7. Respondents with a specialist degree in nursing had a much higher level of knowledge in the management of BLS and ALS than those who did not have this title.
8. Among the respondents, the knowledge of BLS and ALS principles was significantly higher in those who completed the specialist course: Cardiopulmonary resuscitation.

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OCCUPATIONAL BURNOUT IN PARAMEDICS: A SYSTEMATIC REVIEW OF CURRENT RESEARCH[7]

Abstract:
Purpose. *The purpose of this paper was to analyze the current state of research on the burnout syndrome in paramedics, focusing on studies conducted in the past two decades.* ***Methods.*** *8 academic databases with published research papers and articles were analyzed: Academic Search Complete, Eric, Health Source-Consumer Edition, Health Source Nursing/Academic Edition, MEDLINE, PsychARTICLES, PsychINFO, SOCINDEX with Full Text. The analysis focused on original research on occupational burnout in paramedics*

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that met the following criteria: it had used the survey method and it had been done between 1997-2017. The 18 papers selected for analysis included the surveys of a total of 5478 emergency medicine professionals. 17 of the papers were cross-sectional studies and one was a 4-year longitudinal. A majority of the studies used the MBI questionnaire. ***Results*** *The overall results show that between 39% and as much as 75% of the surveyed paramedics exhibit severe emotional exhaustion. According to some of the studies, one in every five paramedics suffers from depression. The research also points to the correlation between exposure to traumatic events and somatic symptoms, such as back pain and sleep loss. Among the potential factors that might protect against burnout, the literature mentions primarily social support (from colleagues, the management or the partner) and personal characteristics (such as high self-efficacy and hope for success).* ***Conclusions.*** *All our outcomes suggest a huge necessity for more research to create targeted, counteract burnt down syndrome programs.*

Keywords:
Burnout, paramedics, occupational health, job satisfaction, social support, prevention

Introduction

Since the 1980s, Cristina Maslach, the inventor of the most commonly used instrument for measuring burnout (the MBI – Maslach Burnout Inventory), has been keenly interested in the issue of work engagement. Initially, she defined occupational burnout as a mental state, which is the result of prolonged work-related stress [1]. With the development of better diagnostic tools, she further elaborated her understanding of this problem, coming to the conclusion that the burnout syndrome is an emotional inner reaction caused by external factors, which may lead to loss of personal and social resources. In its essence, it is the discrepancy between what the employee is expected to do, and what he or she is actually capable of doing. This is connected with the core values adopted by the individual, the sense of decency, dignity, and free will. Once an individual becomes affected with burnout, his or her symptoms will gradually increase in magnitude over time, making the recovery increasingly more difficult [2]. In cases of extended exposure to a given stressor, the body may attempt to adapt to the new situation by going through three stages. In the first stage, the so called alarm stage, the General Adaptation Syndrome (GAS) allows the body to protect itself against stress, but at the same time it also negatively impacts the efficacy of the immune system. In this stage, the endocrine system, circulatory system, nervous system, muscular system, and the metabolism are all mobilized to allow

for the quickest possible resolution of the stressful event. In the second stage, i.e. the adaptation stage, the efficacy of the previously activated biological mechanisms starts so decrease. This happens due to the extended exposure to the stressor, as the body cannot continue to function on the same, elevated level of activity for extended periods of time. At this point, the body may also temporarily adapt to the situation by slightly increasing its own resistance (hence, the alternative name of this stage: the resistance stage). The end result of this stage is passive tolerance of the stressors. The stressful event should persist, the body will enter the exhaustion stage, which may even lead to death of the individual in some extreme cases. Progression through the stages is reversible, however. By using appropriate medical interventions, it is possible to normalize the individual's mental state [3].

The patients themselves may be the cause of severe stress for paramedics [4]. The desire to help, combined with unsuccessful intervention attempts, and sometimes helplessness have a direct impact on the paramedics' mental state. Popa et al. (2010) identifies lack of control and direct threats, e.g. made by intoxicated patients, as the main stressors present in this profession. Moreover, paramedics can never be certain of the results of the administered emergency treatment: it may lead to immediate improvement of the patient's condition or to his or her sudden death. Such uncertainty is also the basis for the feeling of powerlessness [5].

The dynamic character of the work is also an important aspect when considering burnout, as the situations of increased stress, to which the paramedics are often exposed, are punctuated with periods of relative calm [6]. Establishing personal relations in such conditions is more difficult, and the unaddressed trauma can affect the relations in the entire team, which may also pose a potential risk of burnout.

Being faced with such a multitude of factors that apparently have an impact on the work of paramedics, it is imperative to summarize the current state of research and draw general conclusions that will help to create prevention programs custom-tailored to the needs of this particular occupational group.

Methods. Purpose

The purpose of this paper is to analyze the current state of research on the burnout syndrome in paramedics, focusing on studies conducted in the past two decades.

The systematic review will allow for a better evaluation of the burnout levels in paramedics (1) and also for a more in-depth investigation of the factors involved in burnout, considering both individual and profession-specific characteristics (2).

This summary will also show how this problem has been addressed in research over the years. Thanks to the comprehensive approach adopted in this study, it will help to bring a better understanding of the specific needs of paramedics, and thus become a stepping stone for future attempts at creating concrete strategies for combating occupational burnout.

Used methods

8 academic databases with published research papers and articles were analyzed: Academic Search Complete, Eric, Health Source-Consumer Edition, Health Source Nursing/Academic Edition, MEDLINE, PsychARTICLES, PsychINFO, SOCINDEX with Full Text. The analysis focused on original research on occupational burnout in paramedics that met the following two criteria: it had used the survey method and it had been done in the past two decades (1997-2017). The preliminary results were then analyzed. For more precise search results, different combinations of the following keywords were used: paramedics, paramedic, EMP, emergency medical personnel, EMS, emergency medical service, ambulance work team, work stress, burnout, burnout syndrome, M.B.I.

Further analysis included articles that met the following criteria: A. Original research based on the survey method; B. the respondents were paramedics; C. the study was concerned with the factors of burnout.

Method description

The review of the literature available in the analyzed databases yielded 492 hits, some of which included articles that were not concerned with the problem of burnout in paramedics, but merely mentioned some of the keywords in the body of the text. To eliminate any unrelated articles, the search was narrowed down to only those that included a combination of keywords related to emergency medical services (paramedics, paramedic, EMP, emergency medical personnel, EMS, emergency medical service, ambulance work team) and those related to occupational burnout (work stress, burnout, burnout syndrome, M.B.I.). Thus, 90 articles that are directly connected with the burnout syndrome in emergency medical personnel were singled out. By restricting the search results to original research focused on paramedics (not nurses or physicians), 42 articles were excluded.

Due to the temporal scope of the analysis (past two decades of research), 7 additional articles were excluded. Furthermore, studies that did not include an English translation (i.e. were available only in Russian [7] or Chinese [8]) were also excluded from the analysis.

The final selection included 18 articles that met all three inclusion criteria.

A brief description of the selected studies, sorted chronologically, can be found in Table 1.

Results and discussion. Sampling and survey form

The 18 papers selected for analysis included the surveys of a total of 5478 emergency medicine professionals. Some of the studies, such as Schooley et al. (2016), make no distinction between different occupational groups [9], while others also introduce firefighters into the analysis [10] in addition to other analyzed occupations. The results, however, are presented separately.

The majority of the authors decided to separate the occupational groups to emphasize their individual characteristics. Not every study, however, compared the results between the groups. The rationale for treating emergency medicine professionals as a homogeneous group was that the nature of their work, the exposure to a strong stressor, and the connection with medicine constitute sufficient common denominators for that purpose.

The size of the samples was between 20 and as many as 1403 participants, which on average gives 79 respondents per survey. Not all of the authors provided the response rate of the conducted surveys. Based on the data, of the Canadian team led by Halpern (2012) made available by them, the return rate can be estimated to have been only 38.3% [11] and [12]. The remaining studies did not provide such information; however, it is worth noting that some of the respondents were soldiers of the People's Republic of China [13], who probably participated in the survey as part of their military duties.

The review included articles published in English by researchers from different countries: Canada (three articles), Republic of South Africa and Turkey (two articles each), but also Mexico, Italy, Romania, the Netherlands, France, Pakistan, India, Iran, China, and Hong Kong.

Due to the fact that the research teams did not publish any information on the work experience or gender of the respondents, it was not possible to formulate any general conclusions with regard to these factors.

17 of the reviewed articles presented the results of cross-sectional studies, which were conducted to analyze the chosen variables over a fixed period of time. Only the team from the Netherlands [14] conducted a 4-year longitudinal study to investigate the long-term effects of exposure to traumatic events.

Measurement instruments

The Maslach Burnout Inventory (MBI) or an adapted version of it was the most commonly chosen measurement instrument (it was used in 11 out of 18 studies), as it allows for evaluation with regard to the following scales:

emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). One article used the version of the instrument standardized for use in China i.e. the China Maslach Burnout Inventory or CMBI for short (Ho S.Y,&Lo R.Y, 2011 [15]). Five of the reviewed articles also used a version of the MBI questionnaire adapted for people working in human services (MBI HSS).

This version is usually used for social services and healthcare employees. Regardless of the MBI version used, burnout can be identified with high scores on the emotional exhaustion and depersonalization (cynicism) scales and low scores on the personal accomplishment (professional accomplishment) scale [16].

Four of the articles use the 30-item ProQOL scale (Professional Quality of Life). The following teams: Amjad et al. (2013) [17], King et al. (2014) [18], Chang (2011)[13] and Zaidi from Pakistan (2017) [10] used this instrument to control the overall level of burnout, without referring to any specific scales. One team chose an interesting combination of measurement instruments, using both surveys (ICI, Self-Efficacy Scale, SPS, BDI) and interviews to determine the feeling of support in a qualitative evaluation [19].

Regardless of the number of people surveyed, some researchers used few measurement instruments. For instance, Pereda-Torales et al. [20], Stein [21], Khatiban [22], and Popa[23] used only one survey. On the opposite end of this spectrum, there are research teams, such as those from Hong Kong [15] and RSA [24], who used four full surveys for only 35 and 20 respondents respectively.

Comprehensive burnout evaluation

Due to the considerable diversity in the research methods used to evaluate burnout throughout the past two decades, a general overview of the selected articles would not be comprehensive enough. However, the comparisons between specific results presented in the articles are worth exploring, especially if they share a common scale. Despite of the MBI survey being the common thread in all of the studies, the slight differences between some of its versions make summary of descriptive statistics difficult. Nevertheless, three of the articles (the ones from Iran [22], Turkey [9], and Mexico [20]) present their results in a very similar way. They do not provide the mean scores, using a percentage of the highest scores in each scale instead. The overall numbers for burnout presented in the above mentioned studies are, without any exaggeration, alarming. Between 39% [20] and as much as 75% [9] of the surveyed paramedics exhibit severe emotional exhaustion. Between 38% [22] and 84% [9] of the respondents also score high on the depersonalization scale. In accordance with the assumptions of the survey, the third scale, which

should be negatively correlated with the remaining two scales and the entire instrument in general, had the lowest scores. This means that the lower the PA score, the higher the risk of burnout. The PA scores in the reviewed articles were between 2.69% [22] and 56% [9].

Three of the research teams decided to correlate their results with regard to the burnout syndrome. Ho S.Y. (2011)[15] points to the negative correlation between burnout and hope for success (r=-0.62 $P<0.001$). Interestingly, two Canadian teams ([18] and [12]) have conducted independent investigations of the correlation between burnout and stress. Their results suggest a positive correlation between exposure to highly stressful events (trauma) and the onset of burnout symptoms in paramedics. In King et al., r=0.50 $P<0.001$, while in Harpeln et al. R=0.22 $P=0.003$.

Risk factors of occupational burnout

When investigating the correlates of occupational burnout in paramedics, some research teams decided to factor the mood of the participants into the analysis, although not in a direct manner. For instance, the Dutch team [14] has analyzed the sick leaves of the paramedics who participated in rescue operations after an explosion in a firework factory in 2000. The researchers have characterized this event as highly traumatic and considered it to be a potential catalyst for negative changes, both mental and somatic. Their study compared the number of sick leave days before the rescue operations and throughout the four years after the incident. The researchers noted a significant increase in the frequency of somatic symptoms, including back pain and loss of sleep. The number of sick leaves issued due to emotional problems and those issued by a neurologist has also increased. Although the study does not corroborate the correlation between trauma and burnout with statistical data, the authors strongly suggest that such a link exists.

Harpeln et al. [11] has come to the same conclusion on the matter after analyzing a group of 189 paramedics. The results of their analysis have shown a positive correlation between burnout and somatic symptoms (R=0.24 $P<0.003$). Furthermore, the researchers have also uncovered a correlation between the burnout syndrome and depression (R=0.38 $P<0.001$). The severity of depression was also analyzed by the Turkish team [25], who used the Beck Depression Inventory (M=10.00 SD=7.84). Unfortunately, all of the correlations between particular MBI and BDI scales posited by the researchers did not meet the threshold for statistical significance. The above mentioned scale was also used by Rogehr [19]. By analyzing a group of 86 paramedics, Rogehr has determined that 2.3% of them suffer from severe depression and 18.6% has had symptoms of moderate depression in the past. In other words,

one in every five of the surveyed paramedics suffers from clinical depression that might be connected with the nature of their work.

Protective factors in occupational burnout

By conducting cross-sectional studies, the researchers have also attempted to investigate the factors that may help to prevent burnout. Two of the reviewed articles put considerable emphasis on social support. Setti et al. [26] has shown a negative correlation between burnout and social support on a sample of n=782. An analysis of the particular scales also reveals a correlation between support offered by colleagues (EE r=-0.23 $P<0.01$; DP r=-0.204 $P<0.01$; PA r=-0.152 $P<0.01$) and support provided by the management (EE r=-0.203 $P<0.01$; DP r=-0.236 $P<0.01$; PA r=-0.114 $P<0.01$). Unfortunately, the results on the correlation between family support and burnout presented in the above mentioned study are not statistically significant.

On the other hand, the study conducted by King [18] has shown that the partners of paramedics, who are not themselves employed in healthcare, were exposed to equally high stress because they were worried about the welfare of their partner; however, King has also found that the emotional bond shared by the partners is contributing to a faster recovery from stress and better coping for both of them.

In the reviewed articles, two teams have identified certain personal characteristics that are negatively correlated with burnout. Therefore, if we help individuals to maintain a high level of these characteristics, the risk of developing burnout will decrease. According to Pratti et al. [27], self-efficacy is one of such characteristics, as the study has shown a negative correlation between perceived self-efficacy and potential occupational burnout (r=-0.29 $P<0.001$).

Hope for success seems be another personal characteristic that can work as a preventive measure against the effects of emotionally exhausting work. The study conducted by the researchers from Hong Kong [15] has revealed a strong negative correlation between burnout and hope for success (r=-0.62 $P<0.001$). It has also demonstrated as link between PTSD symptoms and burnout, but it is not as robust (r=-0.39 $P<0.05$). The results of the two studies mentioned above provide a compelling reason for putting more emphasis on the development of prevention programs that monitor personal characteristics such as self-efficacy and hope for success.

Conclusions and future perspective

The primary goal of this systematic review of the literature on occupational burnout in paramedics was to analyze of the state of the research

done in the past two decades. However, a preliminary investigation of the available articles on burnout has revealed that research devoted to this problem reaches further back. At the beginning of the 21st century, the focus of burnout researchers has shifted from corporate employees [28] to healthcare professionals, and thus the first instruments for that type of research were developed. Initially, the very definition of what constitutes burnout was controversial, which has made the efforts to create specialized surveys more difficult (there whereas many as 48 different definitions of burnout in the 80s). Hence, actual research on occupational burnout started to get published only after the concept of burnout had been more precisely delineated [30].

Although this review set out to analyze articles published during the past two decades, the analysis was eventually limited to studies conducted between 2007 and 2017. This is due to the fact that earlier research on the topic was mostly descriptive.

However, thanks to this phase of theoretical deliberations, research teams were offered a greater choice of measurement instruments and could choose one that would be the best fit for their target group. The Maslach Burnout Inventory and its modified versions are still the most popular choice ([20], [15], [11], [22], [9], [18], [26], [23], [24], [25]). Despite of the fact that this instrument allows for separate analysis of different scales (emotional exhaustion, depersonalization and personal accomplishment), some studies only provide the overall level of burnout. This is helpful in putting the general picture of the burnout syndrome together across different countries.

Some of the teams have chosen less common but more highly specialized instruments, adapting their methods to the research problem at hand. For instance, the South African group [21] used the Copenhagen Burnout Inventory (CBI), which distinguishes between the different causes of burnout instead of grouping them together, as it is the case with the MBI. The CBI includes scales that can be used to determine whether the reason for burnout stems from issues related to patients, work management or personal life. This instrument has allowed the researchers to develop a rapid intervention plan that could be used to stop the progression of burnout, which was especially important given the fact that the respondents in their study were medical rescue students whose work experience was limited to apprenticeship.

For a more individual approach, the researchers have also used interviews. Although this method is less common in this field of study, two teams from Canada have independently decided to include interviews in their cross-sectional studies [11][19]. It is worth noting, however, that the team led by Harpeln was gathering qualitative data on highly traumatic events (which exposes the respondents to potential re-traumatization), and that Roger (2007) analyzed responses on the perceived social support, which may lead to a decrease in emotional stress [31].

On the basis of the cross-cultural data provided by this review, we conclude that occupational burnout is not correlated with place of residence and the religious or cultural background of the emergency medicine professionals. The review included studies conducted in highly developed countries, such as Canada [11][12][19], France [26], Italy [27]; and developing countries, such as India [17], Pakistan[10], Turkey [9], and Romania [23]; but also in communist states [13]. It is the profession of the respondents and the nature of their work environment that constitutes the common thread in all of the reviewed articles.

Gender, on the other hand, does not seem to influence of the risk of burnout [27]. Women working in emergency medical teams seem to be at equally high risk of developing burnout as men.

The main factors of burnout, i.e. potential threat to life, diminished sense of control, organizational difficulties, feeling of failure, and constant stress [29], are independent from demographic factors. Hence, being employed in emergency medicine itself raises the risk of burnout.

It is noteworthy that some health workers underestimate interpersonal communication at work, which increases the sense of solitude [26][32].

However, if we consider the increase of quality of life and that the subjective assessment of happiness may increase, we would possibly contribute to reducing the risk of professional burnout [33].

Data gathering was an important step in preparing for this review. Thus, 8 databases were examined with burnout-related keywords. With articles which showed similar structure, the scope of the review was narrowed down to a few key terms [34]. The greatest advantage of this review is its comprehensive nature.

The number of articles published on burnout in paramedics also provides interesting insights about the problem. Most international studies on medical professions focus on different target groups. A cursory analysis of the ’burnout’ + profession name combination in the databases have been chosen for this review have revealed 15,606 hits for nurses, 11,210 hits for psychologists, and 9,236 hits for physicians. This shows the great need for further research on paramedics that will help to create effective prevention programs.

Only a comprehensive examination of the emotional and somatic state of people who are at risk of burnout, and of their work environment will allow for the creation of programs that will effectively protect against occupational burnout. This paper took a closer look at burnout in a specific occupational group, and thus can be a stepping stone for future research on the problem of how to help paramedics maintain their job satisfaction.

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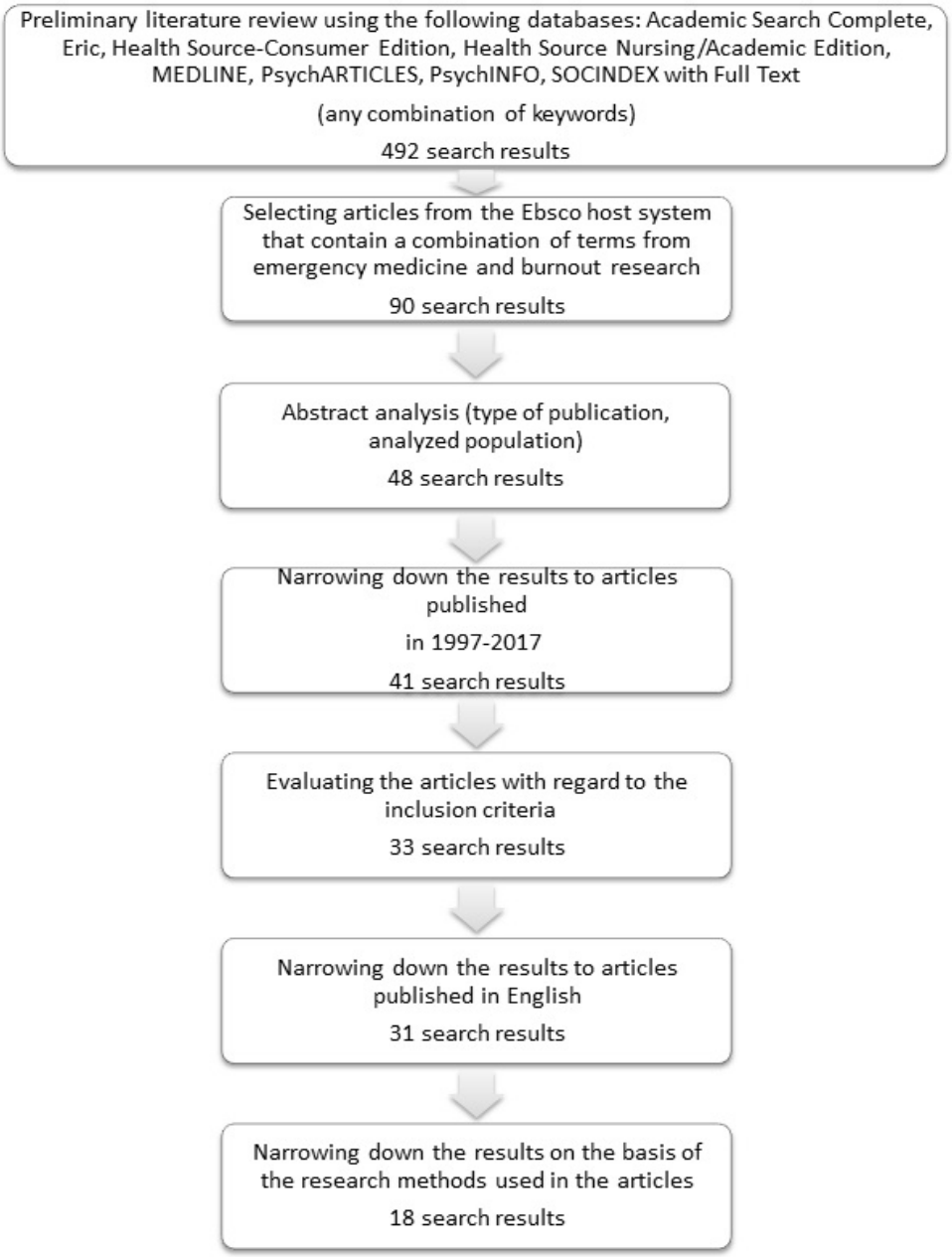
Figure 1. Strategies used to search from the literature



Source: own study.

Table 1. Summary of data

Author, date published country of origin	Type of publication	Survey participants	Research instruments	Analyzed variables	Burnout	Emotional exhaustion (EE)	Depersonalization (DP)	Reduced sense of personal accomplishment (PA)	Other
Zaidi et al. (2017) [10] Pakistan	CS	N=185 100 paramedics 85 firefighters	Professional Quality of Life ProQOL	-Burnout -Secondary stress - Compassion	M= 22.48 SD=4.46	N.D.	N.D.	N.D.	
Setti et al. (2016) [26] France	CS	N=782	-Secondary Traumatic Stress Scale STSS -MBI -Support Appraisal for work stressors Inventory -Family Support Inventory for workers -The Affective Subscale of Organizational Commitment Questionnaire	-Burnout -Social support: colleagues, management, family -Traumatization	N.D.	M= 1.73 SD= 1.30	M= 1.60 SD =1.36	M= 1.73 SD= 1.10	
Stein et al. (2016) [21] RSA	CS	N= 110 Fourth year medical rescue students	-Copenhagen Burnout Inventory CBI	- Burnout	N.D.	N.D.	N.D.	N.D.	Burnout identified in 31% of the students
Schooley et al. (2016) [9] Turkey	CS	N=250 Emergency medicine professionals (nurses, physicians, technicians)	- MBI - own survey	- Burnout - Demographic data	N.D.	75.6% of respondents with the highest score	84.4% of respondents with the highest score	56.12% of respondents with the highest score	
Khatiban et al.	CS	N=260 Emergen	- MBI	-Burnout -Quality	N.D.	46.54% of res-	38.85% of res-	2.69% of responde	

(2015)[22] Iran		cy medicine professionals		of life -Sense of accomplishment		pondents with the highest score	pondents with the highest score	nts with the highest score	
King et al. (2014) [18] Canada	CS	87 teams of two, in which one person is a paramedic	-Perceived Stress Scale PSS-4 -MBI HSS - Rumination Reflection Questionnaire RRQ	-Work-related stress -Coping with partner's stress	M=1.36 SD=1.23	N.D.	N.D.	N.D.	Stress + burnout r= 0.5 *P*<0.001
Nel et al. (2013) [24] RSA	CS	N= 20	-Emotional Intelligence Scale EIS -Utrecht Work Engagement Scale UWES -MBI HSS -Work Evaluation Scale WES	-Emotional intelligence -Sense of accomplishment - Job requirements - Sense of professional accomplishment	N.D.	M= 15.24 SD= 7.21	M= 13.59 SD=9.26	N.D.	
GÖKÇEN et al. (2013) [25] Turkey	CS	N= 347 Emergency medicine professionals including 122 paramedics	-Minnesota Satisfaction Questionnaire MSQ -MBI -Beck Depression Inventory (BDI)	-Burnout -Severity of depression -Sense of professional accomplishment	N.D.	M=12.32 SD=7.31	M=5.92 SD=4.11	M=18.90 SD=6.52	Depression M = 10.00 SD = 7.84
Amjad et al. (2013) [17] India	CS	N=1122	-ProQOL -Organizational Commitment Questionnaire OCQ	-Quality of life -Work engagement	M=69.45 SD= 5.83	N.D.	N.D.	N.D.	
Halpern et al. (2012) [12] Canada	CS	N=189 ambulance paramedics	- Relationship Scale Questionnaire RSQ - Perit-	-Sense of uncertainty - Severity of depression -Burnout	N.D.	N.D.	N.D.	N.D.	Correlations: Burnout + depression (R = 0.38 p<0.001) Burnout +

			raumatic Dissociation Experience Questionnaire -MBI HSS -Brief COPE -Center for Epidemiologic Studies Depression Scale CES 10 - trauma survey	-PTSD symptoms					Trauma (R = 0.22 *P*<0.003) Burnout + somatic symptoms (R = 0.24 *P*<0.003)
Halpern et al. (2011) [11] Canada	CS	N=189 ambulance paramedics	-Relationship Scale Questionnaire RSQ -Peritraumatic Dissociation Experience Questionnaire -MBI HSS - Brief COPE - Posttraumatic Dissociation Experience Questionnaire - CES 10 for Depression	-Distress -Effects of exposure to stress	M=21.8 SD=11.6	N.D.	N.D.	N.D.	
Chang et al. (2011)[13] China	CS	N=102 military medical personnel	-ProQOL -Resilience Scale -Life Status Review Scale	-Burnout -Secondary trauma -Sense of personal accomplishment - Resilience	N.D.	N.D.	N.D.	N.D.	Trauma + Burnout correlation Chi2 = 1.76 *P*<0.05
Ho et al. (2011)[15] Hong	CS	N= 35 Emergency	-Impact of Event Scale	-Burnout -Hope of success	N.D.	M=46.58 SD=8.63	M=49.56 SD=9.29	M=45.00 SD=10.3	

Kong		medicine profess-sionals	Revised China CIES-R -MBI China -Adult Trait Hope ATH	-PTSD symp-toms					
Prati et al. (2010)[27] Italy	CS	N = 451 Emer-gency medicine profes-sionals including fire-fighters	-ProQOL	-Burnout -Self-efficacy -Compa-ssion	M = 1.90 SD=0.64	N.D.	N.D.	N.D.	
Popa et al. (2010)[23] Romania	CS	N= 4725 Emergen-cy medi-cine pro-fessionals including 258 para-medics	-MBI HSS	-Burnout	N.D.	0.63 with 95%Cl	0.46 with 95%Cl	5.01 with 95%Cl	
Pered-Torales et al. (2009) [20] Mexico	CS	N= 160 Emergen-cy medi-cine pro-fessionals	-MBI	-Burnout	N.D.	39.1% of respon-dents with the highest score	56.5% of respon-dents with the highest score	43.5% of respon-dents with the highest score	
Rogehr et al. (2007) [19] Canada	Mix CS + qualita-tive	N=86	-Internal Control Index -Self Efficacy Scale -Social Provi-sions -Social Provi-sions Scale SPS -Beck Depres-sion In-ventory BDI -Social support questionn aires	-Distress -Sense of control -Sense of support	N.D.	N.D.	N.D.	N.D.	2.3% showing severe depres-sion 77% of paramedi cs show no signs of depres-sion
Morren et al. (2007)[14] The Nether=lands	Longitu-dinal Descrip-tive	N=1403	-own survey on somatic symptoms and work absence	-Days of sick leave -Leave causes	N.D.	N.D.	N.D.	N.D.	

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COVID- 19 AND PREECLAMPSIA[3]

Abstract:
Background. *The novel coronavirus SAR-CoV-2 responsible for COVID-19 infection appears to be a significant threat globally, especially affecting vulnerable group of pregnant patients.According to the data obtained from National Center for Disease Control and Public Health (NCDC) of Georgia around 14.5% of pregnant women have been infected by COVID-19 from the onset of the illness outbreak. Data on the effects of the SARS-CoV-2 infection in pregnancy are still emerging. It seems interesting that contracting the infection might drastically change the outcome of pregnancy.* ***Methods.*** *During the study has searched and measured the amount of pregnant women with and also without the coved- 19 SARS- Cov-V-2 infection and compared with one other, it tells us about the preeclampsia in Georgian patients during pandemic, how it is being increased or otherwise increases or not, and can the results be considered as endemic advantages of the location of Georgia, cause of it ecological condition, or informational correct strategy.* ***Conclusion.*** *Preeclampsia is independently associated with COVID-19 during pregnancy; conditions are associated independently of and in an additive fashion with increased risks for preterm birth, the severe perinatal morbidity and mortality index, and composite adverse maternal outcome. Hence, preeclampsia seem to be a strong risk factor for SARS-CoV-2 infection and its related complications. There was no evidence to support that COVID-19 is etiologically associated with preeclampsia. COVID- 19 which is primarily a respiratory infection can have marked multiorgan vascular effects leading to hypotension, renal disease, thrombocytopenia and hepatic disorders, mostly the daily style became non*

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dynamic, as well as the statistic can't be changed by the influence of Covid-19, while it doesn't effects on if, so the study is ready to make much more clarify the condition of preeclampsia during covid infection and either without covid-19 as well, and make it clear what could be the reason of correlation between both of them. In our study all the cases had the same outcome resolved patients and no maternal and neonatal death to all of them. It's been thought that this outcome is directly connected with some environmental factors but it not yet even proved.

Keywords:
SARS-CoV-2; coronavirus; preeclampsia, outcome; perinatal;

Introduction

Preeclampsia is one of the 3 leading causes of maternal morbidity and mortality worldwide. During the past 50 years, there has been a significant reduction in the rates of eclampsia, maternal mortality, and maternal morbidity in the developed countries. Preeclampsia is a condition during pregnancy when a mother gather hypertension with the multisystem progressive disorder. It is caused by placental and maternal vascular dysfunction and resolves after birth over a variable period of time. Although approximately 90 percent of cases present in the late preterm (≥34 to <37 weeks), term (≥37 to <42 weeks), or postpartum (≥42 weeks) period and have good maternal, fetal, and newborn outcomes, the mother and child are still at increased risk for serious morbidity or mortality. The Coronavirus disease 2019 pandemic has had a significant impact on the lifestyle and maternal healthcare as well, The causes of it is not yet to clarify but has already thought that difficulties faced by healthcare systems in adapting to rapidly changing circumstances during the pandemic globally according to the income status of country. According to the data obtained from National Center for Disease Control and Public Health (NCDC) of Georgia around 14.5% of pregnant women have been infected by COVID-19 from the onset of the illness outbreak. Data on the effects of the SARS-CoV-2 infection in pregnancy are still emerging. COVID-19, which is primarily a respiratory infection, can have marked multi organ, vascular effects leading to hypertension, renal disease, thrombocytopenia, and hepatic injury. SARS-CoV-2 can produce direct endothelial damage, throb inflammation, dysregulation of immune responses, and alterations in angiotensin-converting enzyme 2–related pathways.1 Preeclampsia, but not gestational hypertension (GH), causes endothelial damage, placental oxidative stress, and an antiangiogenic state leading to hypertension and proteinuria,2 and similar multi organ effects as seen in severe cases of COVID-19.3 The met analysis of the research

demonstrates that SARS- CoV-2 infection during pregnancy was associated with a significant increase in the odds of pre-eclampsia. There was an increased risks of pre-eclampsia, eclampsia and HELLP syndrome in women with SARS-CoV-2 infection.

Objective

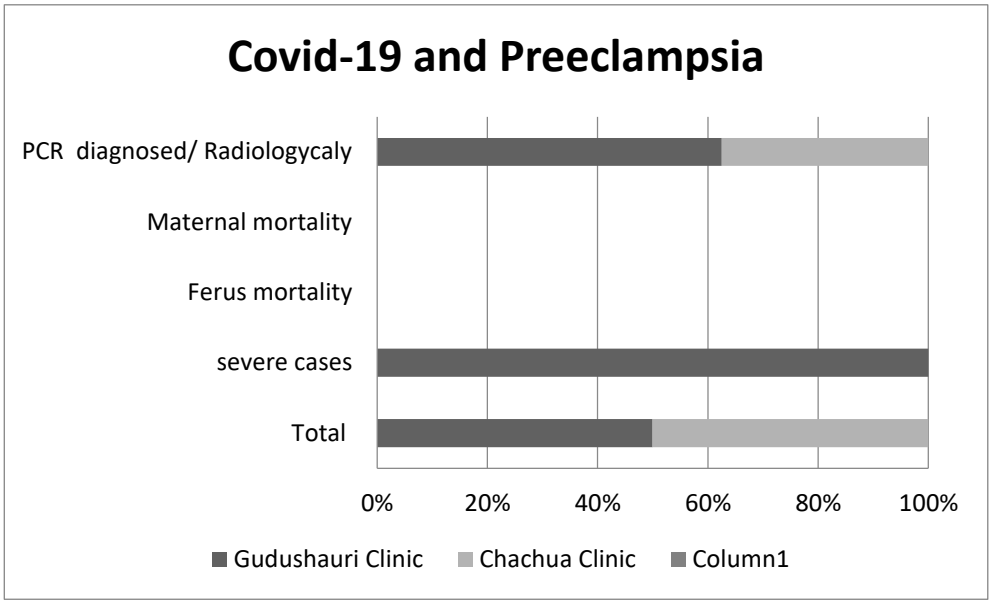
To determine the clinical manifestations, risk factors, and maternal and perinatal outcomes in pregnant and recently pregnant women with suspected or confirmed coronavirus disease 2019 (covid-19)and preeclampsia and to determine the effect of there variables on maternal morbidity or mortality.

Materials and Methods

The study has taken place in Tbilisi, it was moderate, longitudinal, prospective research and included pregnant women with suspected COVID-19. Subjects were divided into COVID-19 and non-COVID-19 groups based on the results of real-time polymerase chain reaction (RT-PCR) for severe acute respiratory syndrome coronavirus 2. Clinical characteristics, laboratory results, and pregnancy outcomes were compared between the two groups. This was case-control analysis of the Georgian Network of Covid-19 and Preeclampsia connection in Obstetric studies. The study took place in Covid- Clinic, and Maternity clinic as well, there enrolled 10-10 cases of diagnosed Covid-19 with preeclampsia and patients without it.

Of these 10 cases from CC, 5 (50%) were diagnosed withCOVID-19 during pregnancy on the basis of a laboratory confirmation (real-time polymerase chain reaction [RT-PCR) test and 20% by radiological confirmation. 30% of cases got an acute symptoms such as: high blood pressure (blood pressure higher or equal to 140x90mmHg in two or more measures), protein in their urine, and swelling in their legs, feet, and hands, epigastric pain. For all the patients there are some mandatory laboratory test while the patients have Covid-19 and Preeclampsia in the same time, Common blood count, Liver functions, Kidney functions, and Urine analysis .There was just one case who had chronic hypertension that had been diagnosed before pregnancy.

Fig. 1. Covid 19 and Preeclampsia



Source: own study.

Conclusion: Beside that there was appeared acute cases with suitable symptoms fortunately in Georgia didn't appeared fetus and maternal mortality.

Outcomes

The neonatal outcomes of interest were 2 from 10 cases preterm birth (32 weeks' gestation), frequency of small for gestational age (SGA) neonates (birthweight below the 10th percentile for gestational age). There was no neonatal and maternal death before and after hospital discharge.

Study Design

During the study has searched and measured the amount of pregnant women with and also without the coved- 19 SARS- Cov-V-2 infection and compared with one other, it tells us about the preeclampsia in Georgian patients during pandemic, how it is being increased or otherwise increases or not, and can the results be considered as endemic advantages of the location of Georgia, cause of it ecological condition, or informational correct strategy.

Pathophysiological mechanism of Covid-19 says that the cytokine storm (it's equal to cytokine storm syndrome) releases during the collapses of

alveoli by the RNA depending RNA polymerase action and production of corona virus inside of the alveolar cells, this provocates to damage the alveoli and release IL-1 IL6 and TNF- α, those ones are responsible for the inflammatory response activation, which could be similar as it's in preeclampsia.

To overview Preeclampsia pathogenesis we need to remind that placenta ischemia triggers the inflammatory responses and release cytokines, the most important issue in those case is that there may be occur the overlap of the symptoms and that's why part of the pregnant and the Doctors as well miss the preeclampsia, while the pregnant woman has the Covid-19 virus. In laboratory tasks there are similarity by the thrombocytopenia, increased ferritin level in the blood and pro-inflammatory cytokines as well.

Conclusion

Preeclampsia is independently associated with COVID-19 during pregnancy; conditions are associated independently of and in an additive fashion with increased risks for preterm birth, the severe perinatal morbidity and mortality index, and composite adverse maternal outcome. Hence, preeclampsia seem to be a strong risk factor for SARS-CoV-2 infection and its related complications. There was no evidence to support that COVID-19 is etiologically associated with preeclampsia. COVID- 19 which is primarily a respiratory infection can have marked multiorgan vascular effects leading to hypotension, renal disease, thrombocytopenia and hepatic disorders, mostly the daily style became non dynamic, as well as the statistic can't be changed by the influence of Covid-19, while it doesn't effects on if, so the study is ready to make much more clarify the condition of preeclampsia during covid infection and either without covid- 19 as well, and make it clear what could be the reason of correlation between both of them. In our study all the cases had the same outcome resolved patients and no maternal and neonatal death to all of them. It's been thought that this outcome is directly connected with some environmental factors but it not yet even proved. Beside that there was appeared acute cases with suitable symptoms fortunately in this clinic didn't appeared fetus and maternal mortality. These findings indicate that future research integrating all Covid- clinicas and rigorous examinations of environmental factors should lead to a better understanding of the relationship between Covid-19 and Preeclampsia outcomes. To accomplish this goal, further research may also benefit from investigating the impact of mechanisms related to prenatal influences.

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SELECTED FACTORS DETERMINING THE QUALITY OF CARDIOPULMONARY RESUSCITATION PERFORMED BY HEALTHCARE STUFF WITHOUT MEDICAL DEGREE[6]

Abstract:
Introduction. *A sudden cardiac arrest may occur in both intra-hospital and non-hospital environment. High quality of cardiopulmonary resuscitation (CPR) performed by bystander may be of crucial importance in increasing the survival rate.* ***Aim:*** *The aim of this study was to assess the influence of selected sociodemographic factors on the quality of CPR performed by healthcare stuff without medical degree.* ***Material and methods:*** *The simulation observational study was conducted among 138 healthcare employees without medical degree. Every subject performed CPR on the adult life-like manikin Little Anne QCPR.*

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The frequency and depth of compressions, relaxation and ventilation volume were measured and analyzed with the aid of dedicated SkillReporter Software Resusci Anne tablet. The measurable values were related to the guidelines of European Resuscitation Council 2021. The statistical analysis was calculated with SPSS 20 statistical software. ***Results:*** *Based on authors' own research, it was concluded that during CPR activities, females were more efficient in chest compressions with slower ventilation of high average volume, whereas males had higher average compression rate with sufficient depth and they ventilated faster and more shallow. Moreover, the higher number of chest compressions of adequate depth was observed with older age group with no significance in obtained ventilation parameters in both groups. People who completed basic resuscitation training, obtained significantly higher average results of ventilation and better tidal volume from the ones without such training.* ***Conclusions:*** *The gender, age and basic training in CPR substantially differentiate the quality of obtained cardiovascular and respiratory parameters. The acceptable quality of cardiovascular parameters with inadequate ventilation parameters were presented.*

Keywords:
cardiopulmonary resuscitation, hospital personnel, non-medical persons

Introduction

According to European Resuscitation Council (ERC) the frequency of occurrence of sudden cardiac arrest (SCA) in Europe ranges between 67 to 170 cases per 100 thousand residents per annum. The incidents most frequently happen in unexpected locations and times, thus creating a serious medical and social problem [1]. In United States alone, the cardiac arrest is registered among 290 thousand hospitalized patients, the main cause being heart (50-60%) and respiratory failure (15-40%) [2]. The priority actions at the scene include a fast emergency assistance, early resuscitation, ventilation and defibrillation. Early and correct proceeding is closely related with better treatment results of hospitalized patients and in out-of-hospital conditions [2,3]. The employment in health care center may increase the risk of contact with the patient in a life-threatening condition. Therefore, they are more often exposed to the situation which requires providing first pre-medical aid. Immediate rescue actions have a decisive influence on the health and life of the victim [4].

The analysis of the national results of the study showed the apparent interest in the respondents' knowledge level. The authors indicate the necessity of confronting the knowledge with the practical skill competence assessment, an essential element of the resuscitation activities [5,6]. The research into the

source of knowledge in the field of the first aid indicated the significant role of television – including the series, social media and also the word of mouth among friends and families. Nevertheless, such knowledge is different from the evidence-based medicine [7,3]. There is a research gap in the study where practical skills of potential rescuers were analyzed.

The main factors that may influence the standard of performed activities at the scene include: awareness, technique and fatigue of the rescuer, individual factors and training. Unfortunately people without medical degree are still unwilling to undertake direct life-saving activities, stating the reasons such as the fear of infection, inappropriate cardiopulmonary resuscitation (CPR) activities and legal consequences of such actions [8]. Additionally, students should be informed of the potential risks during CPR training. [9,10].

Current strategies of improving the quality of cardiopulmonary resuscitation should be based on the research results, including the technology to monitor the quality of cardiopulmonary resuscitation and provision of feedback [3]. The following study allows to determine whether the selected variables such as gender, age and training completion significantly influence the correct and effective execution of cardiopulmonary resuscitation.

Aim

The aim of this work was to assess the influence of sociodemographic factors on the quality of cardiopulmonary resuscitation performed by healthcare employees with no medical degree.

Material And Methods

The study received positive approval issued by the Bioethics Committee of the University of Rzeszów (Nr 2018/03/13e). It was conducted between July and September of 2017. The study took place in the Independent Public Healthcare Centre in Przeworsk.

The test group consisted of 138 healthcare employees with no medical degree employed in the facility. The sample selection was purposive. The accepted eligibility criteria included: voluntary participation, physical fitness that allows chest compression and ventilation, no medical degree directly connected with CPR in the workplace and employment in the medical sector. Non-inclusion criteria included: absence of consent to participate in the study, medical contra-indications disallowing chest compression and ventilation of manikin, working as a doctor, nurse, midwife or paramedic.

The sample group was divided into two age categories of 27-51 years of age (younger age group n=67), and older age group (n=71) 52-67 years of age. The division was made based on median age of the test subjects. The

sample group consisted of 60.1% females (N=83) and 39.9% males (N=55). 11.6% of the study group (N=16) including 16.4% males (N=9) and 8.4% females (N=7) underwent CPR training.

Immediately prior to the proper measurement, study participants were presented with simulation scenario for performing a two minute cardiopulmonary resuscitation in accordance with individual knowledge and skills. The activity was performed on the adult life-like manikin Little Anne QCPR (Laerdal Resusci Anne®, 50 kg, Laerdal, Norway). The measured activity parameters were registered through a monitoring panel SimPad SkillReporter Software Resusci Anne (Laerdal Norway 2015) for QCPR Little Anne manikins (Laerdal Resusci Anne®, 50 kg, Laerdal, Norway).

The following evaluation criteria were adopted:

1. chest compressions at a rate of 100-120 per minute with minimum intervals, waiting after each compression to regain its original shape,
2. chest compressions to the depth of below 5 cm, with 5-6 cm of correct value, above 6 cm,
3. ventilation below 500 ml, 500-600 ml of correct value, above 600 ml over-ventilation.

To verify the differences among variables, $\chi 2$ independence test, t test for independent samples and U Mann-Whitney test were used. The tests were selected to verify normality distributions of variables (Kolmogorow-Smirnov test with Lillefors modification and Shapiro-Wilka test). Moreover, the equipotency of groups was verified with $\chi 2$ test. The significance level was adopted to $p < 0.05$. The calculations were performed with SPSS 20 software.

Results

Based on authors' own research, it was concluded that the average percentage of chest compressions with adequate depth and its mean depth were significantly lower with females with reference to males ($p<0.001$). Notwithstanding, the female test group obtained a significantly higher percentage of fully released compressions (K: 85.93±26.31 vs. M: 68.09±35.03; $p<0.001$). Despite indicated differences, no significant variances in the mean percentage results of compressions for both genders were observed. In terms of ventilation parameters, males achieved a significantly higher mean tidal volume (380.78±523.46ml) than females (157.49±305.52 ml). The were no statistically significant differences observed for the ventilation of adequate tidal volume, considering the gender of the test group ($p=0.647$) (Table 1).

Table 1. The characteristics of selected parameters versus the gender of test subjects

Parameters	Females (N = 83)	Males (N = 71)	P-value
Average number of compressions [%]	59.1±32.1	62.4±30.8	0.546
Compressions fully released [%]	85.9±26.3	68.±35	< 0.001
Compressions with adequate depth [%]	53.9±40	85.5±28.2	<0.001
Mean depth [mm]	50.1±9.8	57.1±6.6	<0.001
Compressions with adequate frequency [%]	25.9±35.5	28.4±33.4	0.401
Average result of ventilation [%]	10.1±25.7	15.4±25.7	0.030
Tidal volume [ml]	380.78±523.46	157.4±305.5	0.014
Ventilation with adequate volume [%]	6.96±18.64	7.1±16.6	0.647
The frequency of all ventilation per session [/min]	0.55±1.34	1±1.5	0.019

Mann-Whitney U Test ; N – number of persons, the significance level was adopted to p<0.05

Source: own study.

Considering the age of the test subjects, the higher average percentage of chest compressions with adequate depth were with people of 52-67 years of age (71.5±37.9%) than with people of 27-51 years of age (61.2±39.5%). Moreover, in the older group, the average depth of compressions was significantly higher than with the younger group of 27-51 years of age (p=0.01). The average number of chest compressions fully released was significantly higher with people of 27-51 years of age (84.3±27.1%) than with people of 52-67 years of age (73.2±33.8%) (Table 2).

Table 2. The characteristics of selected parameters versus the age of test subjects

Parameters	Younger group 27-51 (N=67)	Older group 52-67(N=71)	P-value
Average number of compressions [%]	61.3±34.4	73.2±33.8	0.528
Compressions fully released [%]	84.3±27.1	73.2±33.8	0.002
Compressions with adequate depth [%]	61.2±39.5	71.5±37.9	0.037
Mean depth [mm]	50.9±9.1	54.7±9.3	0.014
Compressions with adequate frequency [%]	34.1±37.6	20.1±30.2	0.042
Average result of ventilation [%]	14.6±28.7	9.7±22.6	0.526

Tidal volume [ml]	219.7±377.8	271.7±456.4	0.945
Ventilation with adequate volume [%]	9.5±21.1	4.6±13.8	0.223
The frequency of all ventilation per session /min	0.8±1.5	0.6±1.3	0.618

Mann-Whitney U Test ; N – number of persons, the significance level was adopted to p<0.05

Source: own study.

Analytical determination of table 3 indicates that people with BLS training had significantly higher average result of ventilation (38.31±36.1%) than test subjects without such training (8.67±22.1%). Moreover the test group with BLS training had a higher average of tidal volume (635±522.6%) than test subjects without such training (195.52±377.79%). There were no statistically significant differences for ventilation with adequate tidal volume considering the BLS training among test subjects. There were no observed differences in quality of chest compressions for test subjects without CPR training (53.38±8.25) and with CPR training (53.38±8.25).

Table 3. The characteristics of selected parameters versus BLS training among test subjects

Parameters	BLS training		P-value
	YES (N=16)	NO (N=122)	
Average number of compressions [%]	66.5±32.8	59.6±31.4	0.420
Compressions fully released [%]	85.8±21.5	77.8±32.2	0.863
Compressions with adequate depth [%]	68.3±38.7	66.3±39.1	0.830
Mean depth [mm]	53.3±8.2	52.8±9.5	0.896
Compressions with adequate frequency [%]	32.7±36.6	26.1±34.4	0.332
Average result of ventilation [%]	38.3±36.1	8.6±22.1	< 0.001
Tidal volume [ml]	635. 0±52.6	195.5±377.7	0.002
Ventilation with adequate volume [%]	12.8±22.5	6.2±17.0	0.087
The frequency of all ventilation per session [/min]	2.3±2.02	0.5±1.2	<0.001

Mann-Whitney U test ; N – number of persons, the significance level was adopted to p<0.05

Source: own study.

The general percentage result while performing a two minute cardiopulmonary resuscitation for males equaled to (46.6±24.3%) and was comparable (p=0.51) to an average general result for females (44.1 ±24.6%). There were no statistically significant differences for the general result, including the age of test subjects (p=0.43). It was proven that people with BLS training decisively reached a higher general result (55.1±25.5%) than test subjects without such training (43.8±24.1%) (Table 4).

Table 4. Overall results by individual groups of subjects

Parameters		Overall result	P-value
Gender	Females	44.11 ±24.64%	0.519
	Males	46.69±24.35%	
Age [years]	27-51	46.57±26.44%	0.438
	52-67	43.79±22.56%	
BLS training	Yes	55.13±25.53%	0.045
	No	43.83±24.13%	

Mann-Whitney U test ; N – number of persons, the significance level was adopted to p<0.05.

Source: own study.

Discussion

The study assessed the influence of sociodemographic factors on the quality and efficacy of CPR activities performed by healthcare employees with no medical degree. The observation of test subjects revealed that resuscitation skills are not satisfactory. This applies to respiratory parameters, where volume of air was lower than accepted criteria for the test groups. The lower frequency of chest compressions versus the expected was also observed. Similar conclusions were described by Sitek et al., where the need was raised to study the quality and efficacy of CPR activities in practical simulations to check and correct mistakes [11]. Moreover, research carried by Szpunar et al. interestingly confirms the fact that non-professional knowledge and frequent passive eyewitness participation in CPR activities are not sufficient to perform correct resuscitation [12]. Król et al. share similar conclusions in analyzing knowledge of CPR amongst young people, stating furthermore that beside theoretical information, practical skills are of crucial importance with necessity of undertaking appropriate periodical basic CPR trainings, customized for the specific social group, underlining the fact of systematic changes in SCA

treatment algorithm [13]. It is also worth noting the observations of Więch et al., where research of medical test group proved a significant influence of body composition of people performing resuscitation on the chest compression and ventilation parameters. Over-mentioned authors describe the results of relation between anthropometrical measurements, nutritional status of participants and quality and efficacy of CPR [14].

Lin et al. In studies show that high-quality CPR improves survival outcomes. The author indicates the measurement of CPR process parameters as a standard in studies assessing the quality of resuscitation. It also describes the significant impact of real-time training feedback on the improvement of CPR quality in accordance with the guidelines [15, 16]. Souchtchenko SS mentions the correct positioning of the hands on the chest, the depth, the frequency of compressions, the degree of chest relaxation and properly conducted ventilation as factors significantly affecting the effectiveness of resuscitation [17]. Sari et al. Observed in the study that the use of the chart during CPR improves the quality of resuscitation [18].

Based on authors' own research, the number of chest compressions with adequate depth was significantly higher with older people of 52-67 years of age and amounted to 72% in relation to younger people of 27-51 years of age. Presented results were similar to the ones obtained by Fernando et al., where number of chest compressions with adequate depth were at 66% and 55%, with the average age of participants set at 62.3 years of age [19]. Skorning et al. obtained the results of chest compressions with adequate depth in the test group of 21-61 at the level of 45 % [20]. In turn, other research of chest compressions with adequate depth showed 70% in the test group of average age of 23 years (IQR 21-32) [21].

Non-medical healthcare employees achieved the depths of chest compressions on the level of (61.2±39.5). However, the study of Bucki et al. showed lower results for non-professionals of 36.03±1.22 mm. [22]. Analysis of gender influence indicated the fact that males had better results in depth of chest compressions (57.18±6.69) than females (50.10±9.88). The research of Lopez-Gonzalez et al. showed the data concerning the gender influence on the quality of chest compressions. The authors suggested that gender did not determine the efficacy of compressions, but the physical fatigue and BMI of the test subjects did, which would explain lack of unambiguous dominance of gender in the results obtained [23]. On the other hand, other studies also indicated that gender had a statistical significance on the number of male chest compressions [24].

Within the test group, the average result of ventilation among people with BLS training was 38%, whereas people without such training had merely 8.6%. Ventilation with adequate volume in the test group was 6.9% for males and 7.1% for females, thus indicating lack of differences for the results

considering the gender and age of test subjects. It is well worth noticing the study results of Iskrzycki et al., where efficient ventilation was on a high level (approx. 91%), with ventilation of adequate volume reaching around 33% [21]. Analysis of the study results obtained in the test group showed the highest differences in the variable of BLS training. People with completed training indicated higher level of general efficacy of resuscitation. The general result while performing a two minute cardiopulmonary resuscitation within the test subject group was 25.5-55.1%, thus indicating a low level of execution of the resuscitation. The results were similar to those achieved by Kurowski et al. (approx. 40%), and much higher to those of Iskrzycki et al. (approx. 61%) [21,25].

The conducted study showed a low level of performance of ventilation and chest compressions among the group of healthcare employees with no medical degree. The need of additional trainings and skill improving activities for the respondents, resulting in better quality of cardiopulmonary resuscitation in the out-of-hospital environment, is evident.

The limitations of the study

The study registered some limitations. We have assessed the practical skills of respondents and their influence on correct CPR activities. The male test group was decisively less numerous, but with a higher percentage of people who underwent CPR training in comparison to females. Moreover, people with CPR training represented a proportionally less numerous group. Additional limitation was the use of manikin in the CPR activities, which only provided similar conditions to real scenarios, suggesting a lower engagement of test subjects.

Conclusions:

The gender, age and basic training in CPR substantially differentiate the quality of obtained cardiovascular and respiratory parameters. The acceptable quality of cardiovascular parameters with inadequate ventilation parameters were presented.

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