MEDICAL UNIVERSITY OF PLOVDIV
FACULTY OF PUBLIC HEALTH
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OPTIMIZING HOSPITAL DISASTER RESILIENCE

ABSTRACT of the dissertation

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ABBREVIATIONS USED

CIS	communication and information system
FMS	Forward Medical Station
MHAT	multidisciplinary hospital for active treatment
PPE	personal protective equipment
SOP	standart operating procedure
UMHAT	university multidisciplinary hospital for active treatment

CONTENTS

INTRODUCTION

The hospital disaster resilience is still a poorly studied issue, both globally and nationally. It is a particularly significant problem due to the increasing trends in the number and frequency of disasters, which affect the population at risk and pose challenges to the disaster medical support. As the last stage of the medical support, the hospitals need to be able to resist and react to disasters, to maintain their functionality and operability in crises and to be able to recover to their original state or to adapt after a disaster, i.e., to be sustainable. This ability is defined as hospital disaster resilience.

Hospital disaster resilience is a function of two components, static and operational. Although the effectiveness of the static component is set as an element of disaster mitigation activities prior to the disaster and is difficult to dynamically influence in response phases, the operational component is related to the capabilities of medical personnel. The operational component can and should be constantly increased to ensure maximum effectiveness of medical care provided during disaster medical support.

In the conditions of threatening or occurred disaster, the opportunities for increasing the hospital resilience are achieved mainly by optimizing the operational component - human resources, the processes of planning and management of medical activities. Increasing the capabilities of the operational component is the basis for increasing the resilience of hospitals to disasters, accidents and catastrophes.

AIM, TASKS, MATERIALS AND METHODS

1. Aim and tasks

Aim

The aim of the disertation is to analyze the operational component of hospital disaster resilience and the possibilities for its optimization in the Plovdiv Region.

To achieve this goal, the following main **tasks** are set:

1. To analyze disasters that associated with elevated risk level in the Plovdiv Region.

2. To assess the impacts of the disasters on hospitals in the Plovdiv Region.

3. To determine the readiness of the hospitals in the Plovdiv Region for reaction in case of a disaster.

4. To analyze the preparedness of hospital medical personnel to react in the case of a disaster in Plovdiv Region.

5. To compile and propose a program to optimize the operational component of hospital disaster resilience in Plovdiv Region.

2. Materials and methods

2.1. Object of research

Hospital disaster resilience

2.2. Observation units

a) logical units - medical specialists working in the hospitals: doctors, medical professionals in health care (in the sociological survey); disaster planning activities (when examining documents)

b) technical units - 2 multidisciplinary hospitals for active treatment (MHAT) and 1 university multidisciplinary hospital for active treatment (UMHAT)- UMHAT "Plovdiv"- Plovdiv, MHAT "Asenovgrad"- Asenovgrad; MHAT "Dr. Kiro Popov"- Karlovo.

2.3. Signs of observation

a) factorial features - sex, age, years of medical practice, educational qualification degree, profession, position held, type of hospital, length of service in the hospital, length of service in the current position;

b) effective signs: awareness of the hospital disaster medical support plan; knowledge of the approved SOPs in the hospital in case of disaster; hospital resources for disaster medical support; disaster medical support enhancement capabilities; training and drills.

2.4. Organization and conduct of the study

Study time

The survey was conducted in the period July 2019 - September 2019. The purpose of the survey and the questionnaire were presented to the relevant medical professionals. After brief introductions from the interviewer (the author of the present study), the questionnaires were distributed to medical professionals who were willing to participate in the study.

The data collection from the institutions was conducted in the period July 2019 - February 2021. The survey was conducted with the personal participation of the author in cooperation with the management and executive staff of the respective institutions. The author has received written permission from the heads of hospitals to conduct the study, as well as from the Director of the Regional Directorate of Fire Safety and Protection of the Population, Plovdiv.

2.5. Methods and techniques for collecting information

2.5.1. Sociological methods

Questionnaire method

The method of conducting is to fill in a paper form of the questionnaire in a certain hospital, UMBAL, MHAT. The survey was carried out in hospitals in the Plovdiv Region. The study covered 295 medical specialists working in hospitals on the territory of the Plovdiv Region.

Documentary method

It was used in the collection and analysis of data on accidents, (including disasters, accidents and catastrophes) for the period 2015-2019; the study of documents regulating the

organization and conduct of disaster medical support in hospitals- orders, disaster medical support plans.

2.6. Statistical methods

Primary information collected was checked, coded and entered into a computer database for further statistical grouping, recoding, and analysis. Data processing and quantitative analysis were performed with the help of the specialized SPSS 21.0 software for Windows XP. $P < 0.05$ was considered the significance level of the null hypothesis.

Statistical processing of the primary information collected was performed using the following statistical methods.

- Alternative analysis;
- Variation analysis;
- Nonparametric analysis - Pearson's agreement criterion ($\chi 2$ -xi-square);
- Correlation analysis;
- Graphic analysis.

RESULTS AND DISCUSSION

1. Analysis of disasters associated with elevated risk levels in the Plovdiv Region

The following types of natural and man-made disasters may occur in the Plovdiv Region: earthquakes, floods, fires, snowstorms and icing, heat waves, accidents with industrial toxic substances, ionizing radiation incidents, traffic accidents and terrorist acts. The disasters, incidents, and catastrophes that occurred during the period 2016-2019 in the region are presented in Table 1.

Table 1. Disasters, incidents with dangerous substances, and incidents with sources of ionizing radiation in the Plovdiv Region in the period 2016-2019

	2016	2017	2018	2019	**TOTAL**
Disasters	8	12	0	0	**20**
Incidents with dangerous substances	48	23	25	21	**117**
Incidents with sources of ionizing radiation	0	0	2	0	**2**
TOTAL	**56**	**35**	**27**	**21**	**139**

During this period, the number of activities performed to provide assistance, search, and / or rescue operations is as follows: 38 for 2016, 26 for 2017, 23 for 2018, and 30 for 2019.

1.1. Earthquakes

The territory of the Plovdiv Region is characterized by high seismic activity. It is classified as “second-rank earthquake-hazardous areas". The territory of the region is exposed to the impact of internal and external seismogenic regions, in which earthquakes with a magnitude of up to 8, measured on the Richter scale, are possible. The Plovdiv Region falls in an area with intensity VII-IX degree on the scale of Medvedev - Sponhoer - Karnik.

According to the seismic zoning of the Republic of Bulgaria, the Plovdiv Region falls within the Maritsa Seismic Zone of the Middleforest Seismic Region, with an expected maximum magnitude of 7.5 and intensity up to the 10th degree. The area may also be affected by earthquakes from the Sofia Seismic Zone (with expected maximum magnitude 6.5 - 7 and intensity around the 9th degree) and Tundja Seismic Zone (magnitude up to 6, intensity up to the 9th degree), as well as the Rila-Rhodope Seismic Region (maximum expected magnitude 8, intensity above the 9th degree).

The external seismogenic regions of the Republic of Bulgaria, which may have an impact on the Plovdiv Region, have an intensity of 7 and higher on the Medvedev-Sponhoer-Karnik scale: Marmara Region (Turkey), Xanthi Region (Greece), Valandovo Region (North Macedonia).

In the event of an earthquake, there is a possibility of complete and severe destruction of the building and production stock (40-50%) and the power supply system (220 and 110 kilovolts transmission lines) and water supply system, destruction of dam walls and causing catastrophic floods, depressurization of facilities and installations storing highly toxic and flammable substances, impaired transport and communications, creating a complicated sanitary and epidemiological situation, fires. A relatively large number of casualties is expected to occur – irrevirsable and medical losses. Due to the disrupted water supply and sewerage system, a severe deterioration of the sanitary-epidemiological situation and the outbreak of epidemics in the severely affected areas could be expected. Damage to hydrotechnical facilities located on the territory of the region will create a risk of floods.

1.2. Floods

Potentially dangerous dams and hydro facilities on the territory of Plovdiv Region, which may form large-scale flooded teritories, are the dams Pyasachnik, Vacha, Krichim, Topolnitsa, Batak, and Belmeken, as well as the facilities of Irrigation Systems.

In the event of an accident or asynchronous discharge of water from the 40 springs dam, Mominsko, Kochevo and Cheshnegirovo dams will flood 7 settlements with over 6,247,000 inhabitants, 3,450 animals and over 11,000 decares of agricultural land.

The rupture of the the walls of Vacha Dam and Krichim Dam will lead to the formation of a high wave with a height of up to 32 m and a speed of 21.7 km/h, which will cause a catastrophic flood in the town of Krichim. The time to arrive in the first wave to the town is 20 minutes. The other settlements along the Vacha River will also be affected by severe floods.

Other potentially dangerous for floods dams in the region are: Dolni Voden, Kozanovo 1, Moldava 2 and Novakovo 2, which threaten settlements with about 3,200 inhabitants.

During heavy rains, it is possible to get the Maritsa River out of its bed, which is expected to flood parts of the "North" and "Central" neighborhoods of Plovdiv, as well as the village of Katunitsa, village of Sadovo, Cheshnegirovo village, Seltsi village, Popovitsa village and the village of Milevo. In case of torrential rains, the occurrence of local floods along the Chaya, Topolovska, Moldavska, Noviizvorska, Zlatovrahska, Luda Yana,

Cherkezitsa, Sushitsa Rivers is possible. The settlements that will be affected depending on the river spill:

- along the Chaya River- the village of Katunitsa;
- along the Cherkezitsa River - the village of Bolyartsi, the village of Bogdanitsa, the village of Seltsi, the village of Akhmatovo and the village of Popovitsa;
- along the Sushitsa River- the village of Bolyartsi, and the village of Bogdanitsa.

Precipitation with intensity and quantity greater than 30 liters per sq. m. for less than 6 hours in the case of poor passability of the sewerage system can lead to local floods in the municipality of Plovdiv.

As a result of floods, there may be casualties, interruption of the power and water supply systems, interruption of communications, suspension or obstruction of transport, etc.

1.3. Snowstorms and Icing

During the winter season, conditions are created for the formation of heavy snowfall and durable thick snow cover. Snowstorms and gusts can cause: disruption of transport; power outage; disruption of water supply; disruption of communication; blocking of settlements as a result of the accumulated snow masses; disruption of food supply; complicating the supply of solid and liquid fuels for heating; difficulties in transporting patients, pregnant and persons in need of hemodialysis to medical institutions; difficulties in moving medical teams to snow-blocked settlements. This type of disaster is typical mainly for the months of December and January and less often during the other winter months. They occur on average once every 2-3 years and are most pronounced in regions with fields and plains. The most affected neighborhoods are Komatevo and Proslav in the city of Plovdiv, some settlements in the municipality of Sadovo, the village of Bolyartsi, the village of Bogdanitsa, the village of Seltsi, the village of Akhmatovo, the village of Kochevo and the village of Mominsko.

1.4. Fires

Part of the region’s territory is predominantly mountainous and forested, where forests of the first and second degree of fire danger predominate. This creates preconditions for the occurrence of large forest fires, which due to the proximity to agricultural land can cover the field.

The most dangerous for fires on the territory of Plovdiv Region are the forests pertaining to Asenovgrad Municipality, Karlovo Municipality, Hissarya Municipality, Krichim Municipality, Kuklen Municipality, Lucky Municipality and Rhodope Municipality.

On the territory of the Plovdiv Region there are enterprises of different nature, which are classified as risky objects. In the event of a fire in such an enterprise, different types and numbers of casualties are expected. Manufacturers, importers and / or storages of hazardous substances are located in the municipalities of Plovdiv, Asenovgrad, Parvomay, Sadovo, Rakovski, Brezovo, Kaloyanovo, Karlovo, Saedinenie, Stamboliyski, Krichim, Kuklen and Sopot. Of greater importance for the protection of the population than them are: "KCM 2000" - Plovdiv, "Agria" - Plovdiv, "Lukoil Bulgaria", "Naftex Petrol", production of carbide and plastic products (Asenovgrad), raw materials for the perfume industry (Karlovo, Plovdiv), etc.

1.5. Accidents with industrial toxic substances

Manufacturers, importers and / or storages of hazardous substances are located in the municipalities of Asenovgrad, Parvomay, Sadovo, Rakovski, Brezovo, Kaloyanovo, Karlovo, Saedinenie, Stamboliyski, Krichim and Sopot. Enterprises and facilities creating preconditions for accidents with industrial toxic substances on the territory of the region are: "KCM 2000" - Plovdiv, "Agria" - Plovdiv, "Assenova Krepost" - Asenovgrad, "Vinprom Peshtera" - the village of Katunitsa, the enterprises of the food industry, which have refrigeration installations with ammonia - "Cuminiano Fruit" - the village of Katunitsa and "Mesokombinat-Sadovo", plumbing and treatment facilities that use chlorine as a disinfectant, railway and automobile transport of dangerous goods.

Highly toxic substances that can be released in industrial accidents are stored in the following enterprises:

- "KCM 2000" - stores transformer oil in 3 underground tanks of 12 tons,, 5 outdoor tanks of 5 tons and in an oil refinery 2 tanks of 400 liters;
- “Agria” - manufactures and stores a wide range of plant protection products. It is possible to blow up hydrogen sulfide / up to 360 tons /, which is stored and used in the enterprise;
- “Asenova krepost” - ethyl acetate 1800 kg, sulfuric acid 500 kg, isotpropyl 700 kg;
- “Vinprom Peshtera” - carbon dioxide 20-25 tons, alcohol 100-120 thousand liters;
- „Cuminiano Fruit“ - ammonia 2 - 2.5 tons;
- the fruit storage in the town of Krichim - ammonia 8 tons.

In an accident with an ammonia leak from the fruit storage cooling system in Krichim, there will be about 2,700 people injured in the town. The prevailing south wind from the

gorge of the Vacha River and the west winds will lead to gassing of the village of Kurtovo Konare.

In the event of an accident in “Vinprom Peshtera” and “Cuminiano Fruit”, in which there is a leak of industrial toxic substances, the village of Katunitsa with a population of about 2,457 people is threatened by gassing and development of area of chemical damage.

In the event of an accident in “Asenova Krepost“, the Garata Neighborhood of Asenovgrad with a population of approximately 1,600 will be affected.

The population of Kuklen Municipality will be affected by an industrial accident in ”KCM 2000“ or “Agria”.

1.6. Radioactive contamination as a result of an accident at the Kozloduy Nuclear Power Plant or transboundary movement of radioactive substances

Radioactive contamination on the territory of Plovdiv Region can occur in:

- accident at the Kozloduy Nuclear Power Plant, accompanied by the release of radioactive substances into the environment;
- transboundary movement of radioactive substances;
- accidents with sources of ionizing radiation (production-technological, measuring, medical, traffic accidents involving the transport of sources of ionizing radiation).

In case of an accident at the Kozloduy Nuclear Power Plant, the territory of the Plovdiv Region does not fall within the 30-kilometer emergency planning zone. However, it will be necessary to carry out protection measures - temporary shelter, iodine prophylaxis, use of personal protective equipment and decontamination.

Depending on the meteorological situation at an average annual wind speed of 2 m/s, the radioactive contamination will reach the region boundaries after about 24 hours in case of an above-design radiation accident at Kozloduy Nuclear Power Plant and 2-3 days of transboundary transfer of radioactive substances.

Incidents during the transport of radioactive substances will cause local areas of damage, posing an immediate danger to the personnel transporting the radiactive materials. Those incidents do not pose a danger to the population, but they can be an expression of radiation terrorism.

1.7. Terrorism

On the territory of Plovdiv Region it is possible terrorist actions to be organized and carried out. The most endangered are the buildings of public importance and mass residence of people, educational institutions (universities, schools, kindergartens), hospitals, industrial enterprises working with industrial toxic substances, and Plovdiv Airport.

The categorization of the sites according to the degree of risk is as follows:

- buildings with mass residence of people - large;
- educational institutions (schools and kindergartens) - large;
- sites working with industrial toxic substances - medium;
- densely populated neighborhoods - medium;
- vehicles- medium.

The analysis of the risk of terrorism on the territory of Plovdiv Region shows that there is a real danger of terrorist acts. In case of a received and confirmed signal for a possible terrorist act, increased security measures will be introduced in public places.

Conclusion:

The Plovdiv Region is very vulnerable to disasters and there is a high risk of catastrophic earthquakes and floods due to the geographical location of the region. Due to the available industrial complexes in the area, there is a risk of developing an area of chemical damage. An area of radiation damage is possible due to the growing use of radionuclides in industry and medicine, as well as the impact of an possible accident at Kozloduy Nuclear Power Plant. There is an increased risk of thermal injuries related to the climatic features of the area. The density of the population in the towns of the region, as well as the presence of objects of the national critical infrastructure, are prerequisites for carrying out terrorist attacks.

2. Evaluation of the impacts of the disaster on hospitals in the Plovdiv Region

On the territory of the Plovdiv Region, the distribution of hospitals is extremely uneven. There are no hospitals available in the municipalities of Perushtitsa, Brezovo, Krichim, Maritsa, Lucky, Kuklen, Kaloyanovo, Saedinenie and Sadovo.

Disasters can have a direct or indirect impact on hospitals. The direct impact is the hospital's infrastructure damage under the influence of damaging factors, while the indirect impact is the increase in the need for medicines, consumables, blood and blood products, as well as the increase in the workload of diagnostic paraclinical units in hospitals.

The most common disaster that affects hospitals in the Plovdiv Region in historical terms is fire. In case of fire in the building where the hospital is located, evacuation of the patients and the staff outside it is necessary, which increases the need for sanitary transport. Due to the simultaneous impact of 2 main damaging factors - toxic and thermal, the types of casualties that will be evacuated to other hospitals are thermal burns and intoxications. It is recommended that the casualties be referred for treatment in the hospital with: department of general surgery - with at least 3 surgeons (depending on the severity of symptoms and if possible ward / clinic for thermal trauma); intensive care unit; department of internal diseases or toxicology, depending on the severity of symptoms and available options. This will lead to an overburdening of the medical staff working in these departments. Extended work shifts and redeployment of medical professionals need to be introduced. The requirements for the provision of bandages, infusion solutions, painkillers to combat the shock that can be developed by the casualties, as well as the requirements for the provision of oxygen cylinders needed for intoxicated casualties are increasing.

For the period 2015-2019 in the Plovdiv Region, the cases of hospitals affected by fire are 3. During the study period the hospitals in the region were directly affected by the impact of damaging factors, which necessitated the evacuation of both medical staff and patients to another hospital. The fire in the hospital itself made it very difficult to carry out the medical support operations for the casualties and disrupted the implementation of routine medical activities for a period of time. The occurred damages in the static component (building stock) and negative impact on the operational component, expressed in the temporary cessation of the functioning of the hospital reduce the resilience and may lead to temporary dysfunction of hospitals.

The Plovdiv Region is located in an area where an earthquake of the 9th degree on the Richter scale is possible. In the event of an earthquake, due to the impact of damaging factors on the hospital itself and its falling into the area of damage, the use of hospital for disaster medical support will be very difficult or impossible. This, in turn, will require the evacuation of patients from the departments and the burden on neighboring hospitals, as well as the evacuation system itself. Shutdown of the power supply will require the use of alternative sources, generators that have a certain capacity. In the event of an earthquake, it is possible to cut off communications, which hinders the timely conduct of medical activities in the hospital related to disaster medical support. In case the territory in which the hospital is located does not fall into the area of damage and it may be part of the disaster medical support, it must be prepared to meet the increased flow of casualties mainly with poly- and multiple injuries, crush syndrome, compartment syndrome. The large number of injuries will require an increase in the surgical capacity of the hospital, additional resources of blood and blood products, bandages, infusion solutions, and painkillers. Operating theathers need to be prepared to meet increased needs- medical surgical teams, anaestesiologists, surgicall kits and other utilities have to be available at the moment when first casualties arive. In the presence of a hemodialysis department in the hospital, it should provide hemodialysis to casualties with advanced crushing syndrome, which will increase the consumption of dialysis consumables - dialyzers, bloodlines, dialysis kits and fistula needles. The large number of casualties admitted to the hospital may cause stress among working medical staff due to working in unusual conditions and performing nonroutine medical activities. In order to provide timely medical care to the casualties who exceed the capacity of the surgical medical staff, medical specialists with a non-surgical specialty are used as assistants to the operating surgeons. Due to the large number from casualties of the earthquake, a large number of children injured are expected to be admitted to the hospital, which requires medical personnel without a pediatric specialty to be used in disaster medical support. In the period 2015-2019 in the Plovdiv region, there is no data on hospitals affected by an earthquake.

In the event of a flood, the hospital may be flooded. The hospital building stock may be affected. In such a situation, it is necessary to evacuate patients from the hospital to other hospitals that have the capacity and ability to take them. Transfer of patients leads to overcrowding in these hospitals. In the event of a flood, it is mandatory to cut off the power supply, which will cause additional inconveniences in the performance of medical activities - both daily routine and those related to disaster medical support. There may be a breakdown in communications in the event of a flood. There is an increased flow of casualties mainly with

injuries, including poly- and multiple injuries, as a result of the action of the main damaging factor - overpressure. The costs of blood and blood products, bandages, infusion solutions, and painkillers needed to perform medical manipulations on injuried are increasing. The increased flow of this type of injured will increase the surgical capacity. The disaster medical support of hypothermia increases the need of infusion solutions. The Department of Internal Medicine at the hospital must monitor all casualties who have survived drowning for the development of lung complications.

For the period 2015-2019 on the territory of Plovdiv Region there was 1 flood, which affected a hospital. The impact on the hospital has severely jeopardized both medical support and routine hospital medical activities. The transportation of patients was also very difficult. The damages that occurred in the static component (building stock, medical resources, and power supply) and the negative impact on the operational component, expressed in the temporary cessation of the hospital operation, have a negative impact on disaster resilience.

In the event of heat or cold waves, an increase in the number of casualties with exacerbation of chronic diseases, with cardiovascular accidents is noticed. The number of musculoskeletal injury casualties is relatively large during the cold wave and there is an increase in childhood morbidity associated with imperfect thermoregulation in children. The requirements for immobilizers, anti-inflammatory drugs, painkillers have been increased. The medical staff working in the hospital should be redeployed to the departments with increased needs - general surgery, pediatrics, intensive care unit, and internal medicine. This causes an increased level of stress among health professionals who need to work under unusual conditions.

In the event of accidents with industrial toxic substances, the types of injured that occur and require hospital treatment are a large number of intoxicated. These casualties need treatment in an internal or, if possible, toxicology department. In the absence of a toxicology departmemnt at the hospital, the injured are admitted to the department of internal medicine. Not all hospitals have the necessary facilities to treat this type of casualties that requires specific medical activities and the availability of life-saving antidotes. The requirement for equipment for artificial lung ventilation is increasing. The needs for bronchodilators, corticosteroids, analgesics, absorbents are increased. The bed stock of hospital is insufficient to accommodate the large number of intoxicated people. It is imperative to maneuver the bed stock and the medical specialists in the departments in order to provide medical personnel to take care of the treatment of intoxicated casualties. The hospital itself could also be affected and can be inside area of chemical damage. In such a situation, personal protective equipment

must be provided to the medical specialists working in it, as well as means for partial decontamination. All hospital staff and patients must be evacuated from the area of damage after partial decontamination and administration of antidotes (if there is an antidote for the substance) and referred to other hospitals. In the period 2015-2019 in the Plovdiv Region, there are no data on affected hospitals from industrial toxic substances.

With the increased use of radionuclides in medicine, the risk of radiological accidents increases. In such accidents it is necessary to stop the radiation exposure, to do iodine prophylaxis, to apply radioprotectors, to treat radiological burns and combined injuries. If the hospital is affected by the radiological incident, the medical staff uses respiratory protection equipment and full body protection equipment, deals with partial decontamination, provides radioprotectors and means for stopping the primary radiation reaction, subject to full sanitation with copious washing of the body with warm water and soap, but without rubbing, followed by a mandatory check for residual radiation. The need for specialized means of respiratory protection (gas masks and respirators) has increased. The emerging need for iodine prophylaxis requires prior stocks of iodine preparations. Presecuring stockpiles of radioprotectors in the hospital is also key. The dosimetry of medical staff, performed through individual dosimeters, requires that hospitals have stocks of dedicated dosimeters for disaster medical support. The hospital staff and all other people in the hospital are being evacuated to avoid or reduce their exposure. It is recommended that in the presence of a hospital shelter it be used as intended. In the period 2015-2019 in the Plovdiv Region, there is no data on hospitals affected by ionizing radiation sources.

The presence of many entrances and exits of hospitals, ground floors used for warehouses, daily visits by large numbers of patients, attendants, relatives of patients and other citizens, create conditions for the penetration of terrorists. Hospitals as part of critical infrastructure are risky sites with an increased risk of terrorist acts. Terrorist acts can be committed in different ways and by different means, as a result of which a complex situation is created in the hospital with the development of different types of area of damage. In the event of a terrorist attack at the hospital, special armed forces secure the area and rescue the casualties by first finding them and collecting them in the so-called "nest", after which evacuated them outside the area of damage. The medical evacuation is being carried out as soon as possible outside the area of a possible second attack, according to information provided by the police. The casulties were taken to other hospitals. In the event of a terrorist act, the hospital function is suspended until the police receive information that the hospital

area is safe. For the period 2015-2019 in the Plovdiv Region no cases of terrorist acts have been described in hospitals.

Conclusion:

The hospitals in Plovdiv Region can be subjected to direct and indirect impact by the disasters. In case of direct impact on hospitals, it may be necessary to evacuate both the medical staff and the patients, who will be redirected to another hospital. The hospital itself may be affected and to be part of the area of damage and may not be used during the disaster medical support, which makes it difficult to conduct medical support operations for the casualties. All types of disasters will increase the requirements to operational capacity-mobilization of medical staff, extension of work shifts, the need to work in unusual conditions and perform nonroutine medical activities. In the case of indirect impact, there are increased requirements for the static component - the consumption of medicines, consumables, blood, and blood products increases, as well as increased workload of diagnostic paraclinical units in hospitals. The direct impact of disasters is expressed in damage to the static component and negative impact on the operational component, which reduces resilience and can lead to dysfunction and inoperability of hospitals. Increasing the readiness of medical staff for an adequate disaster response is the most flexible and affordable way to increase the hospital resilience by increasing the capacity and capabilities of the operational component.

3. Readiness of the hospitals in the Plovdiv Region for reaction in case of a disaster

Analysis of the readiness of hospitals for response in a disaster was carried out considering the static and operational components of disaster resilience, included in disaster medical support plans. In the performance of task 3, the disasteer medical support plans of hospitals, located in the Plovdiv region, were reviewed: Disaster Protection Plan 2019, approved by the Manager of UMHAT - Plovdiv on 25.06.2019; Plan for protection and medical support of the population of the Municipality of Asenovgrad in case of disasters of MHAT "Asenovgrad" Asenovgrad 2017, approved by the Manager of MHAT "Asenovgrad"; Disaster Protection Plan of MHAT "Dr. Kiro Popov" - Karlovo 2019, approved by the Manager of MHAT "Dr. Kiro Popov" - Karlovo on 14.06.2019. A comparison is made between the hospitals' plans in the Plovdiv Region and a hospital's plan, located outside the Plovdiv Region (emergency plan for disaster protection at the site 'MHAT-Burgas', 2015).

3.1. Disaster protection plan - general provisions

The disaster response plan is "an agreed set of preparation, response and recovery measures and includes a description of responsibilities, governance structures and strategies, and the management of resources and information for the protection of life, property and the environment".

In developing and coordinating it, methodological assistance is provided by the employees of the General Directorate "Fire Safety and Protection Population" of the Ministry of Internal Affairs, who play a significant role in the first stage of disaster medical support. The hospitals as subsequent participants in the medical support of the casulties need to develop hospital disaster response plans and to be in accordance with those of the municipalities, regions and the national plan. In the Republic of Bulgaria, disaster protection plans are prepared in accordance with the Guidelines for Developing and Preparing for the Implementation of Disaster Protection Plans given by the Disaster Risk Reduction Council to the Council of Ministers of the Republic of Bulgaria on the basis of Article 9, paragraph 15 of the Law on Disaster Protection. In order to maintain a plan in line with the current situation in terms of risk, mitigation and prevention measures, it is reviewed and updated at least once every 5 years (Article 9, paragraph 14 of the Law on Disaster Protection). Its revision and

updating is also mandatory in case of changes in the legislation related to its implementation. The current disaster protection plan is in force until a new one is approved and adopted.

3.2. Hospital disaster response plan

It is recommended that the disaster medical support planning process in the hospital be divided into three phases: the pre-disaster phase, the disaster phase and the post-disaster phase, in order to ensure that all aspects of the disasters are covered in the plan.

The purpose of the hospital disaster response plan is to provide prompt and adequate medical care to the maximum number of casualties and to minimize morbidity and mortality caused by disasters. The plans should consider both situations in which the hospital is outside the area of damage, but also those in which the hospital falls into it.

The hospital disaster medical support plan has the following tasks:

• survival and recovery of as many casualties as possible;

• providing round-the-clock emergency medical care to injured;

• providing medical staff, including doctors and medical professionals in health care, able to meet the needs of casualties;

• interaction with other departments of the hospital, as well as with other hospitals to increase the effectiveness of medical care provided to injured.

3.3. Elements of the hospital disaster medical support plan, related to the disaster resilience static component

The provision of resources for disaster medical support, emergency electricity and water supply, and communication facilities are part of the hospital disaster medical support plan and was taken into account in the disaster medical support planning. On the other hand, the above mentioned are the elements of the static component of disaster resilience. On the table 2 are shown on the static component and its elements as a description in the hospital plan. The three hospitals participating in the study from the Plovdiv region and a hospital from another region of the country - MHAT- Burgas - were compared.

Table 2. Elements of the plan, related to the static component of disaster resilience

Elements	UMHAT-Plovdiv	MHAT „Asenovgrad“ - Asenovgrad	MHAT „Dr. Kiro Popov“ - Karlovo	MHAT „Burgas“ - Burgas
Building safety	Sustainable building	monolithic, disaster resistant building	Sustainable building	5 blocks of massive buildings of the 1st degree of resistance
Emergency energy	Not indicated	Diesel unit and the oil needed for it - 300 liters	Not indicated	Diesel units - 2 pieces (for surgical and therapeutic housing)
Oxygen supply	Not indicated	Oxygen storage room containing large oxygen bottles; liquid oxygen tank	Not indicated	Tank with a capacity of 7540 kg of liquid oxygen 99.8%; oxygen storage room containing 100 bottles of 40 liters;
Water reserves	Not indicated	Water tanks - 4 pieces, total capacity 1000 l; 700 l tank for the hemodialysis department	Not indicated	There is no spare own water source
Food supplies	Not indicated	It has a food warehouse	Not indicated	Food supplies for 10 days
Stockpiles of personal protective equipment	Not indicated	300 surgical masks	Not indicated	Civil gas masks
Beds set aside for casualties	274 beds	Not indicated	Not indicated	Traumas - 180 beds; intoxications - 165 beds; infectious diseases - 110 beds
Drugs set aside only for disaster medical support	Not indicated	Not indicated	Not indicated	Not indicated
Stocks of emergency materials	Not indicated	Not indicated	Not indicated	Not indicated
Portable medical equipment	Not indicated	Not indicated	Not indicated	Not indicated
Own medical transport	Not indicated	3 ambulances	2 ambulances	Not indicated
Helicopter pad	Available	Not indicated	Not indicated	Not indicated
Communication system	Mobile phones	Mobile phones	Mobile phones	Mobile phones

The analysis of the collected data on the elements of the hospital disaster medical support plan, related to the static component of disaster resilience in the various hospitals in Plovdiv Region revealed:

1. The disaster resilience of hospital building stock is good.

2. The critical engineering infrastructure (including energy power, water, oxygen and telecommunications) in the hospitals on the territory of Plovdiv Region is insufficient for the proper functioning of hospitals.

3. There is a lack / shortage of personal protective equipment (PPE) for the protection of the staff working in the hospitals in Plovdiv Region.

4. There are some difficulties in the the hospitals in Plovdiv Region, related to the stock of emergency medications, portable medical equipment, beds, and personal protective equipment that are stored for disaster medical support.

5. The possibility of treating a large number of intoxicated and irradiated casualties is limited on the territory of the region.

6. The availability of own sanitary transport to evacuate personnel and patients in case of a disaster in the region is limited.

7. There is a good communication system of the the hospitals in Plovdiv Region.

The comparative analysis of the elements of the plan related to the static component in the different hospitals in Plovdiv Region and MHAT- Burgas shows that:

1. The disaster resilience of hospital building stock is good both in Plovdiv Region and in MHAT-Burgas.

2. The difficulties related to the critical engineering infrastructure (including energy power, water, oxygen, and telecommunications) in the hospitals on the territory of the Plovdiv Region in comparison with these of MHAT-Burgas are greater.

3. Unlike hospitals in the Plovdiv region, MHAT-Burgas has the appropriate PPE.

4. In hospitals in the Plovdiv region and in MHAT-Burgas, there are some difficulties related to the stock of emergency medications, portable medical equipment, beds for the treatment of casualties.

5. The possibility of treating a large number of intoxicated and irradiated casualties in MHAT-Burgas are better in comparison with the hospitals on the territory of Plovdiv Region.

6. The availability of own sanitary transport to evacuate personnel and patients in case of a disaster both in Plovdiv Region and in MHAT-Burgas is limited.

7. Both the hospitals in the Plovdiv Region and MHAT-Burgas have a good communication system.

3.3. Elements of the hospital disaster medical support plan, related to the disaster resilience operational component

The planning and development of disaster response plans, the use of SOPs, the disaster medical support management, hospital human resources, and disaster training and drills are enshrined in the hospital disaster medical support plan, and are also elements of the operational component of disaster resilience. On Table 3 shows the operational component and its elements as a description in the hospital plan. The three hospitals that participated in the study from the Plovdiv region and a hospital from another region of the country, MHAT-Burgas, were compared.

The analysis of the collected data on the elements of the hospital disaster medical support plan, related to the operational component of disaster resilience in the various hospitals in Plovdiv Region revealed:

1. All hospitals in the Plovdiv Region have a disaster medical support plan, which is unclear whether it is periodically updated.

2. Some of the hospital plans in Plovdiv Region consider procedures for increasing the disaster bed capacity, strategies for increasing the number of medical specialists in case of disaster, strategies for evacuation of casualties in case of threat to the hospital.

3. None of the plans of the surveyed hospitals in the region clearly describes the procedures for sorting the casualties.

4. Hospitals on the territory of the Plovdiv Region have a disaster management system and a disaster headquarter.

5. Hospitals located in the smaller settlements in Plovdiv Region have organized fewer medical teams, mainly surgical and therapeutic, while hospitals with more opportunities have provided more specialized teams.

6. The plans of all hospitals in the region do not include developed programs for training medical specialists for disaster response.

7. The plans of only a part of the hospitals in Plovdiv region include conducting disaster drills once a year.

8. Not in all hospitals surveyed in the region, post-disaster assessment reports are prepared.

The comparative analysis of the elements of the plan related to the operational component in the different hospitals in Plovdiv Region and MHAT- Burgas shows that:

1. Hospitals in the Plovdiv Region and MHAT-Burgas have general and specific disaster medical support plans, which is unclear whether they are periodically updated.

2. In the plans of all surveyed hospitals are considered only part of the procedures and strategies of the disaster medical support.

3. None of the plans of the surveyed hospitals clearly describes the procedures for sorting the casualties.

4. Disaster management system and disaster headquarter are available both in the hospitals on the territory of the Plovdiv Region and in MHAT- Burgas.

5. Hospitals located in the smaller settlements in Plovdiv Region have organized fewer medical teams, mainly surgical and therapeutic, while hospitals with more opportunities in the region, as well as MHAT-Burgas, have also provided other types of specialized teams.

6. The plans of all the hospitals studied do not include developed programs for training medical specialists for disaster response.

7. The plan of MHAT-Burgas includes conducting disaster drills once a year, while in the Plovdiv Region - the plans of only part of the hospitals include that.

Elements	UMHAT- Plovdiv	MHAT „Asenovgrad" - Asenovgrad	MHAT „Dr. Kiro Popov" - Karlovo	MHAT „Burgas" - Burgas
Development of specific disaster medical support plans	Available	Available	Available	Available
Plan update	Not indicated	Not indicated	Not indicated	Not indicated
Procedures to increase bed capacity	A maneuver is performed with the beds and the light-ill patients are discharged	Not available	Not available	Up to 60% of patients are discharged for the purpose of freeing beds
Strategies for increasing staff in the event of a disaster	Not available	By terminating the leave of the staff	Not available	Not available
Procedures for sorting casualties	Not available	Not available	Not available	Not available
Use of evacuation strategies for casualties	Not available	Available	Available	Not available
Building an incident management system	Available	Available	Available	Available
Post-disaster assessment reports	Provided in the plan	Provided in the plan	Provided in the plan	Provided in the plan
Organization of teams for disaster medical support	A total of 10 teams, of which 5 main and 5 spare: 2 surgical, 2 anesthesiological, 2 orthopedic, 2 ENT, 2 ophthalmological	A total of 4 teams, of which 2 main and 2 spare: 2 surgical teams and 2 anesthesiological teams	1 main team - therapeutic	A total of 13 teams, of which 2 surgical; 2 orthopedic; 1 neurosurgical; 1 for thermal injuries; 2 anesthesiological; 1 ophthalmological; 2 ENT
Preparation of disaster training programs	Not attached	Not attached	Not attached	Not attached
Conducting disaster drills	Not indicated how periodically they are performed	Conducting drills once a year	Not indicated how periodically they are performed	Conducting drills once a year

Conclusion:

In order to increase the operational component of hospital disaster resilience, it is recommended when planning to focus on critical engineering infrastructure and resource provision in a case of a disaster- stocks of PPE and emergency medicines, portable medical equipment, beds, and the availability of own ambulances. It is necessary to review and thoroughly describe the SOPs for disaster response, related to increasing the number of beds, increasing the number of medical specialists, evacuation of casualties in case of threat to the hospital, sorting of injured. To increase the readiness of medical specialists for action in an event of a disaster, periodic theoretical and practical training is required in relation to the specific activities performed during disaster medical support. The listed set of recommendations will have a positive impact on hospital disaster resilience by increasing the hospital preparedness.

4. Analysis of the preparedness of hospital medical personnel to react in the case of a disaster in Plovdiv Region

4.1. Awareness of the hospital disaster medical support plan

More than half of the respondents (63.4%, n = 187) are confident that they know the plan of the hospital where they work. The highest is the percentage of informed managers (92.9%, n = 26) (p = 0.001 $\chi 2 = 22.50$) (Fig. 1).

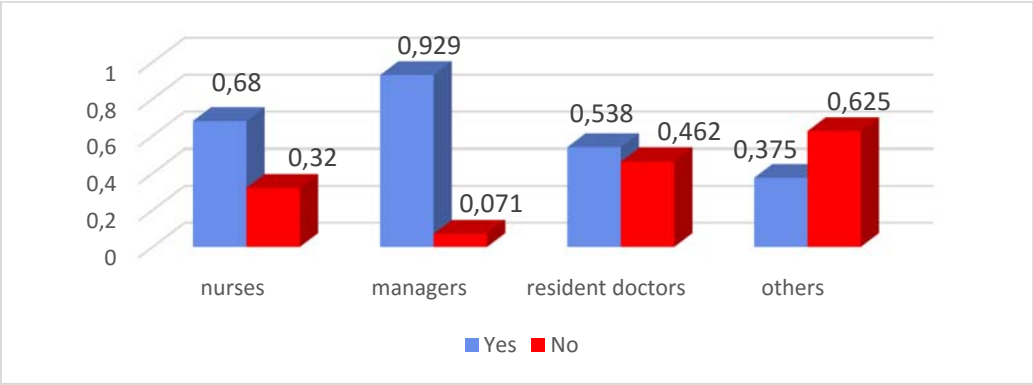

Fig. 1. Dependence of knowledge of the disaster plan on the position held

The lowest awareness is among physicians with the specialty "Emergency Medicine" - only 33.3% (p = 0.004, $\chi 2 = 18.90$). Surgeons' awareness is also insufficient: less than half of them know about it (43.3%, n = 13) (Fig. 2). Insufficient awareness is a prerequisite for reducing the readiness of medical staff to respond, and therefore for reducing the operational component of hospital resilience.

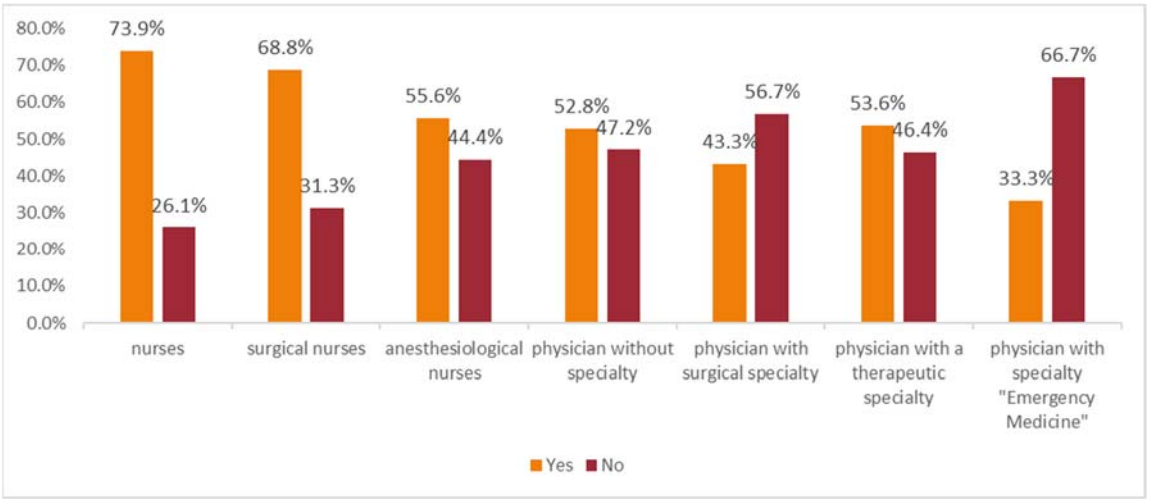

Fig. 2. Assessment of the impact of the specialty on the awareness of the plan

Among the respondents, the majority of them answered that they were not familiar with the way the content of the plan was distributed - 74.2% (n = 219), although they signed the forms. Insufficient familiarity with the content of the plan is most likely due to insufficient in-depth reading and familiarization with its details before signing, which reflects on disaster resilience.

Logically, managers are most informed about how the plan content is disseminated (46.4%, n = 13) (p = 0.05 $\chi 2$ = 7.60). The percentage of nurses (24.7%, n = 37) and resident doctors (23.7%, n = 22) who are aware is low.

In addition to the knowledge of the plan, the knowledge of the notification system is an important element of the disaster medical support as a means of communication between the participants in the disaster medical support. More than half of the respondents (56.6%, n = 167) answered that they are not familiar with this system (Fig. 3).

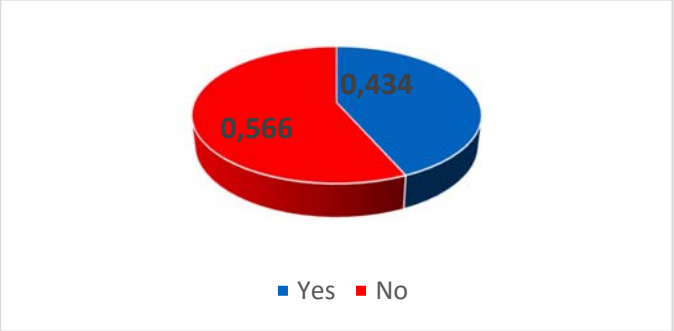

Fig. 3. Distribution according to familiarity with the disaster notification system

There is a good degree of familiarity with the system among the management staff managing disaster medical support in the hospital when needed (75.0%, n = 21) (p = 0.001 $\chi 2$ = 17.18). However, the awareness among other employees is unsatisfactory (60.0% of nurses and 54.8% of resident doctors give positive answers) (Fig. 4). A paradox arises as to how they are familiar with the plan without knowing an essential element of it. Insufficient knowledge of the hospital disaster notification system among other employees is a prerequisite for untimely and inadequate disaster response due to very difficult communication, which greatly threatens disaster resilience.

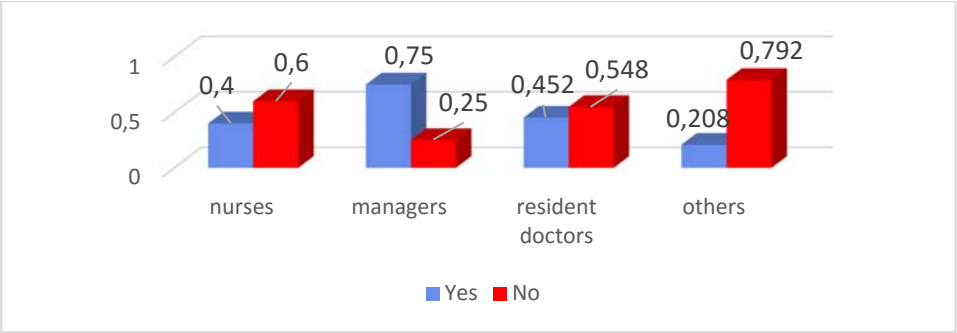

Fig. 4. Dependence of awareness on the disaster notification system on the position held

PPE is needed to ensure safe working conditions for medical personnel. Only 28.1% (n = 83) of the medical staff know where PPEs are stored (Fig. 5).

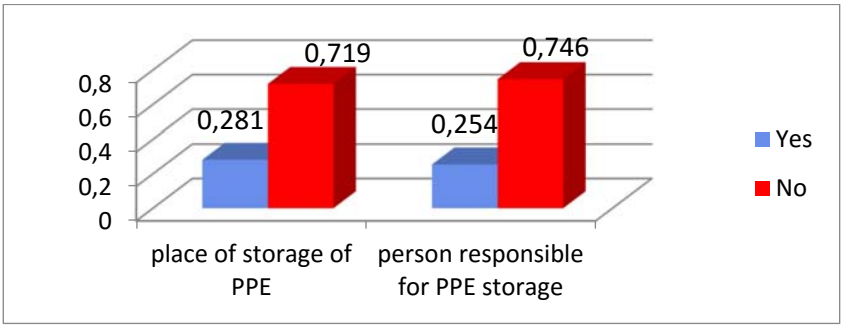

Fig. 5. Awareness of the place of storage of personal protective equipment and the person responsible for their storage

Among hospital workers the most informed about the storage place are managers - 57.1% (n = 16) answer in affirmative (p = 0.002 $\chi 2$ = 14.74) (Fig. 6). Although managers show the best awareness, their relative share is below the expected 90-100%.

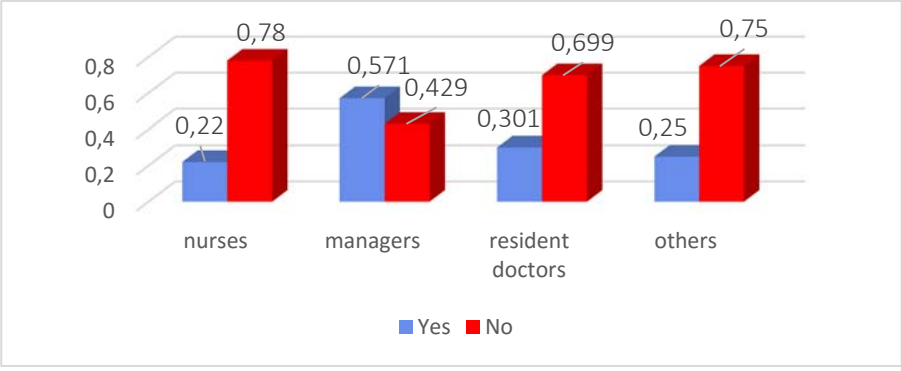

Fig. 6. Assessment of the impact of the position held on the knowledge of the place of personal protective equipment

Only 1/3 of the respondents (25.4, n = 75) know who is responsible for the storage and distribution of PPE where the hospital in they work (Fig. 5). Managers show the highest level of awareness (p = 0.001 $\chi 2$ = 17.92). Almost half of them are aware of the responsible person (57.1%, n = 16) (Fig. 7), but the positive responses are less than 60%. Managers should be familiar with the person responsible for the PPE storage, as they manage the disaster medical support, and the provision of PPE in the event of a disaster is an essential element of it and of the static element of disaster resilience.

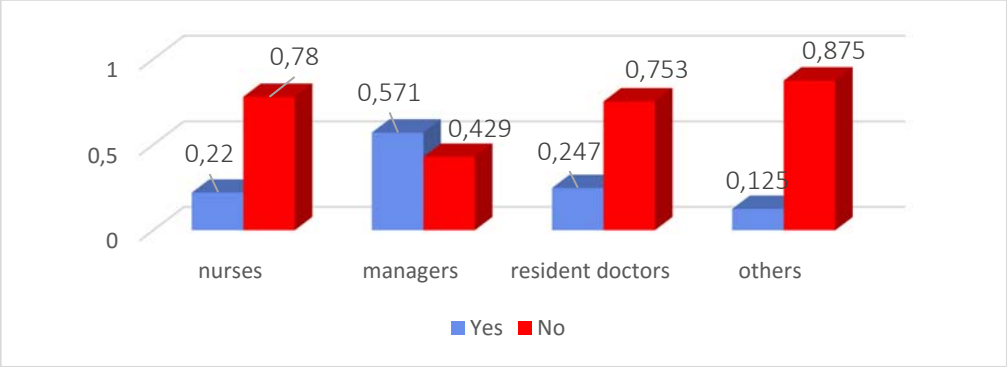

Fig. 7. Dependence of awareness about the person responsible for the storage of personal protective equipment from the position held

The management and coordination in disaster medical support is performed by specially selected staff, included in the so-called "hospital disaster departmental council". Unfortunately, most of the surveyed medical specialists are not familiar with the composition of this council, 84.1% (n = 248). The distribution of the answers to this question by positions again shows the highest competence among managers (p = 0.001 $\chi 2$ = 22.50). About half of them, 46.4% (n = 13), know who the members of hospital disaster departmental council are. However, awareness is below 50%, which defines it as insufficient.

The better information of the managers could be explained by participation in the councils mainly of medical specialists, occupying leading positions. In the current study, 14.3% of the managers are part of the council, while for nurses and resident doctors, this percentage is very small, respectively 1.3% and 4.3%.

Employees in MHAT demonstrate better knowledge (22.1%, n = 23) compared to their colleagues in UMHAT (12.6%, n = 24) (p = 0.045 $\chi 2$ = 4.59), but both groups show very low awareness of council members.

Conclusion:

The high level of awareness of the disaster response plan among the medical staff working in the hospitals contrasts with the low level of awareness of the key elements of this plan (disaster notification system, PPE storage location, composition of the hospital disaster departmental council). All information related to these elements is included in the disaster medical support plan. It is assumed that among the staff the elements of the plan are not well understood or underestimated, which in turn has a negative effect on the operational component of the hospital disaster resilience.

4.2. Awareness of the approved standard operative procedures in hospitals in case of a disaster

Some of the disaster protection algorithms include approved deadlines for the review of the disaster response plan with subsequent notification of medical professionals of the changes in it. When asked if they were aware of these deadlines, only 14.2% (n = 42) of the respondents answered in the affirmative. A relationship was found between awareness of the plan update periods and the position held ($p = 0.002$ $\chi 2 = 14.48$). It is noteworthy that the most informed are managers - 32.1% (n = 9) of them are familiar, followed by nurses (16.7%, n = 25) and resident doctors (8.6%, n = 8) (Fig. 8).

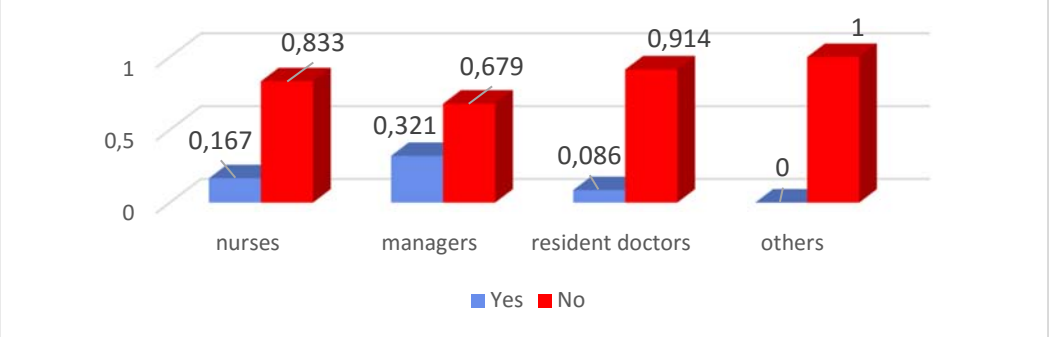

Fig. 8. Dependence between the position held and the awareness of the deadlines for revision of the plan

It is worrying that in all the studied groups in our study the share of the familiars does not exceed 40%, even among managers. Insufficient awareness of the periods of review of the disaster medical support plan has a negative impact on disaster preparedness, leading to a reduction in hospital resilience.

The effectiveness of the plan requires coordination of actions between the different units of the hospital. Among the respondents, there is extremely low awareness of the frequency of coordination meetings with key staff from different hospital departments for action during disasters - only 5.1% (n = 15) of them know how often these meetings are held, which puts doubts on the good coordination of the actions of the individual hospital structures in disaster medical support, and hence calls into question the effectiveness of the management process and therefore reduces disaster resilience.

The main SOP in the implementation of disaster medical support is the triage of the casualties entering the hospital. From the analysis of the results obtained, assessing the knowledge about the triage area, it is noteworthy that the majority of medical staff are not familiar with the established procedures for construction of a triage area and the role of doctors in it (Fig. 9).

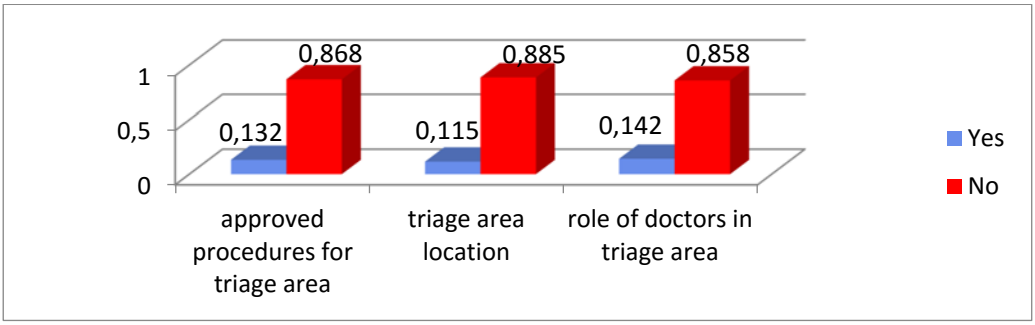

Fig. 9. Awareness of the approved procedures for the triage area, its location and the role of doctors in it

The most familiar are managers (32.1%, n = 9) (p = 0.005 $\chi 2$ = 12.91), followed by resident doctors (14.0%, n = 13) and nurses (11, 3%, n = 17) (Fig. 10). Insufficient knowledge of triage procedures reduces resilience.

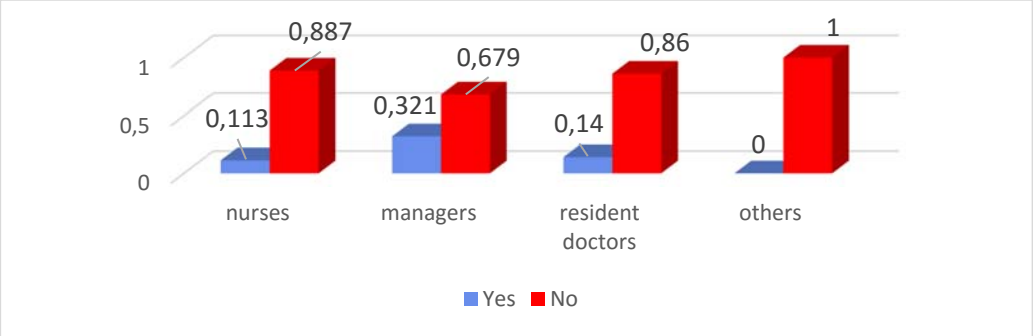

Fig. 10. Dependence of awareness on the procedures for the triage area by the position held

Among the medical staff the most informed about the procedures are the medical professionals with experience in the hospital less than 1 year - 22.2%, followed by those with experience between 1 and 10 years - 19.1% (n = 22) (p = 0.035 $\chi 2 = 8.60$) (Fig. 11).

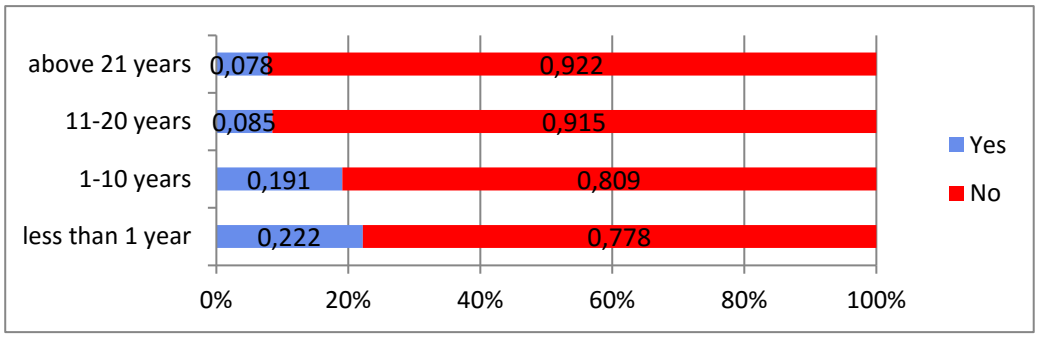

Fig. 11. Awareness of the triage procedures according to the length of service in the hospital

From the analysis of the results obtained, assessing the knowledge of the triage area, it is evident that an extremely large part of the medical specialists (88.5%, n = 261) cannot indicate the location of the area. The relative share of medical professionals who are not familiar with the place and role of doctors in the triage area is extremely high in our study - 85.8% (n = 253) (Fig. 9).

The percentage of positive answers about the activity of doctors in the triage area is low, even among the respondents in managerial positions who are the most informed (25.0%, n = 7), which correlates with the low percentage among resident doctors (17, 2%, n = 16) and nurses (12.7%, n = 19) (p = 0.05 $\chi 2 = 7.65$) (Fig. 12). As the triage determines the further course of the treatment of the casualties, the low level of preparation of the medical specialists working in the hospitals in Plovdiv Region is a prerequisite for decreasing the operational component of the hospital disaster resilience.

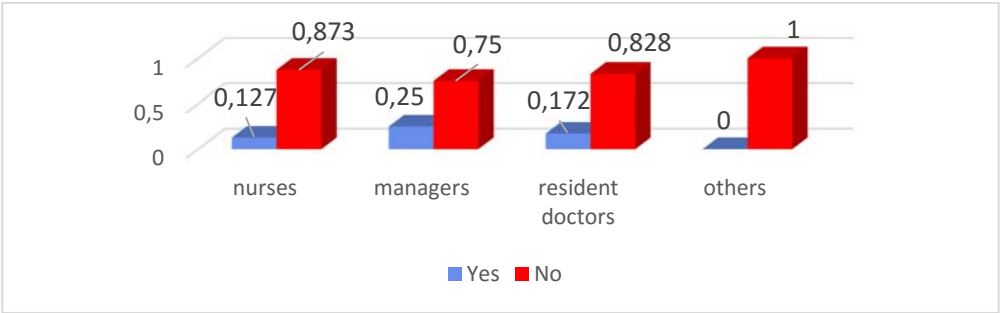

Fig. 12. Dependence of awareness of the role of doctors in the triage area on the position held

In the case of large-scale disasters or those with a large number of casualties, it is sometimes necessary to build a Forward Medical Station (FMS) in order casualties to get medical care as close and timely as possible. Only 15.3% of the respondents (n = 45) are aware of whether the hospital has planned to open a FMS (Fig. 13). The managers are the most familiar, 35.7% (n = 10) know whether the hospital intends to open it (p = 0.012 $\chi 2$ = 10.89). 11.3% (n = 17) of the nurses and 15.1% (n = 14) of the resident doctors gave positive answers.

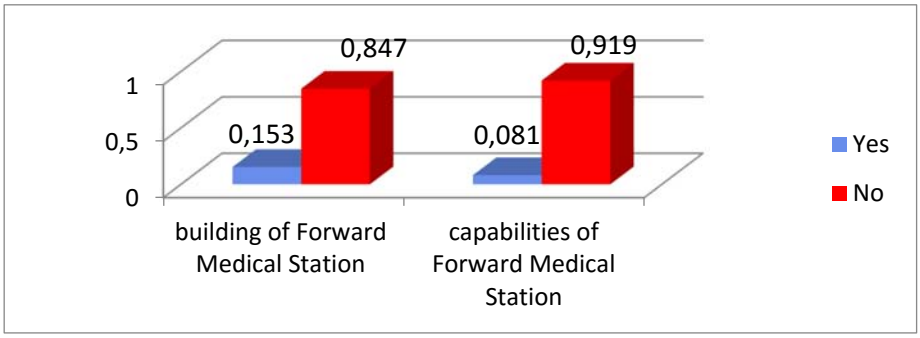

Fig. 13. Familiarity with the building of Forward Medical Station and its capabilities

The analysis of the awareness of the possibilities of FMS, which the hospital can build in an event of a disaster, also shows low self-assessment of the participants in the survey - 91.9% (n = 271) are not familiar (Fig. 13). Managers are the most informed (25.0%, n = 7), followed by nurses (6.7%, n = 10) and resident doctors (6.5%, n = 6) about the possibilities of the Forward Medical Station, which the hospital can make in a disaster case (p = 0.008 $\chi 2$ = 11.95). The ignorance of the medical specialists as to whether their hospital envisages the making of FMS means that they are not aware of where the main steps of disaster medical support will be carried out - medical intelligence, medical triage, first medical aid, sanitation, decontamination, dosimetry. Lack of knowledge of these key components reduces hospital preparedness for disaster response and has a negative impact on the operational component of resilience.

The majority of respondents are not familiar with the approved procedures for optimizing the available bed capacity in order to provide intensive treatment of incoming casualties with life-threatening injuries - 88.5% (n = 261) (Fig. 14).

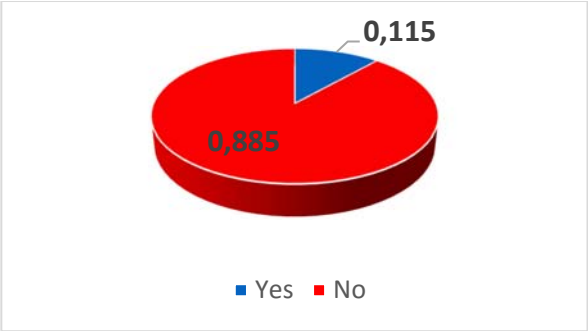

Fig. 14. Awareness of occupied beds release procedures

There was a significant difference in the knowledge of the hospital staff regarding the procedures to be implemented for beds liberazitaion and adopting the bed occupancy according to the position held ($p = 0.001$ $\chi 2 = 18.46$). The most familiar with them are managers (35.7%, n = 10).

An alarmingly high degree of unfamiliarity was found for the place from where life-saving drugs and consumables will be delivered to the hospital in case of disaster, among the respondents - 88.1% (n = 260) (Fig. 15). Low awareness raises questions about the hospital's disaster drug supply, which is associated with a negative impact on the static component of resilience.

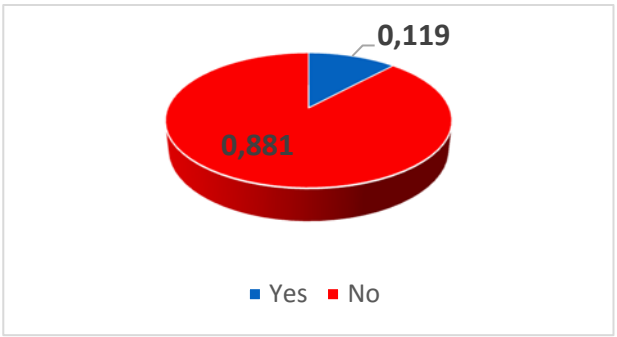

Fig. 15. Awareness of the place from where life-saving drugs and consumables will be delivered to the hospital in case of disaster

When asked to which hospitals the casulties will be evacuated if necessary, a large part of the medical specialists is unaware - 72.5% (n = 214) (Fig. 16).

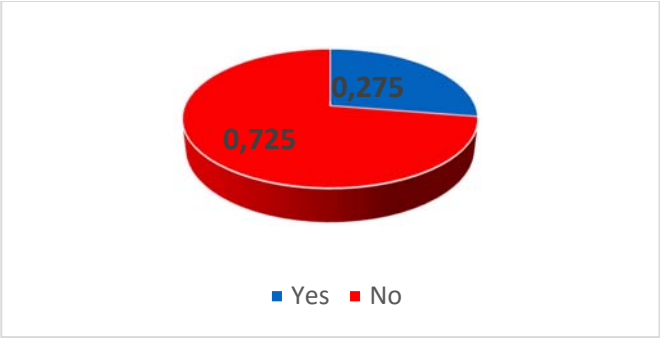

Fig. 16. Awareness of the hospitals to which the casulties will be evacuated if necessary

Among medical staff, managers are the most familiar; more than half of them (64.3%, n = 18) are informed about it (p = 0.001 $\chi 2$ = 22.69) (Fig. 17).

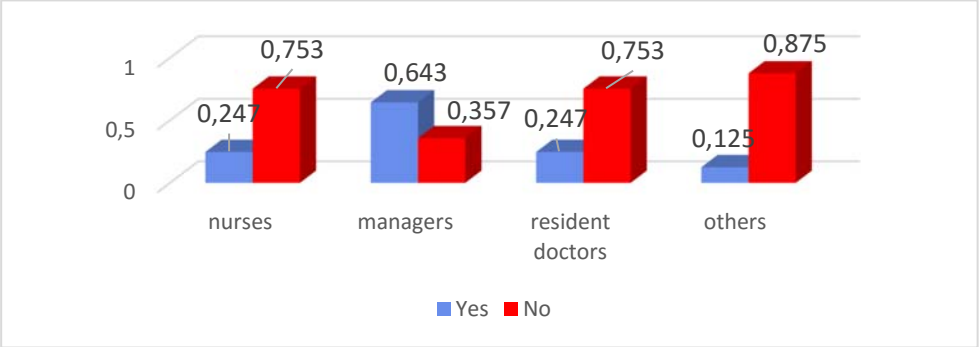

Fig. 17. Dependence of awareness on the hospitals to which the casualties will be evacuated and the position held

Conclusion:

The medical specialists in Plovdiv Region are with low level of awareness about the approved SOPs in hospitals in case of a disaster, concerning the deadlines for revision of the plan, the order of updating its content, holding coordination meetings, the triage area, the role of doctors in the triage area, the possibilities of the Forward Medical Station, as well as the release of occupied emergency beds for the treatment of casualties, the supply and provision of medicines in the event of disasters. Optimization of activities related to the operational component of hospital disaster resilience, in our opinion, must include training of hospital medical specialists on the SOPs approved in the plan.

4.3. Resources of hospitals for disaster medical support

In the event of a disaster, an increased flow of casualties is observed, heading to the hospitals, which requires the provision of beds for their medical support. In our study, the

predominant percentage of respondents (89.5%, n = 264) are not aware of how much additional hospital space (beds, rooms, wards) for the casualties' treatment is planned (Fig. 18).

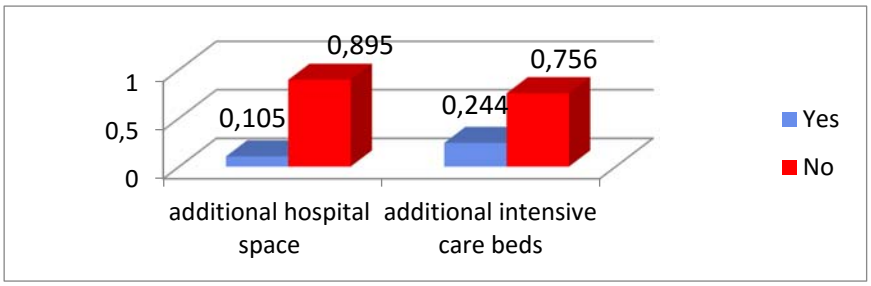

Fig. 18. Awareness of additional hospital space and additional intensive care beds

Managers are most informed about the additional beds planned for disaster medical support (p = 0.001 $\chi 2$ = 17.76) - 32.1% (n = 9) are informed. The percentage of nurses (8.0%, n = 12) and resident doctors (10.8%, n = 10) who are familiar is extremely low (Fig. 19). Insufficient knowledge of the possibilities for admission and treatment of casualties of disasters can lead to deteriorating quality of disaster management, which has a negative effect on the operational resilience of the hospital.

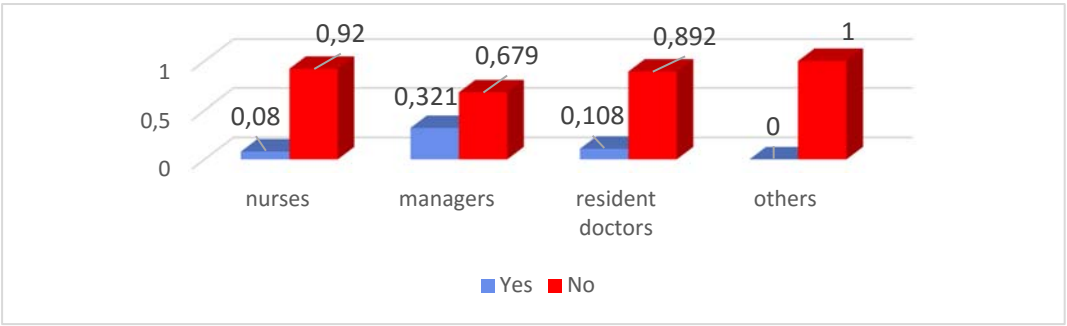

Fig. 19. Dependence of awareness of the additional beds planned on the position held

In order to ensure adequate treatment, hospitals must provide beds for the necessary intensive treatment of incoming casualties. 2/3 of the medical specialists (75.6%, n = 223) were not aware of whether their hospital had planned additional intensive care beds (Fig. 18). Managers are most familiar - 49.2% (n = 12) of them are informed (p = 0.006 $\chi 2$ = 12.34). Only 21.3% (n = 32) of nurses and 29.0% (n = 27) of resident doctors know if the hospital had planned additional intensive care beds. Insufficient knowledge of medical professionals about bed capacity, which can be transformed for intensive care of casualties, is a prerequisite for improper allocation of resources and staff, which implies inadequate management.

Disaster management, inconsistent with the needs of the injured, has a negative impact on operational resilience.

Statistical significance was found between the awareness about the intensive beds planned and the experience of the respondents, according to which the medical personnel with experience of 11-20 years is more informed than the others ($p = 0.029$ $\chi 2 = 9.05$).

The disaster medical support of casualties requires the provision of medication. 80.7% (n = 238) of the medical staff are unaware of whether the hospital has specifically planned drugs for disaster medical support (Fig. 20).

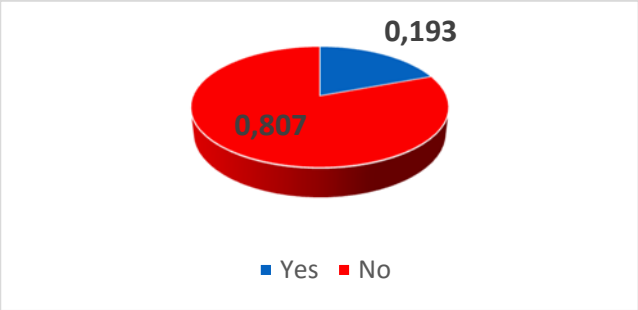

Fig. 20. Awareness of medicines provided for disaster medical support

The most informed are managers - 42.9% (n = 12) are aware ($p = 0.007$ $\chi 2 = 12.25$). Lack of knowledge of the means available to hospital has a negative impact on disaster resilience by affecting its static component.

The resource provision of the casualties of disasters in hospitals also includes medical teams that perform the activities described in the SOP. In our study, 89.8% (n = 265) of the respondents answered that they were not informed about the medical teams specialized for disaster medical support and planned in their hospital (Fig. 21). Insufficient knowledge of the human resources that will be used to treat injured in a disaster can lead to inadequate medical care, which in turn negatively affects disaster resilience.

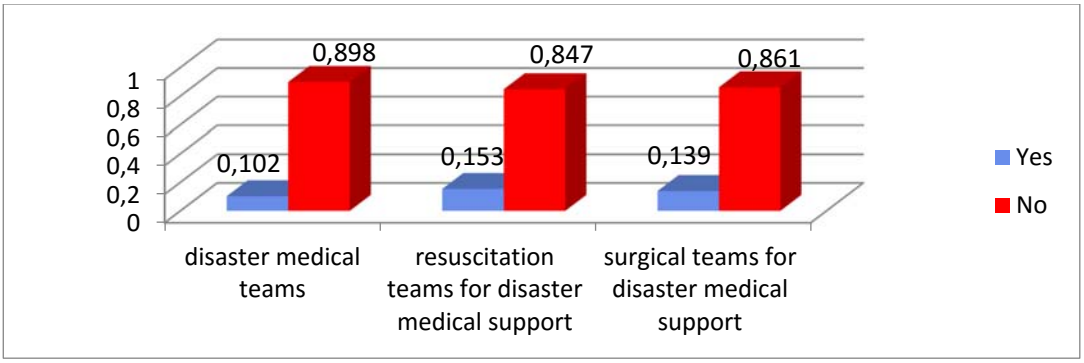

Fig. 21. Awareness of disaster medical teams

A small number of medical professionals are aware of the need to provide additional resuscitation capabilities - 15.3% (n = 39) (Fig. 21). The most familiar are young people up to 40 years ($p = 0.020$ $\chi 2 = 9.80$). With increasing age, the knowledge of medical personnel decreases ($p = 0.002$ $r = -0.178$). In our opinion, the established level of awareness is due to the change of the subject of disaster medicine in the curricula. Older medical professionals are not aware of the importance of the various specialized medical teams for disaster medical support.

Depending on the length of service, the most informed about resuscitation teams are medical professionals with work experience between 1and10 years - 21.7% (n = 25) answered positively ($p = 0.041$ $\chi 2 = 8.24$) (Fig. 22). Most of the respondents have a long enough medical practice, suggesting that they have participated in disaster medical support of casualties and should be aware of the importance of resuscitation medical teams in medical support, so their lack of awareness is unacceptable.

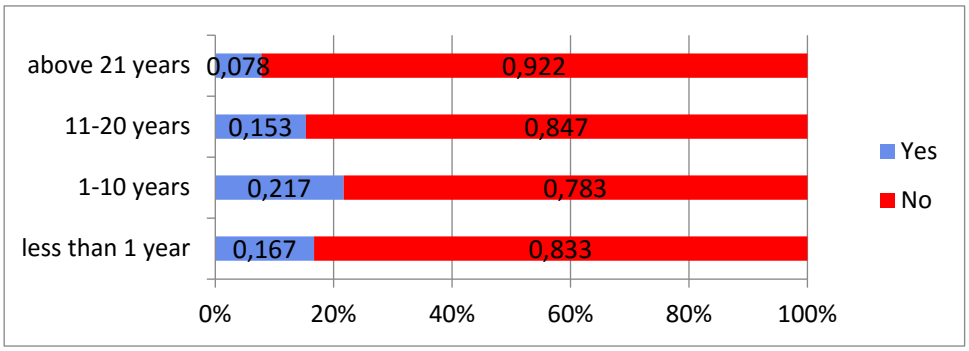

Fig. 22. Dependence of awareness on the planned resuscitation teams for disaster medical support according to the experience

There is a pronounced statistical relationship between the type of hospital and the awareness of employees about resuscitation teams as MHAT are more familiar ($p = 0.001$ $\chi 2 = 19.82$). 27.9% (n = 29) of MHAT's employees are informed, and the share of their collegues working in UMHAT is 8.4% (n = 16). In the plans of the university hospital and one of the multidisciplinary hospitals participating in the study, although the number of resuscitation teams is described, the awareness of the medical specialists working in them is insufficient.

The results are similar regarding the awareness related to the readiness to provide surgical teams, the number and composition of which are planned in advance. The predominant part (86.1%) (n = 254) of the medical staff is not informed about the number that the hospital has to provide in case of disaster (Fig. 21).

It should be noted that there is a significant difference in awareness on this issue according to the profile of hospitals. MHAT specialists are more familiar ($p = 0.033$ $\chi 2 = 5.31$). 10.5% (n = 20) of the MHAT employees were aware, and their colleagues from UMHAT - 20.2% (n = 21). In two of the hospitals in which the study was conducted, the disaster medical support plan indicated the formation of one main surgical team and one spare. However, medical professionals are not aware of them. Similarly, to resuscitation teams, the number of surgical teams is described, but the medical staff is not familiar with them. Poor knowledge implies an insufficient readiness of medical specialists to act in case of a disaster.

In order to ensure the safety of medical teams during disaster medical support, hospitals are required to have PPE stocks. Less than half (42.7%, n = 126) of the respondents were informed about PPE availability in the hospital (Fig. 23).

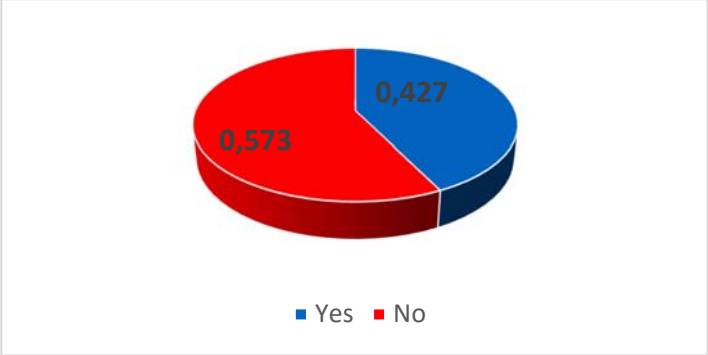

Fig. 23. Awareness of medical professionals about stocks of personal protective equipment

More than half of the surveyed managers (60.7%, n = 17) said they were familiar. Almost half of the resident doctors (49.5%, n = 46) and only 36.0% (n = 54) of the nurses are aware of the availability of PPE stocks in the hospital. It has been statistically proven that managers are the most informed (p = 0.037 $\chi 2$ = 8.47) (Fig. 24). The unsatisfactory awareness could be the cause of secondary casualties, such as medical personnel. Transforming medical professionals from those who provide medical care into those who need it during the disaster, when the capacity of hospitals is limited by human resources, will reduce the hospital disaster resilience.

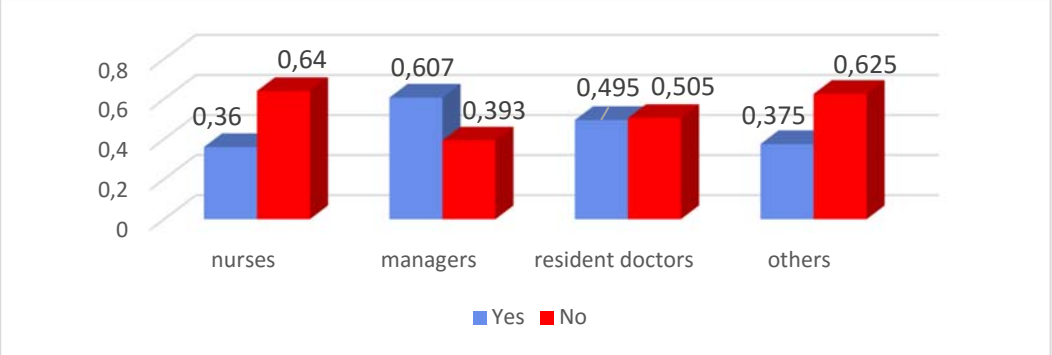

Fig. 24. Assessment of the impact of the position held on the awareness of the available stocks of personal protective equipment

The effectiveness of the disaster medical support in the hospital depends on reliable communication between medical teams and hospital managers, as well as between them and elements of the Unified Rescue System by the use of the communication and information system (CIS). Most medical professionals (83.4%, n = 246) were unaware of the CIS used to communicate with disaster medical managers (Fig. 25).

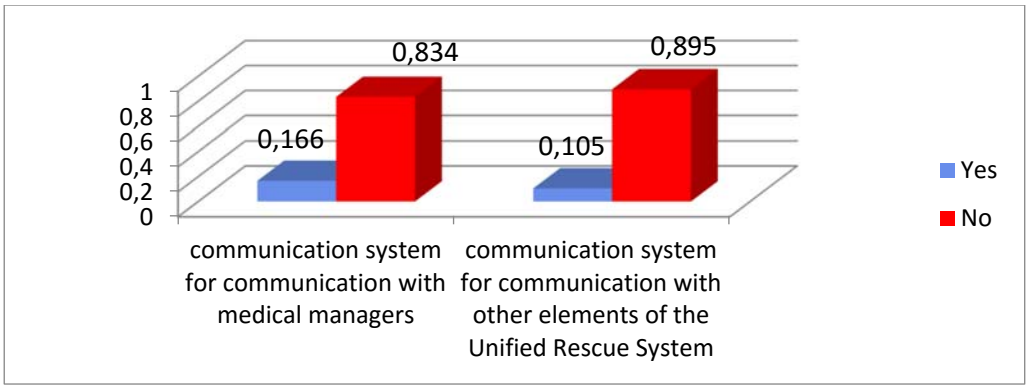

Fig. 25. Awareness of the communication system for communication with medical managers and other elements of the Unified Rescue System

Managers are more familiar with the communication system for communication with disaster medical managers - 35.7% (n = 10) of them are informed (p = 0.004 $\chi 2$ = 13.40) (Fig. 38). Only 14.0% (n = 21) of nurses and 19.4% (n = 18) of resident doctors are aware.

The relative share of uninformed about the communication system for communication with the elements of the Unified Rescue System is extremely high - 89.5% (n = 264) (Fig. 25). Poor knowledge of the communication system in case of a disaster in the hospital is a prerequisite for untimely and inadequate disaster response. Again, the most informed are managers - 21.4% (p = 0.036 $\chi 2$ = 8.56) (Fig. 26). In our study, a large part of managers does not know the type of communication system for communication with disaster medical management, as well as for communication with parts of the Unified Rescue System, which is unacceptable for the position they hold.

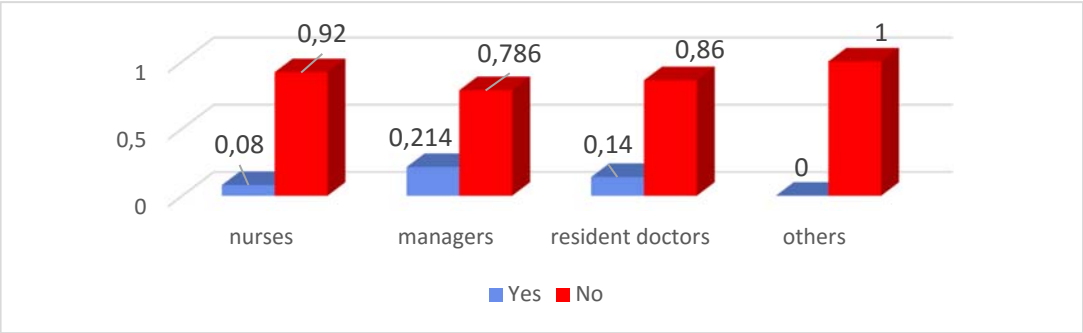

Fig. 26. Dependence of awareness on the communication and information system used for communication with other structures of the Unified Rescue System on the position held

Conclusion:

Medical specialists in the Plovdiv Region are not sufficiently informed about the resources of hospital, set aside for disaster medical support in the form of beds, medicines, specialized medical teams, PPE, as well as the communication and information system using for communication between the elements of Unified Rescue System. According to us, poor knowledge of the various resources is an indicator of the need to improve the training of medical personnel for disaster response. Improving it will increase the hospital disaster resilience by affecting the operational component.

4.4. Ability to enhance disaster medical support

In our survey, the medical specialists working in the hospitals do not know whether teams for enhancement of disaster medical support have been prepared - 85.4% (n = 252) answer negative. Although managers are the most informed, less than half (35.7%, n = 10)

know if the hospital has planned to use teams for enhancement (p = 0.005 χ2 = 12.95) (Fig. 27). Insufficient knowledge of the possibilities of hospital to support the medical forces at disaster medical support implies poor preparation of hospitals, which in turn has a negative impact on disaster resilience.

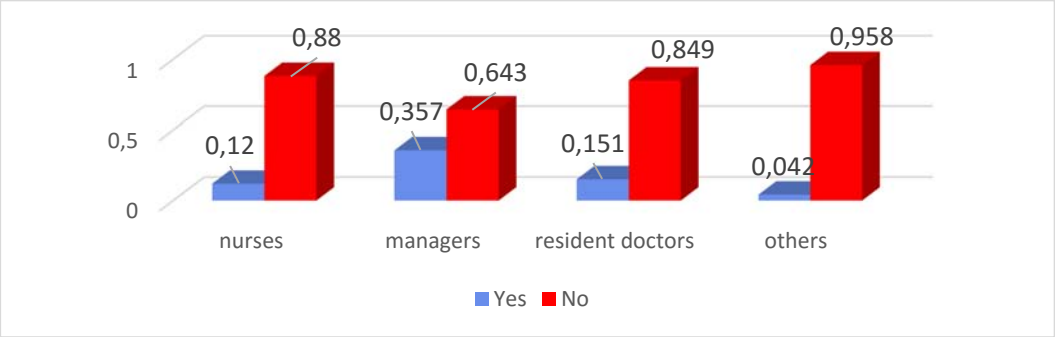

Fig. 27. Dependence of awareness on the teams for enhancement of disaster medical support on the position held

The analysis of awareness about the resources needed to equip such teams shows that 82.0% (n = 242) of medical professionals are unfamiliar. Although managers are the most familiar, only 35.7% (n = 10) know about the resourses (p = 0.048 χ2 = 7.90) (Fig. 28).

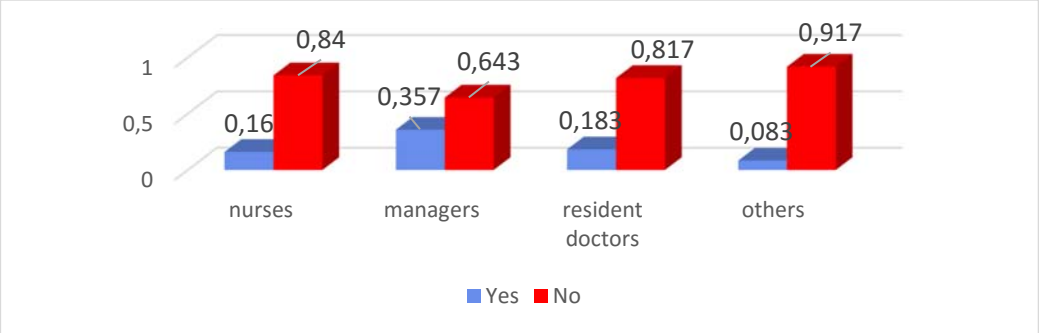

Fig. 28. Assess the impact of the position held on the knowledge of the resource equipment of the teams for enhancement

The majority of medical staff (82.4%, n = 243) are not informed about the means of transport of hospitals, which can be used if necessary. The highest percentage of familiar is among managers (28.6%, n = 8), followed by nurses (13.3%, n = 20) and resident doctors (24.7%, n = 23) (p = 0.015 χ2 = 10.44) (Fig. 29). It is alarming that none of the groups gave more than 30% positive responses.

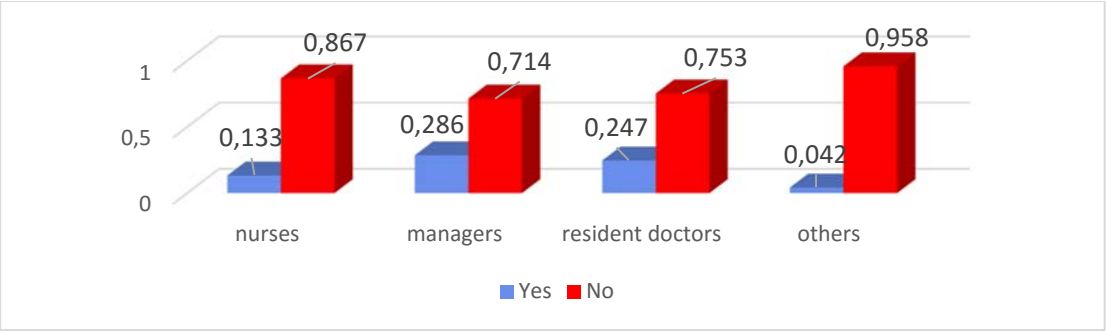

Fig. 29. Awareness of own ambulances for disaster medical support by the position held

Also, the percentage of those who are aware of the the possibilities of hospital to provide resuscitation vehicles for the transportation of casualties with life-threatening injuries is low - 58.6% (n = 173) are not aware if hospitals planning the use of such in disaster medical support (Fig. 30).

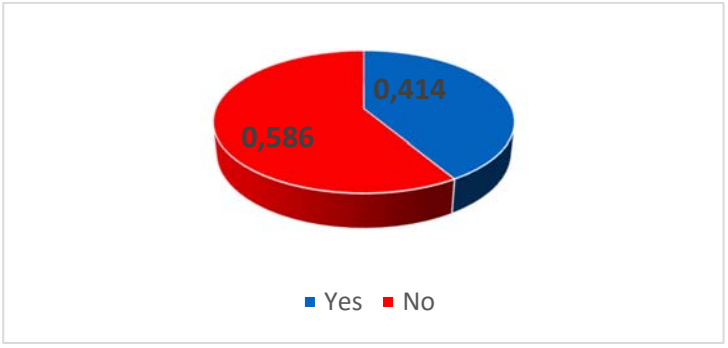

Fig. 30. Awareness of medical professionals regarding the availability of resuscitation vehicles for disaster medical support

It should be noted that the most informed are managers - 71.4% (n = 20) of them are familiar ($p = 0.001$ $\chi 2 = 20.47$). However, the level of awareness among other employees is low - more than half of the nurses (66.0%, n = 99) and resident doctors (50.5%, n = 47) do not know whether the hospital plans to use resuscitation vehicles. The low level of awareness is a prerequisite for low efficiency of medical evacuation and even impossibility for its adequate implementation, which has a negative impact on the operational component of disaster resilience.

Depending on the principle of urgency it may be necessary to carry out an air evacuation of casualties from and to the respective hospital. In our study, a large number of the medical specialists (60.3%, n = 178) are unfamiliar with air evacuation capability of the hospital where they work (Fig. 31).

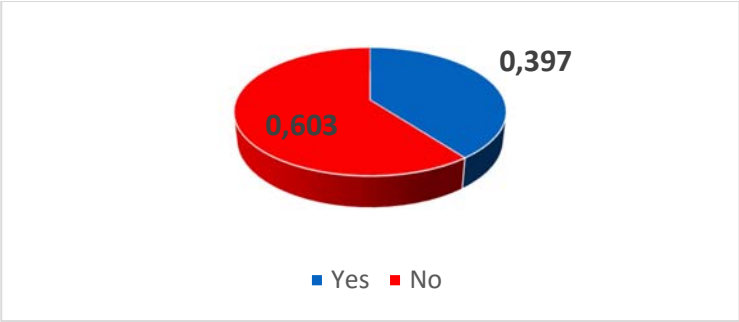

Fig. 31. Awareness of the possibility of air evacuation from and to the hospital

The highest percentage of informed is among managers - 60.7% (n = 17) (p = 0.006 $\chi 2$ = 12.51). 36.0% (n = 54) of the nurses and 45.2% (n = 42) of the resident doctors were aware of the possibility of air evacuation of the hospital (Fig. 32). The good knowledge found among managers that is a prerequisite for good disaster medical management is impressive.

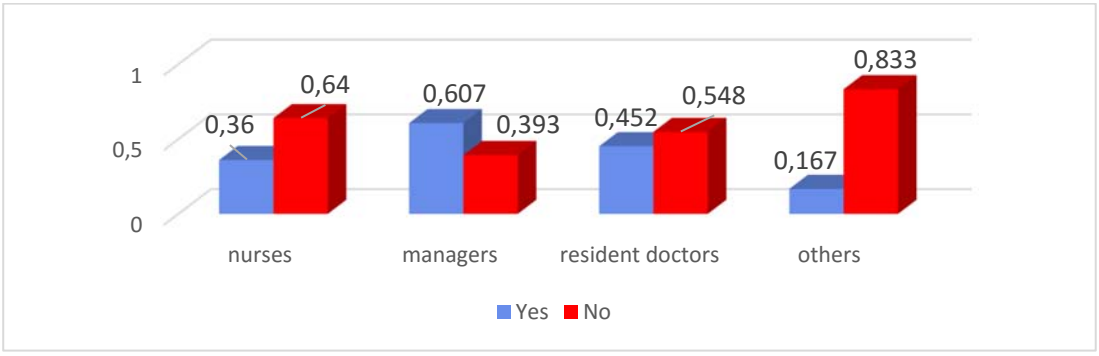

Fig. 32. Relationship between position held and awareness of the possibility of air evacuation from and to the hospital

The employees of UMHAT show a higher level of awareness compared to their colleagues from the MHAT (p = 0.001 $\chi 2$ = 36.48). The medical staff of UMHAT show a high level of awareness of the hospital's ability to carry out air evacuation - 52.4% (n = 100). Only 16.3% (n = 17) of the medical specialists in MHAT answered positively.

As part of hospital disaster response plans, a list of people who will participate in the transport of casualties has been prepared. Most of the medical personnel (86.4%, n = 255) do not know about the existence of a call list of drivers and medical teams for vehicles participating in disaster medical support, and 94.9% (n = 280) of the respondents say that they are not included in it.

In order to coordinate the activities of the medical support of the casualties between the different executors, they must be under general command of the hospital management staff,

which requires a workroom for the disaster management. Most medical professionals (86.1%, n = 254) are not familiar with whether the hospital has such a workroom. Managers show the highest level of awareness (35.7%, n = 10), followed by nurses (12.7%, n = 19) and resident doctors (11.8%, n = 11) ($p = 0.004$ $\chi 2 = 13.56$) (Fig. 33). Low awareness by managers about hospital preparedness for disaster response worsens management quality during disasters, negatively affecting disaster resilience.

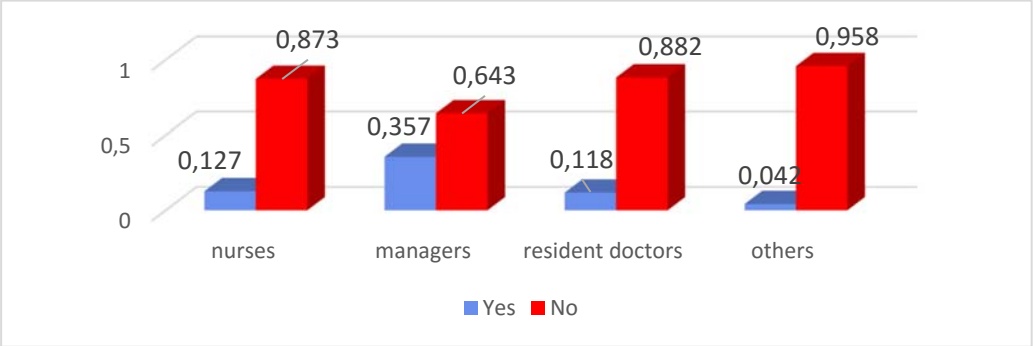

Fig 33. Dependence of the knowledge on the availability of a workroom for disaster management on the position held

Conclusion:

The medical specialists working in the hospitals are insufficiently aware of the availability of teams for enhancement of disaster medical support and the resources related to ensuring their work. This negatively affects the ability of medical institutions to respond adequately providing effective medical care which lead to decrease in hospital resilience.

4.5. Training and drills

According to the medical staff working in hospitals in Plovdiv Region, drills for disaster action are not conducted regularly - 85.8% (n = 253) answer negatively. Managers who indicate that practical classes are a common phenomenon are more among medical professionals, but even their relative share is low - 32.1% (n = 9) ($p = 0.018$ $\chi 2 = 10.01$) (Fig. 34).

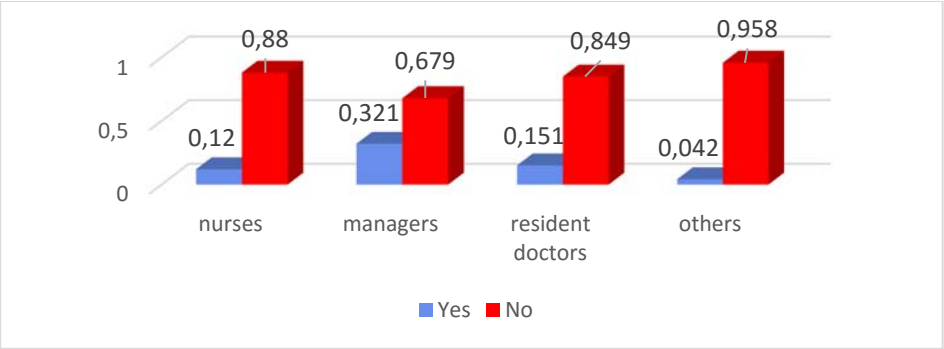

Fig. 34. Dependence of the opinion on the regularity of conducting disaster response drills on the position held

Only 30.8% (n = 91) of the medical specialists indicated that the period of conducting the drills is less than 2 years (Fig. 36). The shares of those who noted that the classes are held over a period of 4-5 years - 6.4% (n = 19) and 2-3 years - 6.8% (n = 20) are equal. More than half (55.9%, n = 165) of the respondents answer that the period for the drills is more than 5 years.

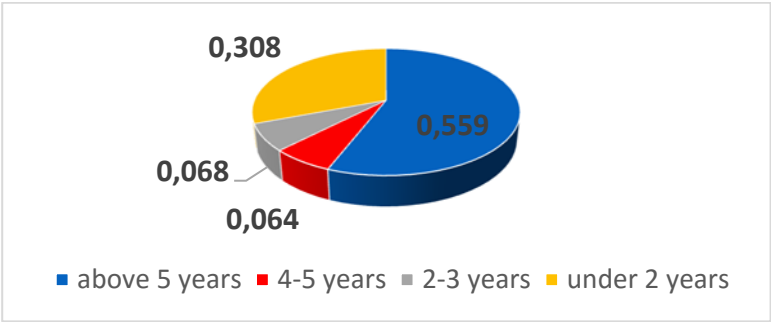

Fig. 36. Opinion of the medical staff for the period of conducting the drills

According to our data, a small number of medical specialists (30.8%) report a period of drills of less than 2 years. This finding shows that the drill of medical professionals is insufficient, which calls into question the automation and speed of their disaster response, which in turn threatens hospital disaste resilience.

Regarding the type of hospital, it was found that 38.2% (n = 73) of those working in UMBAL and 17.3% (n = 18) of those in MHAT claim that the period of drills is less than 2 years. It has been statistically proven that in UMHAT the drills are in shorter periods ($p = 0.001$ $\chi 2 = 16.19$).

Analysis of awareness of the number of disaster drills per year shows that 69.8% (n = 206) state that they are held less than once a year. 16.3% (n = 48) believe that they take place

once a year. 3.7% (n = 11) noted that their number for 1 year is 2, 1.4% indicated 3 workouts per year as an answer, and 8.8% (n = 26) - more than 3 per year.

The relative share (86.1%, n = 254) of medical specialists who did not participate in disaster drills is high (Fig. 37). As an expected consequence of the unsatisfactory participation in disaster response drills is the low percentage of respondents who participated in more than 5 drills (7.1%, n = 21). The main share - 92.9% (n = 274) were participants in less than 5.

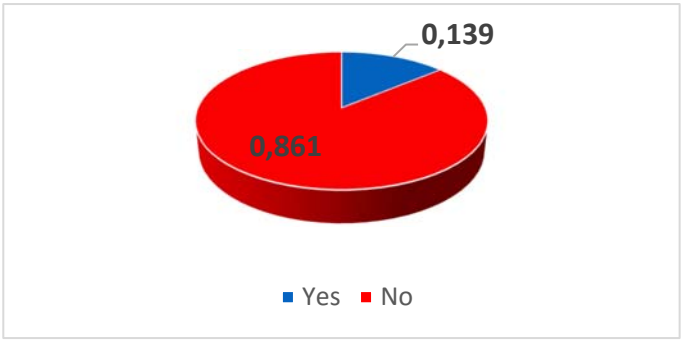

Fig. 37. Participation of medical staff in disaster drills

Managers participated more often in disaster response drills, 39.3% (n = 11) of them were participants (p = 0.001 $\chi 2$ = 22.64). Only 17.2% (n = 16) of the resident doctors and only 6.7% (n = 10) of the nurses took part in drills.

Statistical significance was found between the participation in disaster drills and the experience of the respondents, according to which the medical staff with less than 1 year of experience participated more often than the others (p = 0.026 $\chi 2$ = 9.30) (Fig. 38). The majority of medical specialists have a sufficiently long medical practice, which suggests that they have had the opportunity to participate in disaster practical classes, but still answer negatively.

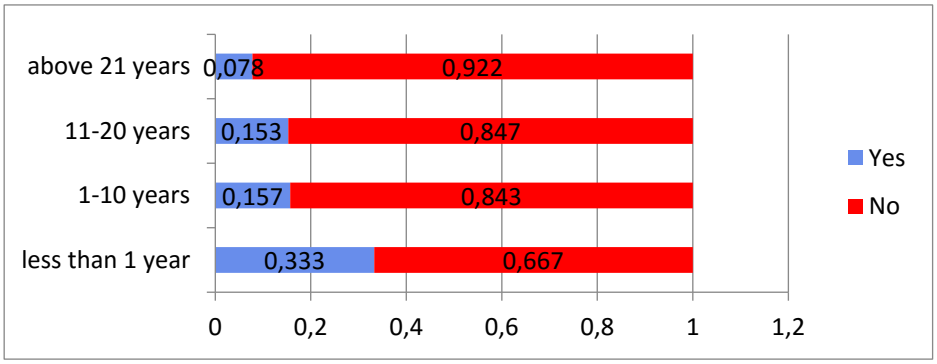

Fig. 38. Participation of the medical staff in disaster drills according to the length of experience

MHAT employees participated in disaster drills more often than their UMHAT colleagues (p = 0.033 $\chi 2$ = 5.32). However, among the employees of both MHAT and UMHAT, the medical specialists who declare being participants are less than 30% - 20.2% (n = 21) of the medical personnel of MHAT and 10.5% (n = 20) of UMHAT.

Most medical specialists (80.0%, n = 236) indicate that they have not received theoretical and practical training on disaster actions in the hospital where they work (Fig. 39).

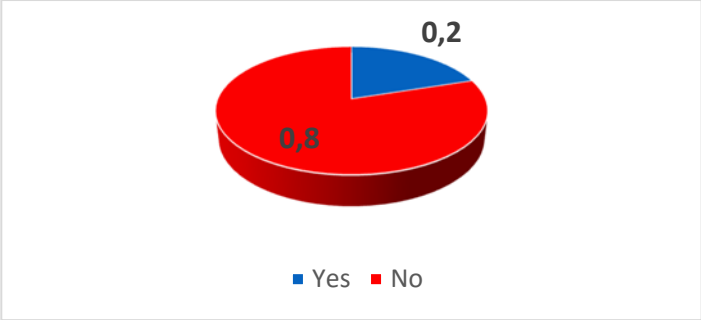

Fig. 39. Opinion of the medical specialists for conducting theoretical and practical training for action in disasters

Regarding the number of conducted disaster trainings in hospitals 92.2% (n = 272) of the respondents state that they have been participated theoretical and practical training less than 5 times. This training was carried out more frequently in managers; half of them (50.0%, n = 14) responded positively (p = 0.001 $\chi 2$ = 23.94). Only 11.3% (n = 17) of nurses and 23.7% (n = 22) of resident doctors indicated that they had been trained to deal with disasters.

The majority of the employees in UMHAT (94.8%, n = 181) and in MHAT (87.5%, n = 91) have not received training, but in UMHAT it has been conducted more often (p = 0.004 $\chi 2$ = 13.54).

Lack of or insufficient theoretical and practical training is related or could lead to slowing the response of medical personnel in the event of a disaster and reducing the effectiveness of the disaster response, which negatively affects human resources as part of the operational component of disaster resilience.

Theoretical and practical disaster training in hospitals is carried out jointly with the reaction forces of the Unified Rescue System of the municipality and the region according to the disaster response plan. More than 2/3 of the respondents (88.1%, n = 260) are not aware whether the hospital participates in joint exercises for disaster reaction with other institutions (Fig. 40).

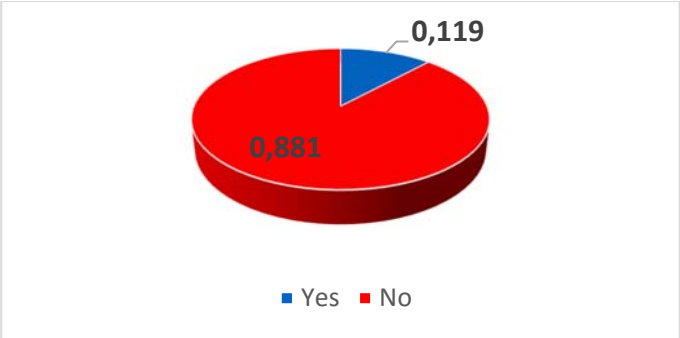

Fig. 40. Awareness of medical professionals about the participation of the hospital in joint exercises for disaster response with other institutions

Conclusion:

The results of our study show a low frequency, volume, and scope of theoretical and practical training of employees in hospitals with regard to specific activities performed during the disaster medical support. Carrying out the training and drills specified in the plans, as well as the use of role-playing games and the possibilities of modern information technologies will increase the readiness of medical professionals and will have a positive impact on hospital disaster resilience.

5. Program for optimization of the operational component of the hospital disaster resilience in Plovdiv Region

Our own research on the awareness and preparation of hospital staff for disaster response, as well as the analysis of the readiness of hospitals to act in an event of a disaster, give us reason to offer a program to optimize the operational component of the disaster resilience of hospitals in the Plovdiv region.

5.1. Audience for which it is intended, venue, and curriculum of the program

- Audience for which it is intended: hospital staff
- Hours: 16 hours of theory and 14 hours of practice
- Venue: lectures - report halls of hospital departments; practical classes - according to the nature and subject of the class - in the emergency department, in the intensive care unit, in front of the entrance of the hospital
- Curriculum - 16 hours of theory, divided into lectures lasting 4 hours, to be held once a week after the completion of the report of the relevant department of the hospital; 14 hours of practice - divided into practical classes lasting 2 hours, to be held once a week after the completion of the report of the relevant department of the hospital

5.2. Objectives of the program for optimizing the capabilities of the operational component of the hospital disaster resilience

1. Theoretical and practical preparation for the use of PPE in the event of a disaster.

2. Theoretical and practical preparation for communication in an event of a disaster.

3. Theoretical and practical preparation for the coordination of actions in the event of a disaster.

4. Acquisition of knowledge and skills for the triage of casualties and construction of a triage area and a reception sorting department.

5. Acquisition of skills for building Forward Medical Station.

6. Development of an approach to disaster planning and management.

7. Theoretical and practical training for first aid and first medical aid in the event of a disaster.

5.3. Tasks of the program for optimizing the capabilities of the operational component of the hospital disaster resilience

Mastering: additional theoretical knowledge and practical skills for distinguishing and using different types of personal protective equipment in an event of a disaster; knowledge and skills for communication during disasters through the use of CIS; skills for coordination with other participants in disaster medical support; knowledge of the elements of the disaster notification system; acquiring knowledge about the role of teams for enhancement of disaster medical support; theoretical knowledge of hospital disaster departmental council; skills for construction of a triage area, reception-sorting department, Forward Medical Station with the located areas inside and outside it; skills for triage of casualties, performing first prephysician medical first physician medical aid in FMS; work with the equipment in the intensive care unit; preparation of an estimate of the necessary means and capabilities for providing medical aid to the casualties; developing a plan for the storage and use of medicines during a disaster and drawing up a list according to the profile of the hospital with those that will be used if necessary; preparation and resource provision of the specialized medical teams for providing medical aid to the casualties; planning the provision of PPE; organization of training and drills for action in a case of a disaster; management and work in an emergency trauma team, in the operating theather, during postoperative and intensive therapy and during the transportation of the casualties.

5.5. Teaching methods - lectures and practical classes.

5.6. Technical tools and aids used in training - multimedia, role-playing games, tests.

5.7. Compulsory competencies:

<u>Theoretical knowledge about:</u>

- the similarities and differences between the different types of gas masks and respirators;
- action of hopkalite bullet;
- measuring and determining the face part of the gas mask;
- carrying, putting on, putting off and stowing gas masks;
- the similarities and differences between the different types of protective clothing;
- functions of the hospital disaster departmental council;

- tasks related to the disaster medical support of the hospital disaster departmental council;

- elements of the disaster notification system;

- functioning of the disaster notification system;

- the role of teams for enhancement of disaster medical support;

- teamwork in an event of a disaster - role and tasks of medical professionals and non-medical staff.

Practical skills:

- to know the available CIS in the hospital;

- to be able to work with CIS in case of a disaster;

- be able to coordinate his/her actions and those of his/her team with other participants in the disaster medical support;

- to be able to build a triage area and a reception-sorting department;

- to be able to triage casualties;

- to be able to build FMS with the areas located inside and outside it;

- to perform first pre-physician medical aid and first physician medical aid in FMS;

- all nurses to be able to work with the equipment in the intensive care unit;

- the members of the hospital headquarter to be able to prepare an estimate of the necessary means and capabilities for providing medical aid to the casualties;

- the members of the hospital headquarter to be able to develop a plan for the storage and use of medicines during a disaster and drawing up a list according to the profile of the hospital with those that will be used if necessary;

- the members of the hospital headquarter to be able to determine the composition, as well as its preparation and resource provision of the specialized medical teams for providing medical aid to the casualties;

- the members of the hospital headquarter to be able to plan the provision of PPE;

- the members of the hospital headquarter to be able to organize training and drills for action in a case of a disaster;

- anesthesiologists to be able to manage or participate in an emergency trauma team, in the operating theather, during postoperative and intensive therapy and during the transportation of the casualties;

- anesthesiologists to be able to triage casualties.

LECTURE COURSE PROGRAM

Lecture: Personal protective equipment

Trainees: all hospital staff

1. Study of the the device of general military gas mask and isolating gas mask.
2. Study the device of hopkalit bullet and respirator.
3. Measure and determine the face part of the gas mask.
4. Carrying, putting on, putting off and storing the gas mask.
5. Introduction to different types of protective clothing.
6. Familiarization of the personnel with the available personal protective equipment, the place for their storage, the person responsible for their storage.

Lecture: Hospital Disaster Departmental Council (Disaster Management Headquarter)

Trainees: managers- medical and nonmedical

1. Hospital disaster departmental council - definition, composition and functions of the council.
2. Getting acquainted with the participants in the specific council of the hospital.
3. Familiarization of each participant with the specific activities for his / her job, which he / she has to perform in a case of a disaster.

Lecture: Disaster notification system - a means of communication between the participants in disaster medical support.

Trainees: all hospital staff

1. Disaster notification system - definition and function.
2. Elements of the system and their functioning.
3. Familiarization of the participants with the specific notification system of the hospital.

Lecture: Teams for enhancement of disaster medical support

Trainees: the medical staff of the hospital

1. Teams for enhancement of disaster medical support - definition and possible composition.
2. Introducing the medical specialists to the specific types of enhancement teams that the hospital has planned for the disaster medical support.
3. Familiarization of each member of the team with the specific activities for his / her job, which he / she has to perform in an event of a disaster.

PRACTICAL CLASSES PROGRAM

Practical class: Working with communication and information system

Trainees: all hospital staff

1. Familiarization of the personnel with the available communication and information system in the hospital with the responsible persons who will be notified in case of disaster.
2. Demonstration of work with the communication and information system.
3. Practical work of everyone with the communication and information system.

Practical class: Coordination in disasters at the level of a hospital and at the level of elements of the Unified Rescue System

Trainees: heads of various departments and units of the hospital

1. Role of the coordination meetings in case of disaster - clarification of the tactics and coordination of the actions of the individual departments in the overall disaster management of the hospital, as well as coordination with other elements of the Unified Rescue System.
2. Getting acquainted with the elements of the Unified Rescue System and their role in disaster medical support.
3. Demonstration of the type and volume of activities that the heads of individual units and departments must perform according to the specifics of their position.
4. Role game.

Practical class: Triage of the casualties in case of disaster in the hospital

Trainees: the medical staff of the hospital

1. Familiarization of the staff with the way to build a triage area.
2. Demonstration of the type and volume of activities that medical professionals must perform in the triage area.
3. Type and volume of activities performed in the hospital reception-sorting department.
4. Solving cases by sorting casualties.
5. Role-playing game of sorting injured.

Practical class: Construction of Forward Medical Station

Trainees: the medical staff of the hospital

1. Familiarization of the personnel with the way of the construction of Forward Medical Station - location of the areas inside and outside it, as well as acquaintance with the specific areas where medical triage, first medical aid, sanitation, decontamination, and dosimetry are performed.
2. Demonstration of type and volume of the activities that the medical specialists have to perform in the different areas of the Forward Medical Station according to the specifics of their activity.
3. Role game - construction of Forward Medical Station.

Practical class: Activities of the nurse in the intensive care unit in a case of a disaster

Trainees: nurses working in the hospital

1. Introduce nurses to the structure and operation of the equipment in the intensive care unit - monitors, devices for artificial lung ventilation, perfusors and infusors.
2. Demonstration of work with the equipment in the intensive care unit.
3. Practical work of each nurse with monitors, devices for artificial lung ventilation, perfusors and infusors.

Practical class: Activities of the hospital headquarter for management before and during a disaster

Trainees: medical and non-medical

1. Familiarization of the hospital headquarters members with the tasks of the headquarter before and during disasters:
    - Preparation of an estimate of the necessary means and capabilities for providing medical aid to the casualties - the structure of the bed capacity and its manuever if necessary, the provision of medical staff and specialized medical teams, vehicles available to the hospital;
    - Developing a plan for the storage and use of medicines during a disaster and developing a list according to the hospital profile with those that will be used if necessary;
    - Determining the composition, as well as its training and resource provision of the specialized medical teams to provide medical aid to the casualties;
    - Stocking with personal protective equipment and appointing a person responsible for their storage and distribution;

- Organization of training and drills for action in a case of a disaster with the managers, as well as all hospital staff;
- Maneuvering of the bed base and the medical staff;
- Making disaster management decisions;

2. Practical work of each of the headquorter members according to his/her position and responsibilities.

<u>Practical class:</u> Activities of anesthesiologists in case of a disaster

Trainees: anesthesiologists working in the hospital

1. Familiarization of anesthesiologists with the medical activities that are possible during disaster medical support in hospitals:
   - Head or member of an emergency trauma team, in the operating theather, during postoperative and intensive therapy and during the transport of the casualties;
   - Triage during prehospital medical triage;
   - Assisting their colleagues in the management of the airways, obtaining vascular access, conducting cardiopulmonary resuscitation, treatment of those affected by chemical or biological agents;
2. Practical work of each of them.

CONCLUSIONS

1. The Plovdiv region is very vulnerable to disasters.

2. The hospitals in the Plovdiv region may be affected by direct and indirect impact of disasters.

3. Impacts on the static and operational components have the potential to reduce disaster resilience.

4. To increase operational hospital resilience, it is necessary to optimize disaster medical support plans.

5. It is necessary to optimize the existing standard operating procedures.

6. The resilience of the operational component is directly related to postgraduate theoretical and practical training of hospital staff.

CONTRIBUTIONS

Contributions of scientific and theoretical nature:

1. The multifactorial negative impact of disasters on the healthcare system in Plovdiv region is analyzed.

2. The role and the place of hospitals for the disaster resilience of the healthcare system in Plovdiv region is proved.

3. An analysis of the operational component of disaster resilience in Plovdiv region has been performed.

4. The importance of the operational component of hospital disaster resilience for increasing of the resilience has been determined.

5. The main elements of the operational component that can be influenced in the mitigation and preparation phases have been identified.

6. The main directions for optimizing hospital disaster resilience by increasing the capacity of the operational component have been identified.

Contributions of an applied nature:

1. The main activities for which hospitals must be prepared for an adequate and effective disaster response are identified.

2. The main areas of the operational component of hospital disaster resilience in the Plovdiv region which need to be optimized to increase resilience, are identified.

3. A program has been created to optimize the capabilities of the operational component of the hospital disaster resilience in the Plovdiv region.

4. A schedule of theoretical courses and practical classes to increase the hospital disaster resilience in Plovdiv region is proposed for implementation.

Enrichment of the Theory and Practice of Disaster Medicine:

1. The necessity of increasing the hospital disaster resilience is proved.

2. The elements of the static and operational component of hospital resilience are clearly and precisely differentiated and defined.

PUBLICATIONS RELATED TO THE THEME OF DISSERTATION

List of scientific publications related to the disertation:

1. **Georgieva M,** Kostadinov R, Semerdjieva M. Disaster medical support plan as an element of hospital disaster resilience. Folia Medica 2021 (under print) (referenced and indexed in Scopus)

2. **Georgieva M,** Kostadinov R., Valkanova E. Hospital staff readiness for disaster medical support. Trakia Journal of Sciences 2018; 16 (1): 133-135. (referenced and indexed in Web of Science)

3. **Georgieva M,** Kostadinov R, Etova R. [The training of paramedics in disaster medicine - a prerequisite for increasing disaster resilience.] Proceedings of the First National Conference "Public Health - a global priority in science and practice" 2017; 105-110. [Article in Bulgarian]

List of participations in scientific forums related to the diseratation:

1. **Georgieva M.,** Kostadinov R., Etova R. [THE TRAINING OF PARAMEDICIANS IN DISASTER MEDICINE - PREREQUISITE FOR INCREASING DISASTER RESILIENCE.] First National Conference "Public Health - a global priority in science and practice" June 9-10, 2017, Varna [Short oral presentation in Bulgarian]

2. **Georgieva M**., Kostadinov R., Valkanova E. [READYNESS OF HOSPITAL STAFF FOR ACTION IN CASE OF A DISASTER.] Second National Conference of Public Health, June 14-15, 2018, Stara Zagora Mineral Baths [Poster in Bulgarian]

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