MEDICAL UNIVERSITY – Varna

FACULTY OF PUBLIC HEALTH
Department of Disaster Medicine and Maritime Medicine

DR. YASEN YONKOV GEORGIEV

PREPAREDNESS OF HEALTHCARE FACILITIES IN EMERGENCY RESPONSE TO NATURAL AND ANTHROPOGENIC DISASTERS IN VARNA REGION OF BULGARIA

A B S T R A C T

of a Dissertation

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SCIENTIFIC SUPERVISORS:

Prof. Dr. Krasimir Gigov, MD
Assoc. Prof. Nikolina Radeva, pHD

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Public Defense Notice

The public defense will take place on October 31, 2025, at 12:00 PM, in Room 402, 4th floor, at the building of the Regional Health Inspectorate (RHI), affiliated with the Faculty of Public Health of the Medical University "Prof. Dr. Paraskev Stoyanov" – Varna, located at 55 Marin Drinov Street, Varna.

The dissertation materials are available at the Science Department of the Medical University "Prof. Dr. Paraskev Stoyanov" – Varna, 55 Marin Drinov Street, and on the official website of MU-Varna.

The numbering of tables and figures does not correspond to those in the dissertation itself.

USED ABBREVIATIONS

BRC	Bulgarian Red Cross
EC	European Commision
EU	European Union
URS	Unified Rescue System
DPL	Disaster Protection Law
MH	Ministry of Health
NSI	National Statistical Institute
NCHI	National Center for Health Information
NCPHA	National Center of Public Health and Analyses
UN	United Nations
OC	Operational Center
FSCP	Fire Safety and Civil protection
TIC	Toxic Industrial Chemicals
PTSD	Post-Traumatic Stress Disorders
RHI	Regional Health Inspectorate
WHO	World Health Organization
EMCC	Emergency Medical Care Center
CBRN	Chemical, Biological, Radiological, Nuclear
CT	Computer Tomography
CRED	Centre for Research on the Epidemiology of Disasters
EM-DAT	Emergency Event Database
GIS	Geographic Information System
HIT	Health Information Technology
HVAC	Heating, Ventilation and Air Conditioning
IDDRR	Internation Day for Disaster Risk Reduction
IRDR	Integrated Research on Disaster Risk
PAHO	Pan American Health Organization
START	Simple Triage and Rapid Treatment
UN	United Nations
UNISDR	United Nations Office for Disaster Risk Reduction
WHO	World Health Organization

I. INTRODUCTION

In recent years, the risks associated with disasters have been steadily increasing, and the resulting emergency situations have affected a growing number of people at local, regional, national, and international levels. Hospitals and other healthcare facilities are generally considered safe spaces. Nevertheless, the high number of incidents—both anthropogenic and natural—demonstrates that these institutions are not immune to risk and often face serious challenges.

A critical issue is the extent to which healthcare institutions are prepared to protect themselves and respond during disasters. Studies conducted in various countries offer a clear answer to this question: globally, preparedness remains at a low level. Data from research and real-life experience indicate that the provision of medical assistance to disaster victims and their potential evacuation involves highly specific requirements. Even highly qualified professionals who lack experience in disaster management and emergency healthcare—particularly under conditions of limited time and constrained diagnostic and treatment capabilities—may be unable to provide adequate care.

Healthcare facilities are among the primary providers of health services to the public. They play a vital role in disaster response, yet disasters can severely impact their functionality. Natural disasters such as earthquakes, hurricanes, floods, and wildfires—as well as man-made events including terrorist attacks, pandemics, and others—can disrupt hospital operations, thereby increasing risks for patients, staff, and visitors.

Natural and anthropogenic hazards can affect hospitals in multiple ways. Infrastructure damage—including buildings, equipment, and utilities such as electricity and water supply—can impair hospitals' ability to operate at full capacity, thereby reducing their capacity to deliver services. At the same time, a sudden surge in demand for healthcare can result in overcrowding and staff overload, increasing the risk of adverse events and compromising patient safety. The shortage of essential materials, including medical supplies, equipment, medications, and food, can also have a negative impact on patient care.

The preparedness of hospitals to respond to natural and man-made disasters is a key factor in reducing the associated risks. Hospitals must develop comprehensive disaster management plans that identify potential hazards, define response protocols, and ensure the availability of appropriate resources—including personnel, supplies, and equipment. These plans should also include communication measures for staff, patients, and stakeholders during emergencies, and protocols for coordination with external agencies such as emergency services and government bodies.

In conclusion, the risk posed by natural and anthropogenic hazards to healthcare institutions is a serious concern. Disasters may damage infrastructure, overwhelm healthcare systems, and cause critical shortages, thereby increasing risks to all involved. Hospitals must prioritize planning and disaster preparedness to ensure the continuity of essential healthcare services during and after mass-casualty events, including regular staff training and drills.

Implementing comprehensive and routinely updated disaster preparedness plans can significantly reduce the risks associated with such hazards and ensure the safe and effective provision of healthcare services to society and its communities.

II. AIM AND OBJECTIVES OF THE STUDY

Based on the literature review and the analysis of current issues related to the preparedness of healthcare facilities in Varna District for protection and response in the face of natural and anthropogenic hazards, the following primary.

AIM:

To examine the preparedness of healthcare facilities in Varna District for protection and response in the event of natural and anthropogenic hazards, and to propose measures to increase their resilience and reduce risk.

OBJECTIVES:

1. To identify the risks posed by natural and anthropogenic hazards in Varna District.
2. To study the types of hospital healthcare facilities operating in Varna District.
3. To investigate the level of preparedness of hospital healthcare facilities in Varna District for protection and response in case of anthropogenic and natural disasters.
4. To assess the capacity of hospitals in Varna District to reduce the risk from anthropogenic and natural hazards.
5. To develop preparedness measures for protection and effective and timely response to disasters in the hospital healthcare facilities of Varna District.

III. MATERIALS AND METHODS OF THE STUDY

1. Main Thesis and Research Hypotheses

The main thesis of the dissertation is that in order to effectively address natural and anthropogenic hazards impacting the functioning of hospital healthcare facilities and public health as a whole, it is necessary to enhance the resilience of these institutions by implementing measures related to infrastructure, critical systems, protection planning, staff training, and intersectoral cooperation.

To support the main thesis of the dissertation, the following research hypotheses have been formulated:

1. Natural and anthropogenic hazards turn into disasters for individual communities due to the lack of preparedness in certain components of the healthcare system.
2. Disasters are a contributing factor to the emergence of a range of public health problems.
3. Effective organization and management—encompassing preparedness for protection and response across all components of the healthcare system—are essential for overcoming challenges and enhancing disaster risk management capacity.
4. The implementation of targeted interventions aimed at strengthening the operational capacity of healthcare facilities is critical to ensuring an adequate and timely response to disasters.

2. Research Approach

The study is based on a qualitative research design, incorporating the collection, processing, and analysis of non-numerical data with the aim of gaining an in-depth understanding of the practices, experiences, and perceptions of key stakeholders regarding the disaster preparedness and response capacity of hospital healthcare facilities. This approach facilitates comprehensive insight into the problem and fosters the generation of new ideas and strategic solutions for addressing the growing challenges associated with the increasing frequency and severity of disasters, which continue to affect an expanding population at local, national, and international levels, and exert a progressively detrimental impact on healthcare systems.

The object of the study comprises hospital healthcare facilities, given their critical role within the broader framework of disaster risk reduction and capacity building for the protection of the population.

The selected methodological approach is defined by the specific characteristics of both the subject of the dissertation and the phenomena under investigation. Through the use of in-depth interviews with key decision-makers possessing the requisite knowledge, skills, and competencies, it was possible to collect, process, and analyze data that contributes directly to achieving the defined scientific aim of the study.

3. Research Methods

The research objectives were accomplished through the use of qualitative data derived from in-depth interviews with open-ended questions. These interviews were approved by the Committee for Scientific Research (CSRD) under Protocol No. 134, dated 20.06.2023. The approach preserved the autonomy of the respondents' perspectives and allowed for adaptation in response to emerging research questions. In-depth interviewing, as a method, is widely employed in exploratory research projects with the purpose of collecting extensive data through an open and flexible inquiry framework.

Data collection was conducted in real-world settings; responses were audio-recorded, transcribed, and systematically described.

All applied methods and analytical instruments were selected in accordance with the study's scientific objectives. They analyzed and evaluated discrete aspects of the investigated phenomena, and their integrated application enabled a holistic understanding of the research subject, thus supporting the attainment of the dissertation's goal.

For data processing and analysis within the qualitative study, the research utilized exploratory methods and software tools including Microsoft Excel 2022 and MaxQDA.

4. Study limitations

Participants in the study were adult volunteers (over 18 years of age), holding leadership or organizational roles in disaster risk management within hospital healthcare facilities in Varna District. They shared their personal expert opinions in the context of structured, face-to-face interviews. Each participant provided written informed consent prior to inclusion in the study.

Regarding the **object of the study**, the following scope limitations were established in the framework of the dissertation:

- **Type of healthcare facilities:** The focus was on multi-profile hospitals for active treatment, due to their operational significance and capacity in disaster response..
- **Level of expertise:** Participants were selected based on possessing the necessary competencies—knowledge, practical skills, and relevant professional experience.
- **Occupational roles:** Only individuals holding executive or managerial positions within hospital healthcare institutions were included.

- The study is territorially limited to the Varna District—specifically the cities of Varna and Provadia—due to the specific nature of potential disaster risks and their impact on the regional healthcare system.

Regarding the subject of the study: The preparedness of hospitals for protection and response in disaster situations occupies a central position and is of critical importance, given their classification as part of the country's critical infrastructure and their fundamental role within the healthcare sector.

5. Materials Used

The information required to achieve the aims and objectives of the dissertation was obtained from the following sources:

- Review, processing, analysis, and synthesis of data from scientific publications authored by Bulgarian and international researchers.
- Secondary data from Bulgarian and international empirical studies.
- Statistical data derived from national and international databases and statistical reference sources.
- Primary and secondary data from Bulgarian and international organizations and institutions.
- In-depth interviews with individuals over 18 years of age, holding leadership and organizational roles in disaster risk management within hospital healthcare facilities, who provided expert opinions based on their professional experience.

Throughout the research process, materials from the past 20 years were utilized from the following sources:
The National Center for Health Information (NCHI), National Statistical Institute (NSI), Ministry of Health (MoH), National Center for Public Health and Analyses (NCPHA), Regional Health Inspectorates (RHI), Regional Directorates of Fire Safety and Civil Protection, the municipalities of Varna and Provadia, the World Health Organization (WHO), the European Commission (EC), the United Nations Office for Disaster Risk Reduction (UNDRR), among others.

6. Object of the study

To achieve the aim and objectives of the dissertation, the subjects of the sociological research are adult individuals—experts occupying leadership and organizational positions related to disaster protection in hospital healthcare facilities within Varna District.

Inclusion criteria for participants:

- Minimum age of 18 years;
- Current professional position;
- Informed consent to participate in the study.

The interview questions were tailored to the respondents' level of competence and their respective professional roles. They were also aligned with the individuals' responsibilities concerning hospital disaster preparedness. The topics covered include the level of institutional readiness, potential challenges during the disaster response phase, staff response capacity, risk reduction activities, and organizational resilience.

From a territorial perspective, the sociological survey is limited to the cities of Varna and Provadia. However, in addressing the research objectives, consideration was also given to other planning regions and administrative districts within Bulgaria.

The rationale for selecting Varna District includes the following factors:

- The **geographical characteristics** of the region allow for the inclusion of a variety of disaster scenarios and their impact on healthcare facilities and the healthcare system as a whole.
- The **demographic, economic, and socio-cultural diversity** of the region provides a representative framework encompassing the full spectrum of existing differences present across the country.

The hospital healthcare facilities were selected based on the following criteria:

- Institutional profile;
- Geographical location;
- Experience in disaster management;
- Infrastructure characteristics;
- Bed capacity;
- Number and qualifications of medical and non-medical staff.

From a territorial standpoint, the study involved experts from the following **multi-profile hospitals for active treatment** located in Varna District:

- University Multiprofile Hospital for Active Treatment "St. Marina" EAD, Varna;
- Military Medical Academy – Varna Branch (MBAL-Varna "Military Medical Academy"), Varna;
- Multiprofile Hospital for Active Treatment "Tsaritsa Yoanna – Provadia" EOOD, Provadia.

7. Subject of the Study

The **preparedness of hospital healthcare facilities in Varna District** for protection and response in the face of **natural and anthropogenic hazards** constitutes the subject of this dissertation. It is examined through a comprehensive lens, taking into account the following key aspects:

- *Response capacity***:** Preparedness is a prerequisite for developing institutional capacity and ensuring an effective response that protects both personnel and patients while minimizing material damage.
- *Resource optimization:* Operating under resource constraints (including workforce, medical supplies, and equipment) is a common practice. Advance planning supports the optimal allocation and utilization of these resources in areas of greatest need during and after disasters.
- *Patient safety:* The presence of evacuation plans, backup systems for powering medical equipment, and adequate medical supplies contributes significantly to enhancing patient safety during disaster situations.
- *Public health:* Hospitals are a critical component of health security and emergency medical services during disasters. Understanding their level of preparedness and resilience enables effective collaboration with all relevant stakeholders and supports coordinated disaster response.

- *Risk reduction:* Healthcare facilities face a range of risks, including cybersecurity threats, infectious disease outbreaks, and natural disasters. Risk mitigation is essential for ensuring continuity of operations and the provision of necessary care to patients and disaster-affected individuals in need of medical assistance.
- *Staff training and support:* Healthcare professionals must possess the knowledge, skills, and competencies required to provide care under disaster conditions. Their preparedness enhances both confidence and compassion, strengthening the institutional capacity to manage crises.
- *Community trust:* When hospitals are well-prepared and resilient, they build greater public trust and confidence. Communities are more likely to seek care and adhere to public health directives when they believe in the healthcare system's capacity to manage emergencies effectively.

The expert experience shared by disaster management professionals offers valuable insights into the various aspects of the study. Their opinions significantly enhance the reliability of the research by ensuring alignment with the dissertation's stated aim and objectives: to support capacity building for protection, identify potential challenges, enhance institutional preparedness and awareness, improve intersectoral communication, and strengthen resilience in disaster situations.

8. Research Process

Conducting in-depth interviews with executive directors and disaster preparedness coordinators of hospital healthcare facilities is of critical importance for understanding institutional readiness, response strategies, and potential areas for improvement. The qualitative data analysis was conducted in a structured and methodologically rigorous manner, following recognized principles of thematic analysis.

1. Formulation of the research question: The central research question guiding the analysis was clearly defined to ensure focus and relevance throughout the process.
2. Data collection: The gathered and synthesized data were rich in content and diversity, capturing a wide range of perspectives and contextual nuances.
3. Transcription: Audio-recorded interview data were transcribed into textual form, given their fundamental importance for accurate textual analysis.
4. Identification of analytical units: Analytical units within the dataset were systematically identified, including key words, phrases, and expressions relevant to the study objectives.
5. Coding: Each unit was systematically coded based on its content. Codes represented emerging themes, concepts, or patterns observed in the data. Coding was performed both manually and with the assistance of specialized qualitative analysis software.
6. Category formation: Related codes were grouped into broader conceptual categories. These higher-order categories served to structure and organize the coded data meaningfully.
7. Theme and pattern identification: Common themes and patterns were identified within the categories. Themes reflected the central ideas derived from the data, while patterns highlighted underlying relationships, trends, or regularities.
8. Data interpretation: Identified themes and patterns were interpreted in the context of the research question. This step provided meaningful insights and contextual

understanding of the findings, exploring their implications within the broader scope of the study.

9. Reporting: Findings were reported clearly and coherently. The report includes illustrative quotes and examples from the data to support the identified themes and patterns.

Throughout the entire research process, the principle of neutrality was upheld. Efforts were made to eliminate bias or preconceived assumptions that could compromise the analysis or synthesis of the data. Particular attention was given to the contextual meaning of the data and the linguistic nuances, in order to achieve a deep and nuanced understanding of the research topic.

8.1 Documentary Method / Information

To achieve the aims and objectives of the dissertation, a variety of information sources were utilized regarding the subject and object of the study:

1. Literature sources – Preparedness and protection of healthcare facilities in the face of natural and anthropogenic hazards. Issues related to protection, prevention methods, and preparedness of healthcare institutions during disaster situations are insufficiently discussed in the international literature, and the available information in Bulgarian sources is very limited. Therefore, the majority of referenced publications are by foreign authors. Concurrently, for the theoretical and methodological analysis, results from various theoretical and empirical studies were employed, including monographs, articles published in specialized scientific journals, and research reports.
2. Empirical studies and technical reports – To clarify the subject of the study, materials, data, and findings from research conducted by:
    - Bulgarian governmental and non-governmental institutions such as the Ministry of Health, Regional Health Inspectorates (RHI), Bulgarian Red Cross (BRC), among others;
    - International institutions and organizations including the World Health Organization (WHO), the United Nations (UN), and the United Nations Office for Disaster Risk Reduction (UNDRR), among others.
3. Statistical databases – Data from various Bulgarian statistical sources were used to characterize the object of study and analyze its dynamics.

8.2 In-Depth Interview Method

Three in-depth interviews were conducted, each based on a pre-prepared set of 22 questions addressing the preparedness for protection and response of selected hospital healthcare facilities in Varna District against natural and anthropogenic hazards. The questions were designed to elicit personal opinions and positions from the interviewees and were developed based on a World Health Organization document (Hospital Emergency Response Checklist: An All-Hazards Tool for Hospital Administrators and Emergency Managers), aimed at reducing disaster risks for healthcare facilities and building effective protective capacity.

The interviews were conducted face-to-face, each lasting approximately 60 minutes per respondent. The principle of impartiality toward any specific individuals, personal characteristics, or professions was strictly observed. Respondents were encouraged to engage openly with the questions. Anonymity of participants was maintained. Interviewees were informed that their selection was based on their positions, knowledge, experience, and competencies. As a rule, questions were asked exactly as written in the interview guide. In cases where participants experienced difficulty with terminology or phrasing, additional explanations were provided.

The questions covered the following areas:

- Respondent characteristics – a critical component of the study. The goal was to include executive directors or disaster preparedness coordinators in hospital healthcare facilities.
- Resilience of healthcare institutions to various impact factors.
- Capacity of hospital healthcare facilities to provide adequate protection and timely response during disaster events.
- Established organizational structures and implemented measures for mitigating risks associated with anthropogenic and natural disasters.
- Updating and supplementing protection plans for risks of diverse nature.
- Preparation of a Command Post for facility leadership.
- Issues related to protection and prevention methods.
- Fire safety and other specialized preparedness measures.
- Training and readiness of healthcare personnel for disaster situations.
- Preparation of sites and equipment for decontamination in the event of unconventional hazards.
- Provision of reserves of material and technical resources.
- Evacuation planning and other measures related to potential disaster impacts.

8.3 Analytical Method

1. Risk analysis of disaster situations and their impact on healthcare facilities – The objective is to identify and rank disaster risks in Varna, the Varna region, and at the national level. This facilitates the assessment of risks to healthcare institutions, their personnel, and patients.
2. Statistical database analysis – Utilization of data from the National Statistical Institute and scientific publications indexed in international databases concerning disaster events in recent years and their consequences.
3. Analysis of disaster events in Varna District and their aftermath.
4. Analysis of the number of affected individuals and the measures taken following disaster occurrences.
5. Comparative analysis of various studies to identify differences or variations in attitudes among persons responsible for protection and preparedness of healthcare facilities in disaster scenarios.
6. Analysis of the level of disaster preparedness and response capacity of the healthcare facilities participating in the study.
7. Systematic analysis of documentation from the Regional Health Inspectorate – Varna, Ministry of Health, Ministry of Environment and Water, and others.

To conduct the aforementioned analyses, various materials were utilized, including:

1. Legal and regulatory framework:

- Disaster-related laws: Disaster Protection Act, National Disaster Risk Reduction Program 2021-2025, Annual Implementation Plans of the National Disaster Risk Reduction Program 2021-2025, Ordinance on the conditions, procedures, and authorities for conducting disaster risk analysis, assessment, and mapping, Health Act, among others.
- Disaster protection laws: Ministry of Interior Act, Defense and Armed Forces Act of the Republic of Bulgaria, National Single European Emergency Number 112 System Act, municipal and regional ordinances on disaster response, Varna District Disaster Protection Plan, etc.

2. Strategic disaster protection documents – National Strategy for Disaster Risk Reduction 2018-2030, Municipal Disaster Risk Reduction Programs, among others.

9. Tabular and Graphical Methods for Data Visualization.

A variety of tables and charts have been developed to illustrate the research results. These include linear graphs, planar and three-dimensional graphical representations, cartograms, cartodiagrams, and photographs.

IV. RESULTS AND DISCUSSION

Natural and Anthropogenic Hazards in Varna and Varna District

Varna District is located in the northeastern part of the Republic of Bulgaria and spans an area of 3,819.5 square kilometers, accounting for 3.45% of the country's total territory. As of December 31, 2020, the population of the district was 470,124 residents. It borders the Black Sea to the east, Shumen District to the west, Dobrich District to the north, and Burgas District to the south. The district comprises 12 municipalities, 11 towns, and 148 villages. The largest municipality by area is Provadia (517.8 sq.km), followed by Dolni Chiflik (487.1 sq.km) and Valchi Dol (472 sq.km), while the smallest are Beloslav (93.1 sq.km) and Byala (161 sq.km).

Population distribution is highly urbanized: 83.15% of the residents live in urban areas, while only 16.85% reside in rural areas. In the city of Varna, 38% of the land is developed, 41% is used for agriculture, and 21% is forested.

The relief of the region is hilly and flat, featuring plateaus, lowlands, and valleys. The total coastline stretches for 32 kilometers, starting in the north at Kranevo (near Cape Ekrene) and reaching the southern tip of Pasha Dere. Due to the area's topography, extensive construction, diverse natural formations, and the influence of various climatic and geological factors—including heavy rainfall—the Varna region is at increased risk of landslides.

Several rivers run through the district, including the Kamchia, Provadiyska, Batova, Osenovska, Suha Reka, Dvoynitsa, Fandakliyska, and Devnenska, as well as the Beloslav and Varna Lakes. According to some sources, there are 84 registered dams in the area, 11 of which are considered potential disaster hazards (Panteleeva, 2023). The largest of these is the Tsonevo Dam.

The Varna region is also known for heavy seasonal rainfall, which can exacerbate the risk of flooding and the formation of ravines (36 have been identified in the Varna area). Such events can have serious consequences for infrastructure, housing, and public safety. The economic sector is concentrated in the industrial zones of Varna and Devnya, where a large number of enterprises and facilities are located. These areas pose a significant risk of large-scale industrial accidents that could affect nearby populations.

Key railway lines connecting eastern and western Bulgaria pass through the district. The road infrastructure includes a segment of the Hemus Motorway.

The presence of bridges and the connection to Asparuhovo district via the Asparuhov Bridge in Varna create risks of major traffic accidents with multiple casualties. Damage to the bridge could also isolate part of the population from the city center. There are an additional six bridges spanning the Kamchia River. The Trans-European Transport Networks pass through the Port of Varna, linking Europe with the Middle East.
Varna Airport is one of the largest in the country and serves as the region's air transport hub. It plays a key role in supporting the city's tourism through domestic and international flights.

Based on the geographical profile and the analysis conducted, the most characteristic hazards in the district include extreme temperatures, landslides, earthquakes, floods, hurricane-force winds, forest fires, infectious diseases, and epidemic outbreaks. In industrial zones, where toxic substances are stored and processed, accidents with serious consequences for the population are possible. Due to the city's nature and its developed tourism sector, the risk of terrorist threats cannot be ruled out. There is also a high risk of anthropogenic disasters related to transportation, including aviation, railway, road, and maritime incidents.

4.1.1.1 Earthquakes

Varna District is located in Eastern Bulgaria and is part of the Mediterranean-Transasian seismic belt, which is characterized by moderate seismic activity. The maximum expected magnitude is up to 8 on the Richter scale and intensity IX on the Medvedev–Sponheuer–Karnik scale (MSK-64).

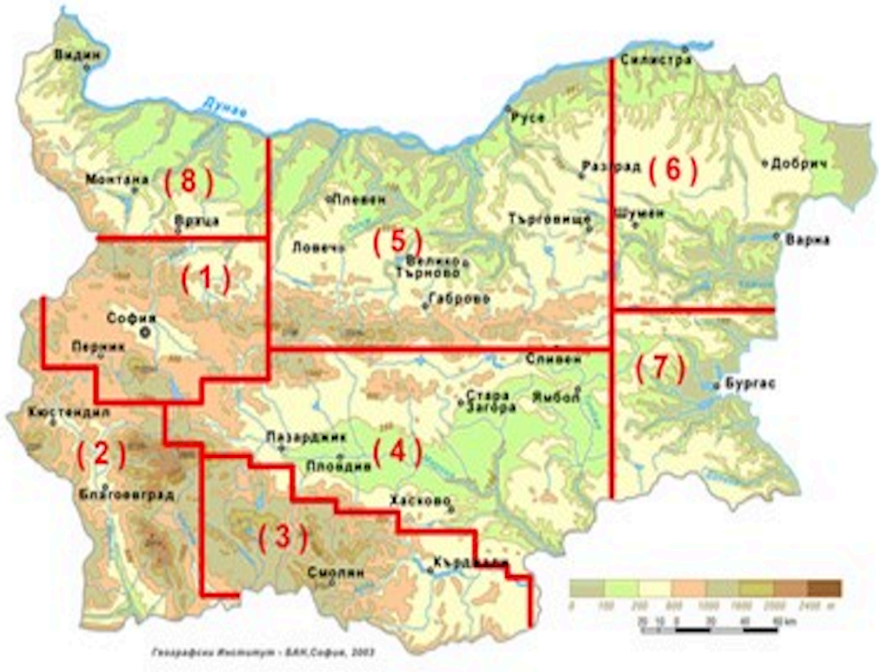

Figure 1. Seismic zones in Bulgaria 2000
Източник:Л. Христосков, 2000

Legend: (1) Sofia; (2) Struma; (3) Rhodopes; (4) Maritsa; (5) GortnoOryahovska; (6) Shabla; (7) Burgas; (8) Vidin

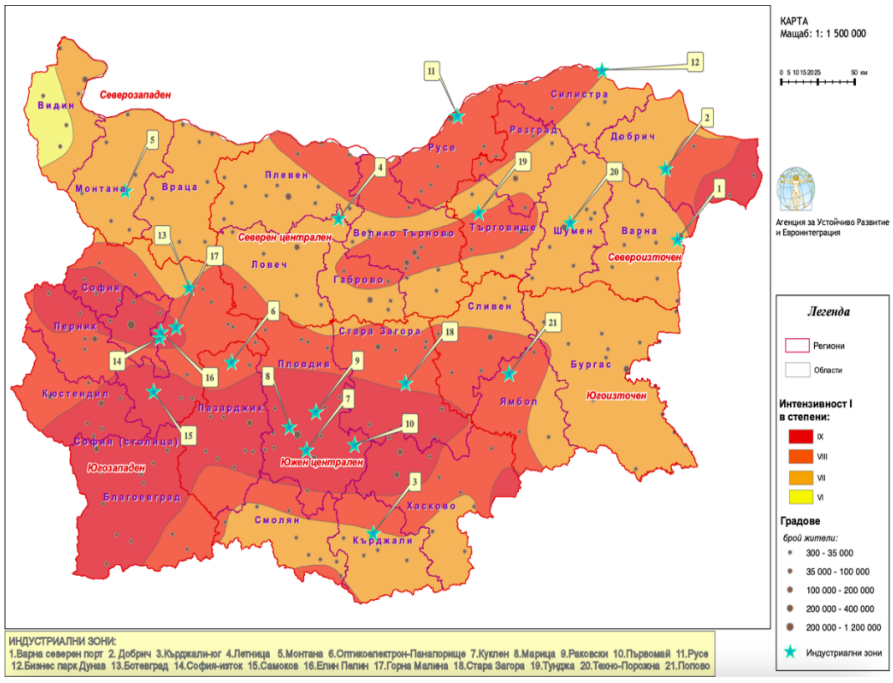

Figure 2. Seismic zoning of the main industrial zones in Bulgaria by districs and development regions, 2004
Source:Bulgarian Spatial Data Infrastructure (БИПД)

In the event of a major earthquake, infrastructural damage is expected, along with disruption of utility and energy services, and damage to industrial, public, and residential buildings. Due to the presence of numerous chemical companies in the vicinity that handle hazardous substances, there is also a risk of chemical accidents and explosions. The release of

these substances into the environment could contaminate the affected area, potentially leading to secondary consequences and the need for decontamination. The complex situation that may arise could also result in epidemics. Residential buildings that do not comply with seismic construction standards are expected to be severely damaged and rendered uninhabitable. Residents of such buildings will need to be evacuated and accommodated in temporary shelters or alternative housing. The capacity of healthcare facilities in the region is likely to be overwhelmed, and the general population may experience panic, fear, and a loss of trust.

Over the past 10 years, six high-magnitude earthquakes have been recorded in Varna and the Varna region, which have either caused or posed a threat to the life, health, and property of large population groups, to the territory, the environment, and the cultural and material assets of the country (NSI). The recorded damages for this period amount to 386,000 BGN, with no available data on the number of injured or deceased.

Historical data indicate that strong earthquakes have occurred frequently in Varna region throughout the years. The most recent significant earthquake in the area took place in 1901, with its epicenter 10 km east of Cape Kaliakra, registering a magnitude of 7.2 on the Richter scale and an intensity of 9. The earthquake caused building collapses and triggered landslides in various locations..

Expected damage in the city of Varna includes infrastructure disruptions, partially or completely destroyed buildings, hindered medical services and emergency aid, buried individuals, and casualties..

During an earthquake, the Operational Center (OC) of the Regional Directorate "Fire Safety and Civil Protection" – Varna, is responsible for informing the population. An automated voice alert system is used to announce the type of disaster and provide instructions for response..

Municipalities in the Varna region conduct annual training for management staff on population protection.

Key units of the Unified Rescue System (URS) – the Ministry of the Interior, Fire Safety and Civil Protection, Emergency Medical Services, and the Bulgarian Red Cross – maintain teams in constant readiness and will respond as needed. According to analysis of URS response actions, reaction time is typically within 4 hours, depending on the location of deployment and the magnitude of the earthquake.

Earthquakes pose a serious threat to healthcare facilities; however, with proper risk assessment and the implementation of necessary safety measures, these risks can be mitigated. High levels of morbidity and mortality are associated with earthquakes in the community. Fatal injuries typically occur within the first few minutes to one or two days following the event. Head and/or chest trauma are the most common causes of death, and lower limb fractures are frequently observed among the injured.

If a destructive earthquake occurs, hospital maintenance personnel must assess the impact and take corrective actions to quickly restore any damaged systems to normal operational status. If a building or a section of it is deemed unsafe, a decision for partial or complete evacuation must be made, and the evacuation plan must be implemented. Department heads are responsible for immediately reporting any life-threatening situations to the administrative director for evaluation and corrective action. In case of fire, staff must raise the alarm and immediately implement the hospital's fire response plan.

In most cases, the evacuation of a large number of patients can be carried out quickly and safely using available resources and personnel.

The success of the evacuation largely depends on the development and evaluation of alternative plans. In the absence of a standardized approach for addressing hospital evacuation, it is advisable to examine existing models for emergency planning and analysis. Pre-planning must also include the development of an internal and inter-hospital network, and a comprehensive

assessment of nearby hospitals with intensive care unit (ICU) capabilities to ensure backup options during an event. Easy access to their contact information must be ensured for all contingencies.

Despite the assumption that communities come together and assist vulnerable individuals, the pre-planning phase should be used to build community relationships.
It is essential to predefine the roles of staff and physicians in the evacuation process, including assigning someone solely responsible for communicating with parents or guardians. A successful evacuation requires thorough planning to ensure maximum patient safety in a changing environment.

The conducted research confirms that all healthcare facilities within the Varna Region comply with the 1977 seismic construction regulations.

Based on the data analysis, we can summarize that earthquakes represent a serious geological hazard capable of causing substantial damage to infrastructure, loss of human life, and long-term socio-economic consequences. The high seismic activity in certain regions of Bulgaria, including coastal and urbanized areas, poses a significant risk to both the population and critical infrastructure, including healthcare facilities.

The primary risks include:

- **Structural damage to healthcare facilities:** Earthquakes can inflict severe damage to hospitals, clinics, and medical centers, potentially leading to partial or complete destruction of healthcare infrastructure. This would severely limit the ability to provide medical care precisely when demand is highest. The destruction of medical supply warehouses may result in shortages of essential medicines, dressings, and life-saving equipment.
- **Disrupted access to healthcare services:** Following high-magnitude earthquakes (M-7 and above), the road infrastructure may be severely damaged — including collapsed bridges and cracked or blocked roads — which would hinder the evacuation of casualties and access to medical facilities. This would be particularly challenging for patients in need of urgent medical attention, as well as individuals with severe injuries, disabilities, or life-threatening conditions.
- **Communication and power failures:** Damage to the electricity grid and communication networks can disrupt coordination between healthcare institutions, emergency response teams, and government agencies. Without access to electricity and internet connectivity, hospitals will face significant difficulties in managing emergencies and maintaining communication with other components of the healthcare system.
- **Mass displacement of the population:** The collapse of residential buildings may result in large-scale displacement, increasing the number of people seeking refuge in emergency shelters. The lack of adequate sanitary conditions in these temporary shelters may facilitate the spread of infectious diseases, placing additional pressure on the healthcare system.
- **Overburdened emergency departments:** Earthquakes often lead to a surge in patients seeking medical care. Healthcare facilities may face shortages of hospital beds, medical personnel, and equipment. Severe trauma cases, including fractures, internal bleeding, and critical injuries, may require urgent surgical intervention, yet the available resources may prove insufficient.

- **Psychological consequences:** Earthquakes can also have profound psychological effects, including post-traumatic stress, anxiety, and depression. Healthcare facilities will need to provide psychosocial support to the affected population, including deploying psychologists and psychiatrists to assist both survivors and rescue teams.

4.1.1.2 Fires

A number of companies, ports, enterprises, and factories operate in the Varna District, some of which handle industrial toxic substances and chemicals that pose a significant fire hazard. The use of gas-based heating systems in many residential buildings further increases the risk of fire outbreaks. Fires represent a serious threat to human life and property, potentially causing substantial damage to both the natural environment and urban or rural areas.

The presence of the Varna East and Varna West ports is of great economic importance to both the city and the country. However, they also constitute potential disaster risk zones, threatening human health and life, infrastructure, the environment, and the economy. Such disasters may result from various causes, including ship accidents, explosions of gases or fuels, negligence, or the ignition of hazardous materials. Ports are typically zones of intensive activity, involving the handling and storage of large volumes of fuels, chemicals, gases, and other dangerous substances. This makes their infrastructure highly vulnerable to fires and explosions, which can rapidly escalate and cause extensive destruction.

In June 1977, at the port of Varna, the Bulgarian motor tanker "Erma" was unloading 721 tons of crude oil. Due to an incident during the loading or unloading process involving flammable materials, an explosion occurred, which subsequently engulfed approximately ten fuel tanks owned by "Petrol," as well as another tanker in close proximity to the "Erma." The tanker "Erma" sank, and the number of explosions reached 91. The ensuing emergency response operation lasted for hours, with significant risks posed to the port and the city due to the nearby "Petrol" fuel depot.

The risk of fire in Varna and the surrounding region is not limited to the port area alone. Fires may also occur in fuel storage facilities and industrial plants that work with toxic industrial chemicals (TICs). When such substances are released during combustion, their toxicity can have suffocating and life-threatening effects on the exposed population.

Scientific evidence increasingly indicates that climate change plays a critical role in the rising frequency and intensity of wildfires. Rising temperatures and disruptions to the hydrological cycle contribute to vegetation desiccation, making forests more prone to ignition. Furthermore, climate change may lead to more extreme weather events, including prolonged droughts and an increased incidence of heatwaves—conditions that further elevate wildfire risk.

Wildfires pose a major threat to public health and the environment and can significantly disrupt society. They result in air pollution with toxic gases and particulate matter, which can lead to numerous health complications. In addition, wildfires negatively affect mental health due to the loss of property and the fear associated with evacuation. Inadequate infrastructure and limited access to emergency response resources can severely hinder firefighting efforts and rescue operations.

The risk is highest during the summer and autumn months, driven by elevated temperatures and human activity. The primary high-risk areas include the forested zones near Varna, Aksakovo, the village of Avren, Suvorovo, and Dalgopol. In such scenarios, rapid expansion of the affected territory is likely, influenced by prevailing weather conditions. According to data from the National Statistical Institute (NSI), the number of recorded fires between 2010 and 2020 shows a decreasing trend until 2018, followed by a rise in 2019 and 2020.

Table 10. Number of Fire in Varna and Nationwide for the Period 2010-2020 г.

Region	**Number of fires**										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Nationwide	1630	2185	3010	764	2245	2474	2448	741	480	521	754
Varna	30	16	11	15	28	47	4	2	1	1	3

Source: National statistic institute (NSI)

The protection of the population in case of fire is of utmost importance and involves a number of systematic measures that can be applied both in advance and during an emergency situation. Summarizing the recommendations and the results of the study, the main measures include:

Education and public awareness: There is an observed increase in the frequency and quality of training among various population groups regarding proper procedures in the event of fire, including how to use fire alarm systems and fire extinguishers, how to evacuate safely, and where to gather in designated safe areas

Staff training: Training of personnel in buildings and the public sector in fire response, including first aid, use of firefighting equipment, and evacuation procedures

Planning for rapid evacuation: Plans are developed for the swift and safe evacuation of the population in case of fire for all buildings. These plans should include clearly defined evacuation routes, assembly points, and instructions for specific groups such as children, the elderly, and persons with disabilities. Evacuation maps and route diagrams are posted on each floor of the buildings

Preventive building measures: It is critically important to install fire detection systems, automatic fire suppression devices, fire staircases, and emergency exits in buildings. Regular maintenance and inspection of these systems is essential

Cooperation with the fire service: Good relations are established with the local fire department, with regular drills and simulations conducted for coordinated actions in the event of a fire

Firefighting water supply planning: Ensuring access to water for firefighting, including the installation of hydrants and fire water reservoirs

Communication and warning: Use of early warning and public notification systems in case of fire, including mobile phone alerts, radio, and television announcements

Planning for Specific Scenarios: Actions and drills are planned for specific scenarios such as fires in large buildings, industrial facilities, or open areas. In the city of Varna, helicopters are not yet available, but they can be requested through the emergency hotline 112

Rescue Infrastructure: The maintenance of specialized rescue infrastructure is of critical importance, including helicopters, boats, and other means of access to affected areas

Community Preparedness:The creation of a community-based civic initiative is encouraged, including the formation of volunteer teams for first aid and fire suppression

Preparedness of Healthcare Facilities:

The available facilities for providing medical care to patients with severe burns in the territory of Varna and the Varna district include St. Anna General Hospital (MBAL "Sv. Anna"), St. Marina University Hospital (UMBAL "Sv. Marina"), and the Military Medical Academy Hospital – Varna. Specialized medical assistance can be provided at the Clinic of Thermal Trauma and Plastic Surgery or the Clinic of Toxicology at the Military Medical Academy – Varna

In case of a large number of casualties, additional hospital beds and departments may be opened at St. Anna and St. Marina hospitals.

In the event of a fire, the immediate notification of the population is of paramount importance. This is carried out through the public alert siren system by the duty officer at the Operational Center of the Regional Directorate for Fire Safety and Civil Protection – Varna

1.1.1.3 Floods

Due to the climatic conditions of the region, floods in Varna and the Varna District are most commonly caused by heavy or torrential rainfall

In such situations, the intensity of precipitation exceeds the drainage capacity of the terrain and sewer systems, resulting in flooding. A characteristic feature of this type of flood is that it occurs in areas lacking a natural river network. This issue is often more pronounced in rural areas due to the absence of proper infrastructure and paved streets, which leads to the formation of high-velocity water streams. Ground-level floors of buildings are particularly at risk, as large volumes of water may block exits, critical junctions, and impede the movement of rescue teams and emergency medical services.

The region also contains many ravines with steep slopes that can become clogged, preventing water from draining properly

This may result in overflow from drainage channels, and as the water descends, it may flood lower-lying areas.

Data analysis identified the 2014 flood as one of the most severe on the territory of the city of Varna, specifically in the Asparuhovo district

On July 19, at approximately 7:00 PM, part of the Asparuhovo neighborhood was overwhelmed by a massive volume of water following several days of heavy rainfall, amounting to nearly 150 liters per square meter. According to some sources, this exceeded the monthly average for June by nearly four times. Submerged electrical substations failed, communications broke down, and calls to the emergency number 112 became impossible. Shortly afterward, the first reports of missing persons emerged. As a result of the flood, 13 people lost their lives.

The majority of floods in the region are of small to medium scale, with damages being primarily material

In recent years, a trend toward global warming has been observed, with rising temperatures potentially leading to accelerated snowmelt and widespread flooding. The Provadiyska River poses a serious overflow risk, which could affect the area around the town of Provadia, while flooding from the Kamchiya River could impact the region of Dalgopol if it breaches its riverbed.

Таблица 11. Number of Floods in Varna and Nationwide for the Period 2010-2020 г.

Region	Number of floodings										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Nationwide	651	382	692	547	360	266	184	159	84	108	100
Varna	5	174	333	25	67	57	109	7	4	3	4

Source: National Statistic Institute (NSI)

Table 3 presents data from the National Statistical Institute (NSI) over recent years. The trend shows a decrease in flood-related disasters up to 2018, followed by a slight increase in 2019 and 2020

In 2015, a state of emergency due to flooding was declared in several settlements within the Varna municipalities of Provadia, Dalgopol, Avren, and Aksakovo. The floods were caused by the overflow of small dams and slope water that could not be absorbed by the ground and spilled through ravines. In the Varna District, it became necessary to breach multiple dikes to release the water and prevent more severe flooding. As a result, part of the population was evacuated and no casualties were reported.

Tsunami waves are rare along the Bulgarian Black Sea coast. However, there are records of such events caused by seismic activity, particularly in the area near Shabla.The secondary consequences of flooding may have serious impacts on society and public healthThese may include the loss of potable water, leading to intense demand and panic among the population. Floods may also impact regional food supplies, either significantly reducing them or hindering their distribution due to damaged infrastructure. The evacuation of large groups of people involves complex logistics and may be difficult to carry out. The sudden deterioration of living conditions following a flood may lead to the outbreak of diseases such as cholera and bacterial infections, particularly among those with open wounds or injuries. Floods can damage certain healthcare facilities, rendering them temporarily or permanently non-functional.

Structural damage to hospitals, clinics, and other medical institutions may compromise the provision of essential health services. Flooding often disrupts communication networks, hindering coordination and information exchange between emergency responders and pre-hospital care providers. This breakdown in communication can obstruct the timely delivery of medical aid and emergency care. The increased demand for healthcare services during and after floods may overwhelm medical facilities and place significant strain on healthcare resources. Cooperation between governmental agencies, healthcare institutions, non-governmental organizations, and public education on proper behavior is essential for building effective flood protection and prevention systems.

Based on data analysis, we can conclude that floods are among the most widespread natural disasters, with significant impact on human populations, infrastructure, and the environment. They may result from heavy rainfall, hurricanes, river overflows, sea level rise, and dam failures. In urban areas with high levels of urbanization, floods also pose a serious threat—especially to healthcare systems and public health

At particularly high risk and in need of prioritized measures are:

• ***Damage to hospital infrastructure:*** Floods can cause severe structural damage to healthcare facilities. Water infiltration may lead to the destruction of medical equipment, damage to electrical installations, and disruption of the water supply, rendering these facilities non-operational**.**

• ***Limited access to healthcare services:*** Floods can damage transportation infrastructure, including bridges, tunnels, and major roadways, significantly hindering the ability of patients to reach medical facilities. This may obstruct the movement of medical teams and the delivery of medications and medical supplies

• ***Communication breakdowns:***Power outages and disruption of telecommunications networks may limit coordination between emergency services, hospitals, and other public health structures. The lack of effective communication delays disaster response and complicates emergency management

• ***Increased burden on healthcare institutions:***Floods lead to a surge in emergency medical cases, including trauma, drowning, infections, and other diseases caused by contaminated water. River overflows can cause serious complications for healthcare facilities. Patients may face shortages of beds, medical personnel, and equipment

• ***Spread of waterborne and infectious diseases:*** Floods create favorable conditions for the transmission of waterborne diseases such as cholera, hepatitis A, and leptospirosis. Contaminated drinking water and lack of proper sanitation further exacerbate health risks for the population

• ***Need for emergency evacuation and temporary medical stations:***In cases of large-scale flooding, large groups of people may be forced to leave their homes. This necessitates the deployment of temporary medical stations and mobile healthcare units in evacuation zones, requiring additional resources and personnel

• ***Displacement of the population:*** Floods force thousands of people to abandon their homes and seek shelter in evacuation centers. These centers are often under-resourced medically, and the overcrowding increases the risk of infection spread

• ***Economic losses:*** Floods result in substantial economic losses associated with the destruction of homes, infrastructure, and health-related impacts. The healthcare sector also suffers significant damage, including the loss of equipment, medicines, and interruption of hospital operation.

• ***Psychological and social consequences:*** The loss of homes, loved ones, and a sense of security can lead to elevated levels of stress, anxiety, and post-traumatic stress disorder among

affected individuals. This requires the provision of psychological support and long-term care for those impacted.

1.1.1.4 Landslides

Landslides are geological hazards that pose significant risks to human populations, infrastructure, and the environment. In addition to their immediate physical and structural impacts, landslides can have serious consequences for healthcare systems and public health.

In recent years, the city of Varna has established itself as one of the fastest-developing cities in Bulgaria, with intensified construction being a contributing factor. According to data from the National Statistical Institute (NSI), Varna ranks among the top cities in terms of building density. This is not coincidental, as historical records show that the population increased several times after World War II. As of December 31, 2020, the population was 332,394 people, according to the NSI, and a large proportion of these residents live in landslide-prone areas. The population increases significantly during the tourist season, as the area around the city includes numerous seaside resorts.

Landslides in this part of Bulgaria are among the most serious problems, affecting nearly the entire coastal slope. The intensified construction activities exacerbate these processes, and every year new activations are recorded, causing infrastructural damage. Major landslides in the region include those in the areas of Kabakum, Trakata, Fichoza, Galata, the area around Pasha Dere, and others. In Varna District, nearly 90 landslides have been registered. According to some authors, the total area affected by landslides along the coastline and in the vicinity of Varna and the Golden Sands resort exceeds 33,000 decares. The largest landslide in the region remains the one in the "Trifon Zarezan" area, where the coastline has been receding for years. Upon its initial activation, the landslide had an approximate width of 300 meters and a length of 60 meters. Researchers identify the primary cause as intensive construction on the slope and the installation of numerous septic tanks for hotels.

Landslide processes result from a combination of anthropogenic and natural factors, with intensified urbanization being one of the main causes of their occurrence. These events can be triggered by various factors, including heavy rainfall, seismic activity, and human activities such as deforestation and land-use changes. Landslides have the potential to cause severe infrastructure damage, disrupt communities, and result in loss of life and injuries.

From data analysis, we can summarize that landslides may have long-term consequences on healthcare systems and public health:

- ***Infrastructure damage***: Landslides can cause significant damage to healthcare facilities, including hospitals, clinics, and medical supply warehouses. Structural damages may render these facilities inoperable, limiting access to essential medical services for the affected population
- ***Accessibility issues:*** Landslides may block roads, bridges, and transport routes, hindering patients' access to healthcare facilities and medical personnel's ability to reach affected areas. Remote and mountainous regions are particularly vulnerable to accessibility problems during landslides
- ***Communication breakdowns:*** Landslides disrupt communication networks, impeding coordination and information sharing between healthcare providers, emergency response services, and public health authorities. This can obstruct the timely delivery of medical care and emergency assistance to the affected population

• ***Population displacement***: Landslides often force people to leave their homes and seek temporary shelter in evacuation centers or informal settlements. Displaced persons may face challenges accessing healthcare services, especially if relocated to areas with limited medical infrastructure
• ***Increased demand for medical care and shortage of hospital beds***: Landslides frequently result in injuries, trauma, and other emergency medical cases among the affected population. The surge in demand for medical care can overwhelm healthcare facilities, leading to shortages of medical supplies, staff, and equipment

All major healthcare facilities in Varna Municipality and the surrounding district will be involved in providing medical care to the population during disaster situations related to landslides.

Conclusions:

1. **Bulgaria is vulnerable to various natural and anthropogenic disasters**, including floods, earthquakes, landslides, fires, extreme temperatures, and industrial accidents. These disasters result in fatalities, material damage, and negative psychological consequences.
2. **Floods are the most frequent natural disasters in the country**, with the areas around major rivers (Danube, Maritsa) and the Black Sea coast being the most vulnerable. The lack of adequate infrastructure and climate change increase the risk.
3. **Earthquakes pose a serious threat to Bulgaria**, especially in active seismic zones such as the Rila Mountains and the Black Sea region. Weak infrastructure and aging buildings elevate the risk of destruction and casualties.
4. **Anthropogenic disasters include transportation incidents, industrial accidents, and technological catastrophes**. The high mortality rate in some cases highlights the need for enhanced safety measures.
5. **Varna District is particularly vulnerable to landslides, floods, and industrial accidents**. Urban development and industrial activity in the region create additional risks.
6. **Climate change increases the frequency and intensity of disasters**. An increase in extreme weather events such as droughts, heatwaves, and storms is expected, affecting the population and infrastructure.
7. **The disaster management system is based on legal and strategic documents**, such as the Disaster Protection Act and the National Strategy for Disaster Risk Reduction. However, improvements in prevention and response are needed.
8. **Medical infrastructure and hospital preparedness are crucial during disasters.** Evacuation plans, coordination between institutions, and resource provision are essential to reduce casualties and damage.
9. **Public education and raising awareness are important** for effective disaster management. Lack of knowledge on how to react in crisis situations increases the risk of casualties and panic.
10. **Better prevention and infrastructural adaptation are required**, including the construction of resilient structures, modernization of sewage systems, expansion of fire protection, and the implementation of new early warning technologies.

4.2 Types of Healthcare Facilities providing hospital ccare in Varna and Varna District

Hospitals and healthcare facilities play a critical role during disasters. It is imperative that they remain structurally resilient and operational during emergency situations. To ensure that hospitals and healthcare facilities can withstand emergencies and disasters, assessing their vulnerabilities is of utmost importance. These vulnerabilities may be structural (load-bearing systems), non-structural (architectural elements, installations, and equipment), as well as related to systems and operations.

During emergencies or disasters, hospitals and other healthcare facilities must remain safe, accessible, and function at maximum capacity to assist in saving lives. They must continue to provide critical services such as medical and nursing care, laboratory and other health services, as well as respond to increased demands associated with the disaster situation. A safe hospital should remain organized with active emergency response plans and healthcare personnel trained to maintain the functioning of the network.

According to data from the National Statistical Institute of the Republic of Bulgaria (NSI), at the end of 2022, there were 341 healthcare facilities providing hospital care in the country, with a total of 54,707 beds (Table 12). Of these, 319 are hospitals with 52,462 beds. Outpatient care facilities number 2,172 with 1,303 beds, and other healthcare institutions are 1,148 with 1,751 beds.

Table 12. Healthcare and Medical Facilities in the Republic of Bulgaria as 31.12.2022 г.

Facilities	**Numbers**	**Beds**
Healthcare facilities for hospital care	**341**	**54 707**
Hospitals	319	52 462
Including:		
Multidisciplinary hispitals	179	38 144
Specialized hospitals	140	14 318
Centers for dermatology and venereal diseases	3	30
Comprehensive oncology centers	7	1 193
Mental health centers	12	1 022
Outpatient Healthcare Facilities	**2 172**	**1 303**
Diagnostic and Consultative centers	111	276
Medical centers	786	948
Dental centers	64	5
Medical-Dental centers	60	74
Independent Medical-Diagnostic and Medical-Technical laboratories	1 151	-
Other healthcare and Medical Facilities:		

Including:		
Emergency Medical Care centers	27	-
Hospices	43	1 229
Homes for Medical-Social Care of children	4	450
National centers without beds	4	-
Regional centers without beds	28	-
Centers for comprehensive care of children with disabilities and chronic diseases	10	70

Source: NSI (https://www.nsi.bg/bg/content/3310/лечебни-и-здравни-заведения-на-3112)

Against the background of the Republic of Bulgaria, NSI data for Varna and Varna District show that as of 31.12.2020, there are 16 hospitals operating in Varna District with a total of 2,665 beds (Table 13)

Table 13. Healthcare and Medical Facilities in Varna District as of 31.12.2020 г.

Region	**Facilities**	**Numbers**	**Beds**
Varna	**Healthcare facilities providing hospital care**	**16**	**2 732**
	including		
	Multidisciplinary hospitals	6	2 014
	Specialized hospitals	10	718
	Outpatient healthcare facilities	**173**	**121**
	Diagnostic and consultatitive centers	9	8
	Medical centers	71	113
	Dental centers	8	-
	Medico-dental centers	7	-
	Independednt medical-diagnostic and medical-technical laboratories	78	-
	Other healthcare and medical facilities	**12**	**361**

Source: NSI (https://www.nsi.bg/bg/content/3312/лечебни-и-здравни-заведения-на-3112-по-статистически-райони-и-области)

According to the Health Facilities Act, hospitals are classified as multidisciplinary and specialized. As of 31.12.2020, there are 6 multidisciplinary hospitals with a total of 2,052 beds, meaning that 37.5% of the hospitals concentrate 77.0% of the total bed capacity in the district. Their bed capacity varies widely, ranging from 60 to 1,384 beds. As of 31.12.2020, there are 10 specialized hospitals in Varna District, of which 9 provide acute care with 493 beds, and one is a rehabilitation hospital with 120 beds. The hospital bed availability in Varna District at the end of 2020 was 566.9 beds per 100,000 population (compared to the national average of 783.9), compared to 567.4 beds per 100,000 population at the end of 2019. As of 31.12.2020, there are 169 outpatient healthcare facilities in Varna District, with 101 beds designated for short-term observation and stay.

Other healthcare and medical facilities include emergency medical care centers, regional health inspectorates, homes for medical-social care of children, hospices, national centers without beds, dialysis centers, and transfusion hematology centers. At the end of 2020, there were 12 such facilities in Varna District with a total of 356 beds, the largest number being hospices – 6 facilities with 261 beds. Compared to 2019, the number of other healthcare and medical facilities increased by one, and their bed capacity rose by 26.7%.

In disaster situations, accidents, and other emergencies, the life and well-being of the affected population must always be protected, especially in the minutes and hours immediately following the impact or exposure, as time is critical for saving human lives. The ability to provide healthcare services continuously from critical infrastructure such as medical facilities in such situations is a matter of life and death.

The availability of an adequate number of hospital beds during disasters is crucial for several reasons:

• ***Emergency medical care:*** Disasters can lead to a sudden increase in the number of injuries, illnesses, and casualties. An adequate number of hospital beds ensures that affected individuals can receive immediate medical attention.

• ***Capacity to handle large numbers of casualties:*** Disasters overwhelm healthcare systems. Having sufficient beds allows hospitals to accommodate a large number of patients without compromising the quality of care.

• ***Triage and patient stabilization:*** Hospital beds are essential for triage, where patients are assessed and prioritized according to urgency. Stabilizing critical patients requires available beds.

• ***Isolation and quarantine:*** During pandemics or epidemics, hospitals need beds for isolation and quarantine. This helps prevent disease spread and protects other patients.

• ***Recovery after disaster:*** After the initial impact, hospitals play a vital role in recovery. Adequate beds facilitate ongoing treatment, rehabilitation, and follow-up care.

• ***Continuity of care:*** Patients with chronic conditions or those undergoing treatment rely on hospital beds. Disasters should not disrupt the continuity of their care.

• ***Psychological support*:** Disasters cause primary and other injuries. Hospital beds provide space for emotional support, counseling, and psychiatric services.

• ***Resource allocation****:* Limited beds necessitate difficult decisions. Having sufficient beds ensures fair distribution of resources during critical situations.

Hospital care facilities include hospitals, dermatovenerological centers, mental health centers, and comprehensive oncology centers. According to the Healthcare Facilities Act, hospitals are

classified as multidisciplinary and specialized. There are 179 multidisciplinary hospitals with 38,144 beds and 140 specialized hospitals with 14,318 beds.
Compared to 2010, the hospital bed capacity has decreased by 2.2%, entirely due to a reduction in the number of beds in multidisciplinary hospitals (for the Republic of Bulgaria).
The bed capacity in hospital care facilities is justified as follows according to data from the National Statistical Institute (NSI):

Table 14. Hospital Beds in Inpatient Healthcare Facilities as of 31.12.2021 by Type of Bed, Statistical Zones, and Statistical Regions.

Statistical Zones Statistical regions	**Total**	**Beds for Active and Intensive Care**	**Beds for rehabilitation care**	**Beds for Long-term Care**	**Other beds**
Bulgaria	**54 491**	**45 803**	**6 548**	**2 140**	**-**
Northern and Southwestern Bulgaria	**23 429**	**19 319**	**2 702**	**1 408**	**-**
Northwestern	6 108	5 257	377	474	-
North central	5 476	4 605	501	370	-
Northeastern	4 843	4 442	351	50	-
Southeastern	7 002	5 015	1 473	514	-
Southwestern and South Central Bulgaria	**27 458**	**22 880**	**3 846**	**732**	**0**
Southwestern	15 666	12 998	2 219	449	-
South Central	11 792	9 882	1 627	283	-

Source: NSI (https://www.nsi.bg/bg/content/15248/легла-в-лечебните-заведения-за-болнична-помощ-на-3112-по-видове-легла-статистически-зони-и-статистически-райони-ревизирана-групировка)

As of December 31, 2021, there were 179 multiprofile hospitals in Bulgaria, concentrating approximately 70% of the total hospital bed capacity nationwide. The number of beds in these institutions varies widely—from 15 to 1,345 beds—with the highest numbers observed in university hospitals. Specialized hospitals for active treatment numbered 140, with a total of 14,318 beds.

4.2.1 University hospital for active threatment UMBAL "St.Marina"

The University Multiprofile Hospital for Active Treatment "St. Marina" JSC (the Company) is a commercial enterprise registered in the Republic of Bulgaria under the Commercial Act, with its headquarters and registered office located in Varna, 1 Hristo Smirnenski Street. UMHALAT "St. Marina" JSC was established in the year 2000.

Today, UMHALAT "St. Marina" JSC – Varna is one of the most modern diagnostic and treatment structures in Northeastern Bulgaria. Its main areas of activity include therapy, surgery, pediatrics, cardiology, neurology, oncology, internal medicine, medical imaging, medical diagnostic laboratories, infectious diseases, and psychiatry.

The hospital provides diagnostic, consultative, and therapeutic services through 39 specialized clinics, 12 departments, 5 laboratories, and 32 consultative offices. It is equipped for comprehensive oncological patient care, including advanced imaging diagnostics (endoscopy centers, computed tomography, magnetic resonance imaging with 1.5T and 3T capacity, positron emission tomography, and SPECT/CT), modern pathology with immunohistochemical and molecular-genetic analysis, personalized medicine, 3D laparoscopic surgery, individualized chemotherapy, and high-tech radiotherapy using three linear accelerators, including capabilities for radiosurgery.

The infrastructure also includes a Da Vinci Xi robotic surgical system, a modular radiosynthesis system for the production of radiopharmaceuticals based on Gallium-68, a combined neuronavigation system for stereotactic interventions, and a newly established angiographic laboratory for interventional treatment of cerebrovascular diseases, developed in collaboration with the Medical University "Prof. Dr. Paraskev Stoyanov" – Varna.

As one of the leading healthcare facilities in the region, UMHALAT "St. Marina" plays a key societal role during natural and anthropogenic emergencies in the city of Varna and the Varna District.

According to data from the Regional Health Inspectorate (RHI) and the Ministry of Health (MoH), the hospital has a total bed capacity of 1,298. (Table 15)

Table 15. Bed capacity of UMBAL "St.Marina hospital" as of 28.04.2024 г.

№	Healthcare facilities for hospital care	Total number of beds	Total number of beds for Acute care
1	**UMBAL St. Marina Hospital**	**1298**	**1069**
	Intensive	**67**	
	Pediatric	10	
	Intensive care	38	
	Others	19	
	Pediatric	**78**	
	General pediatrics	58	
	Pediatric hematology and oncology	20	
	Therapeutic Beds	**704**	
	Internal medicine	30	
	Gastroenterology	55	
	Endocrinology and Metabolic disorders	19	
	Cardiology	77	

	Nephrology	28	
	Rheumatology	35	
	Pulmonology and Phthisiology	21	
	Clinical haematology	102	
	Infectious diseases	105	
	Neurology	78	
	Dermatology and venereology	8	
	Medical oncology	80	
	Radiation therapy	5	
	Nuclear medicine	2	
	Others*	59	
	Surgical beds	**242**	
	General surgery	65	
	Thoracic surgery	18	
	Pediatric surgery	5	
	Maxillofacial surgery	12	
	Cardiosurgery	34	
	Neurosurgery	20	
	Orthopedics and Traumatology	30	
	Vascular surgery	18	
	Urology	26	
	Otorhinolaryngology ENT	14	
	Palliative Care and rehabilitation Beds	**53**	
	Psychiatric Beds for Acute Care	**155**	

Source: Regional Health Inspection (RHI-Varna)

4.2.2 MBAL – Varna "Military Medical Academy"

MBAL-Varna, or the Multi-Profile Hospital for Active Treatment "Prof. Dr. Stoyan Kirkovich" – Varna, is one of the leading medical institutions in Bulgaria. It is part of the Military Medical Academy "Georgi Sofijski." MBAL-Varna within the MMA is the sole healthcare facility in Northeastern Bulgaria specializing in the treatment of acute poisonings, toxic allergies, and burns.

The clinical laboratory at the Military Hospital Varna performs hematological, biochemical, hemostasis, and immunological tests, as well as assays for hormones, tumor markers, cardiac markers, blood gas analysis, and urinalysis.

The Multi-Profile Hospital for Active Treatment – Varna is the only institution in Bulgaria providing diagnosis and treatment of diving-related diseases. It serves as an interregional center for Northeastern and Eastern Bulgaria in toxicology, thermal trauma, and

plastic surgery. The hospital is equipped with a modern material and technical base, built in accordance with all current national hygiene and sanitary standards and requirements for such a healthcare facility.

The hospital houses a hyperbaric center, Doppler and EMG equipment for diagnosing neurological diseases, a three-dimensional ultrasound device, a cardioechograph, an ultrasonic scalpel for parenchymal organ resection, and modern physiotherapy equipment for treatment of neurological, gynecological, dermatological, and musculoskeletal disorders. The clinical laboratory is equipped with state-of-the-art instrumentation for laboratory diagnostics, performing hematological, biochemical, hemostasis, immunological tests, as well as assays for hormones, tumor and cardiac markers, blood gas, and urine analysis.

As an interregional center for Northeastern and Eastern Bulgaria in toxicology, thermal trauma, and plastic surgery, the hospital will play a key role in the community during natural and anthropogenic hazards in Varna and the Varna region, especially in emergencies related to burns or acute chemical intoxications.

Table 16. Bed capacity as of 28.04.2024 г. of MBAL-Varna "Military Medical Academy"

№	Inpatient Healthcare facilities	Number of beds for Non-critical condition	Number of beds for intensive care	Total number of beds
2	***MBAL-Varna "Military Medical Academy"***			
	First and Second Infectious Diseases Clinic	70		
	Intensive Care and Non-Invasive Ventilation Unit		8	
	Intensive Care and Non-Invasive Ventilation Unit		7	
	Pulmonology and Phthisiology Clinic	39		
	Separate Sector in the Clinic of Infectious Diseases and the Cardiovascular Diseases Unit	24		
	Separate Sector in the Rheumatology Clinic	50		
	Separate Sector in the Vascular Surgery Clinic		22	
	Separate Sector in the Second Pediatric Clinic	12		
	Separate Sector in the Infectious Diseases Clinic	22		
	Separate Sector in the Gastroenterology Clinic	30		
	Separate Sector in the Endocrinology Clinic	24		
	ОБЩО	**271**	**37**	**308**

Source: Regional Health Inspection (RHI-Varna)

4.2.3 MBAL "Tsaritsa Yoanna – Provadia" Ltd., Provadia city

Multiprofile Hospital for Active Treatment "Tsaritsa Yoanna – Provadia" Ltd. is the main healthcare institution in the Provadia municipality, providing hospital care, diagnosis, treatment, and rehabilitation for patients with acute and chronic diseases, injuries, and conditions requiring inpatient treatment.

The hospital is situated on an elevation in the northwestern part of the town of Provadia. The building is solidly constructed, with inpatient wards located in the main building, while the diagnostic-consultative block, clinical laboratory, imaging department, and administration are adjacent to the inpatient facility. The hospital pharmacy is located in a neighboring building. MBAL "Tsaritsa Yoanna – Provadia" Ltd. plays an important role in the healthcare of the region.

The facility includes departments for internal medicine—cardiology, nephrology, and pulmonology—neurology, physical and rehabilitation medicine, imaging diagnostics, and a medical-diagnostic laboratory.

Table 17. Bed capacity as of 28.04.2024 г. of MBAL "Tsaritsa Yoanna – Provadia“

№	Inpatient Healthcare facilities	Beds for non critical conditions	Beds for intensive care	Total beds
3	***MBAL "Tsaritsa Yoanna – Provadia***			
	Department of Neurology	5		
	Department of Internal Medicine	15		
	Department of Physical and Rehabilitation Medicine	12		
	TOTAL	**32**		**32**

Conclusions:

1. **Critical role of hospitals during disasters –** Healthcare facilities must remain structurally resilient and fully operational during disaster situations to provide adequate medical care.
2. **Vulnerability assessment –** Hospitals should be assessed for structural, non-structural, and operational vulnerabilities to ensure their safety and preparedness during disasters.
3. **Adequacy of hospital beds –** The availability of a sufficient number of beds is vital to manage sudden increases in patient load during disasters, provide quarantine and isolation, and continue treatment for chronic patients.
4. **Distribution of hospital capacity –** In Bulgaria, 341 hospital care facilities operate with a total of 54,707 beds, of which 70% are concentrated in multidisciplinary hospitals.
5. **Healthcare infrastructure in Varna –** The Varna region has 16 hospitals with a total of 2,732 beds, with a significant percentage concentrated in multidisciplinary healthcare institutions.
6. **Leading healthcare institutions in Varna –** UMHAT “St. Marina” and MBAL-Varna at the Military Medical Academy (MMA) play a key role in the region, equipped with modern medical equipment and specialized departments**.**

7. **UMHAT "St. Marina" –** center for highly specialized treatment – The hospital possesses the most advanced diagnostic and therapeutic infrastructure in Northeastern Bulgaria, including robotic surgery, magnetic resonance imaging, and radiotherapy.
8. **Specialization of MBAL-Varna at MMA –** The only healthcare facility in Northeastern Bulgaria specializing in the treatment of poisonings, toxicoallergies, burns, and diving-related diseases.
9. **Need for continuity of medical care –** Disasters must not interrupt access to medical services, especially for critically ill patients or those with chronic diseases.
10. **Role of local hospitals –** Smaller hospitals, such as MBAL "Tsaritsa Yoanna – Provadia," provide essential medical care at the regional level and are necessary for the overall healthcare infrastructure of the country.

4.3 Research on the Preparedness of Hospitals in Varna and Varna region for protection and response for Natural and anthropogenic Disasters

To achieve the stated objective, a questionnaire was constructed for conducting in-depth interviews. The questions were adapted based on a World Health Organization document (Hospital Emergency Response Checklist: An All-Hazards Tool for Hospital Administrators and Emergency Managers). The aim is to reduce disaster risk and build a resilience strategy for healthcare facilities. A combination of qualitative analysis from the content of the provided answers with the personal opinions and recommendations of the interviewees was performed. Twenty-two questions were discussed, pertaining to the level of readiness of healthcare facilities to respond within their scope of competence and experience. During the interviews, the questions were left open-ended, meaning there was a lack of detailed information and specificity regarding the researched issues. The emphasis was placed on the personal opinion and viewpoint of the interviewees. Healthcare facilities were included based on specific criteria they had to meet. The interview questions covered a wide range of challenges related to the resilience of healthcare facilities and their preparedness for disaster situations. The following main topics were addressed:

1. Infrastructure Resillience

- Assessment of building resilience in disaster situations such as earthquakes, floods, fires, and CBRN incidents (questions 1, 4).
- Availability and maintenance of alternative sources for utility services during disasters (question 2).
- Need for protection and use of underground premises or reserve structures in case of destruction (question 4).

2. Equipment and resources

- Challenges in the maintenance and repair of hospital equipment (question 3).
- Need for reserves of medications and emergency medical equipment (question 12).
- Development and maintenance of operational response protocols (question 13)

3. Operational Management

- Establishment of a hospital command center for disaster management (question 6).
- Advantages of creating an organized operational щтаб (staff) (question 7).
- Alert system and interaction with other institutions and health authorities (questions 5, 8).

4. Personnel and competencies

- Preparedness of hospital staff for disaster response (question 10).

- Skills for performing triage in mass casualty incidents (questions 15, 16).
- Role of training and drills in improving crisis responses (questions 21, 22).

5. Planning and Prevention

- Importance of updating protection plans and preventive measures (questions 9, 19).
- Development of plans to increase hospital capacity during disasters (question 11).
- Priorities for evacuation and rapid recovery after a disaster (questions 17, 18).

6. Practical Aspects

- Difficulties in decontamination and impact on routine hospital activities (question 14).
- Response scenarios and challenges in performing triage in undefined locations (question 16).

7. Experience and Effectiveness

- Influence of staff experience on effective crisis management (question 20).

The interview provides a basis for in-depth analysis of the preparedness of hospital infrastructure and personnel to cope with disasters and emphasizes the importance of coordination, training, and resource availability. The interviewees had 60 minutes for their answers, and the results obtained are compared in Table 18 (page 102 of the dissertation).

The interviewed participants are established specialists with over 20 years of professional experience in healthcare, holding key leadership positions within the system. They are part of management teams responsible for coordination and decision-making during disasters and emergency situations in their respective healthcare facilities. These professionals play a crucial role in developing, implementing, and maintaining crisis action protocols, including medical resource management, logistics, and operational coordination between units. They participate in strategic planning and conduct training for their teams aimed at improving preparedness and response in disaster situations. The selection of interviewees was based on criteria of high expertise, extensive practical experience, and participation in crisis structures at national and regional levels. Their contribution is key to understanding the complex nature of healthcare resource management during disasters and to identifying best practices, as well as challenges related to the implementation of strategic decisions. The current analysis, based on their expertise, aims to provide a deeper understanding of management mechanisms in disaster situations, as well as to offer recommendations for optimizing processes related to healthcare system preparedness.

Respondent 1 (Appendix 2) is an expert with proven experience in disaster situation management, particularly in the context of healthcare. With many years of experience in leading response teams during disasters and emergencies in healthcare facilities, they have accumulated extensive knowledge and skills that rank them among the most competent in their field. Their position in the leadership group is a result of their undisputed ability to analyze, evaluate, and direct actions during critical events. Their role in the crisis щтаб is not only strategic but also practical for the healthcare facility where they work. They are familiar with the balance between theoretical protocols and real circumstances, always prioritizing the safety and health of patients and staff. Their perspective on communication is also of paramount importance – their ability to gather information, process it quickly, and transmit it accurately and clearly to the relevant teams is a key element for successful resolution of any disaster

situation. In addition to their primary duties, they actively participate in training new personnel, sharing their knowledge and strategies for coping with critical situations. This dedication to training and preparing new staff demonstrates not only their desire to create sustainable response mechanisms but also to ensure continuous high-level competence within the organization.

Respondent 2 (Appendix 3) is a specialist with exceptional experience and in-depth knowledge in crisis management and the organization of actions during disaster situations. Their education and professional experience allow them to meet all requirements and standards necessary for effective management of disaster situations in healthcare. This individual is part of a strategically important team responsible for safety and ensuring stable actions during accidents and crisis situations. With many years of experience in planning and coordinating various disaster scenarios, they possess not only theoretical knowledge but also practical expertise that enables them to react quickly and adequately in conditions of high uncertainty and stress. Their role in the leadership group is fundamental, as they are responsible for creating plans and procedures that ensure maximum effectiveness in disaster situation management. These plans cover not only the internal organization of the hospital but also interaction with various institutions such as the police, fire safety, and municipal structures. This is an individual who possesses strategic vision and the ability to make quick decisions to ensure the safety of patients, staff, and hospital infrastructure. In the planning process, they consider all possible scenarios and develop detailed action procedures for accidents, disasters, or mass casualty incidents. Their competence and skills are manifested not only in the creation of theoretical plans but also in their practical implementation. They participate in regular training and simulations that allow teams to prepare for a wide variety of scenarios. Risk assessments, which they regularly conduct, are also essential for their work to improve response methods and minimize the possibility of failure during disasters.

Respondent 3 (Appendix 4) is a key figure in the management of a healthcare facility, responsible for strategic development, organization of the treatment process, and ensuring high standards of medical care. The healthcare facility is a multidisciplinary hospital that serves a significant number of patients and is of great importance to the regional health system in the area. Therefore, the respondent's position requires a high degree of competence, adaptability, and crisis management skills. With many years of experience in planning and organization, the respondent actively participates in the leadership group for disaster situations and emergencies, being responsible for strategic coordination and the hospital's readiness to respond adequately in extraordinary circumstances. They lead the processes of developing and implementing crisis action plans, securing necessary resources, and maintaining the high functionality of the healthcare facility under conditions of strain and risk.

IV. CONCLUSIONS:

1. **Regarding infrastructure stability and safety** – buildings are considered resilient, with designated safe zones for use when needed.
2. **Healthcare facilities are equipped with independent sources for utility services** – hospitals possess generators and alternative water sources, ensuring continuous operation.

3. **Communication and coordination during disasters** – existing crisis headquarters are convened as necessary.
4. **Alternative premises for emergency cases** – exist within the buildings, but specialized facilities outside the main structures are lacking.
5. **Patient flow management system** – developed and operational for rapid response.
6. **Disaster management plans** – include the distribution of tasks among various units and specialists within the structures.
7. **Organization of crisis teams** – ensured through emergency groups and leaders with specific responsibilities.
8. **Regular training and simulations** – are recognized as important for maintaining operational work, but are not regularly sustained or conducted.
9. **Plan updates** – updates are performed, but a thorough assessment of changing risk and an adapted strategy for its reduction are necessary.
10. **Staff preparedness** – medical personnel are well-prepared, but the unique nature of various natural and anthropogenic hazards should be considered.
11. **Capacity limitations** – hospitals cannot risk exceeding their capacity, and therefore triage is of paramount necessity.
12. **Medication stockpiles** – exist, but are dependent on regular deliveries, i.e., external contractors.
13. **Unified or separate plan for departments** – the general plan is effective, but individual algorithms need to be developed for each department.
14. **Decontamination** – regularly performed internally, and occasionally externally to the building.
15. **Medical triage** – conducted in the emergency department, without a fixed location for preliminary triage.
16. **Disaster risks** – risk exists, but more in-depth analyses are necessary concerning the changing environment.
17. **Evacuation priority** – applied only in cases of immediate danger.
18. **The state's role in recovery** – state support and funding are necessary, due to the inability of healthcare facilities to recover independently in the event of a potential danger.
19. **Most effective method for preparation** – drills are considered most effective, primarily for fire risk, but are not regularly planned and organized with diverse scenarios.
20. **Importance of experience** – practical experience facilitates response during disaster situations.
21. **Physical and psychological resilience of personnel** – crucial for coping with disaster situations, but training and drills are necessary for this purpose.
22. **Need for inter-institutional cooperation** – drills should include the municipality, police, and fire safety

The assessment of the disaster response capacity of the surveyed healthcare facilities, along with the corresponding responses from the respondents, are presented in Table 18. This information pertains to key questions and expert evaluations regarding the protection and response of hospitals during disasters , presented in a synthesized manner with an emphasis on the main resilience criteria. The data is structured to highlight key aspects, recurring themes, and individual differences in opinions. This approach aims to provide clearer analysis, synthesis, generalization, and evaluation.

Table 18. Comparative Analysis of Data from In-Depth Interviews

Question:	Respondent 1	Respondent 2	Respondent 3
1. Building Resilience	✓	✓	✓

2. Alternative Utility Services	✓	✓	✓
3. Difficulty with Rapid Maintenance	✓	✓	✗
4. Underground Premises for CBRN	✗	✓	✗
5. Alert System	✓	✓	✓
6. Hospital Command Center	✓	✓	✓
7. Organization of Disaster Management Group	✓	✓	✓
8. Interaction with Public Institutions	✓	✓	✓
9. Annual Plan Updates	✓	✓	✓
10. Hospital Staff Readiness to Respond	✓	✓	✓
11. Capacity Expansion Plan	✓	✗	✗
12. Reserve of Medications and Equipment	✓	✓	✗
13. Response Protocols for Individual Departments	✗	✓	✗
14. Difficulties with Decontamination	✗	✗	✗
15. Competence of Medical Staff in Triage	✓	✓	✓
16. Danger during Triage in CBRN Incidents	✓	✓	✓
17. Evacuation Priority	✓	✗	✓
18. Post-Disaster Recovery	✗	✗	✗
19. Preventive Measures	✓	✓	✓
20. Disaster Situation Management	✓	✓	✓
21. Training for Enhanced Resilience	✓	✓	✓
22. Conducting Diverse Trainings	✗	✓	✗

1. **Structural Resilience in Disaster Situations**

- The structural integrity of the building is crucial for effective disaster response, such as during earthquakes and fires. Specific zones, such as foyers and halls, have been identified as more resilient and suitable for patient evacuation.
- **Conclusion:** All healthcare facilities should designate and prepare specific zones for the staging and evacuation of patients during disasters.

2. **Importance of Alternative Utility Services During Disasters:**

   The surveyed hospitals are equipped with backup generators for emergency situations, ensuring uninterrupted operation in critical zones, alongside activation of emergency alert systems.

   - **Conclusion:** The availability of alternative energy and water sources is essential for sustaining hospital operations during disasters.

3. **Challenges in Equipment Maintenance and Repair**

   - An emergency response system involving representatives from different hospital departments is in place for all types of disasters.
   - **Conclusion:** Systematic coordination and a clear hierarchy of actions are vital for effective equipment maintenance.

4. **Critical Need for Underground or External Evacuation Facilities**

   - Hospitals lack underground shelters but possess alternative buildings for evacuation in cases of chemical, biological, radiological, or nuclear hazards.
   - **Conclusion:** The construction of protected underground facilities should be considered. These should be equipped with emergency power generators, water supply, and radiation emergency kits.

5. **Advantages of Emergency Alert Systems**

   - Rapid response via alert systems can save lives and protect material assets.
   - **Conclusion:** Alert systems are a fundamental component for successful coordination during disasters and are available in all healthcare facilities in Varna and Varna District.

6. **High Demand for a Hospital Command Center for Disasters**

   - Hospitals have command units for disaster response, coordinating actions from either the central administrative area or a specially equipped crisis management room—referred to as the operational crisis command center.
   - **Conclusion:** An effective command center is key to timely disaster response.

7. **Proven Benefits of an Organized Disaster Management Group**

   - Hospital emergency teams operate according to their competencies, including technicians and support staff.
   - **Conclusion:** Organizing emergency response teams enhances overall efficiency in disaster response.

8. **Improved Coordination with Other Institutions**

   - Regular drills and scenario-based exercises involving external institutions facilitate effective coordination and cooperation.

- **Conclusion:** Practical joint exercises are essential for inter-institutional cooperation.

9. **Benefits of Annual Updates to Disaster Preparedness Plans**

- Protection plans are updated regularly, with a particular focus on fire—considered the most likely scenario for hospitals.
- **Conclusion:** Updating disaster plans improves staff readiness and reduces the risk of errors during emergencies.

10. **Critical Role of Staff Readiness for Disaster Response**

- Despite training and preparedness, each disaster scenario requires flexibility and adaptive response.
- **Conclusion:** Personnel readiness depends not only on drills but also on the ability to respond quickly and appropriately on-site.

11. **Necessity of Surge Capacity Planning for CBRN Incidents**

- Existing disaster action plans are general and cover various scenarios, regardless of scale.
- **Conclusion:** Developing flexible surge capacity plans aids adaptation to diverse incidents.

12. **Sufficient Reserves of Medications and Equipment for Emergencies**

- Hospitals maintain adequate medical supplies and equipment, with daily deliveries ensuring continuity.
- **Conclusion:** Maintaining medical reserves is critical for minimizing the adverse effects of disasters.

13. **Lack of Department-Specific Emergency Protocols**

- General disaster plans exist, but there are no specific protocols for individual hospital departments.
- **Conclusion:** Developing tailored protocols for each department would enhance disaster response effectiveness.

14. **High Competence of Medical Staff in Triage**

- Medical professionals demonstrate high competence in performing triage, which is crucial in disaster situations.
- **Conclusion:** Enhancing staff competence through training and practical exercises is vital for effective triage application.

15. **Identified Risk in Conducting Triage in Unspecified Locations**

- Conducting triage in undefined areas poses a risk that must be evaluated.

- **Conclusion:** Clear guidelines and designated locations for triage during disasters should be developed.

16. **Evacuation in Disasters Proven Necessary Only as a Last Resort**

- Evacuation is a priority but may be hindered by building height or complex layouts.
- **Conclusion:** Developing evacuation scenarios tailored to building specifics is key for effective execution.

17. **Sufficiently Rapid Recovery Response in Surveyed Facilities**

- Disaster recovery is a task for the state and its structures, depending on the extent of damage.
- **Conclusion:** National coordination is critical for successful post-disaster recovery.

18. **Preventive Measures for Protection Implemented by Surveyed Facilities**

- Preventive measures include clinical organization and the role of security personnel, with clear staff instructions.
- **Conclusion:** Preventive strategies should be integrated into the hospital's daily operations.

19. **Demonstrated Staff Experience in Disaster Situations**

- Experience and instinct are as vital as theoretical knowledge for disaster response.
- **Conclusion:** Practical experience among personnel is decisive for effective disaster management.

20. **Frequent Drills and Training with Diverse Scenarios Established**

- Conducting drills with various scenarios is important, but requires competent leadership.
- **Conclusion:** Exercises significantly enhance hospital preparedness for disaster scenarios.

Summary Conclusions:

1. The importance of a systematic approach to hospital disaster management has been emphasized.
2. A well-established emergency response structure exists, which can be further improved through risk assessment and reduction strategies.
3. More frequent and varied training scenarios involving both natural and anthropogenic hazards are needed.
4. Improved coordination with external institutions and collaboration with external contractors enhances operational capacity and strengthens hospital resilience overall.
5. Resource availability and enhanced staff readiness are key factors in effective disaster management.

VI. RECOMMENDATIONS

Targeted actions by institutions, hospital management, and medical personnel are necessary to improve the preparedness of healthcare facilities in Varna District for protection and response in the event of natural and anthropogenic hazards.

Component 1: Management and control

A Command Group (Emergency Operations Center) must be organized and activated to coordinate disaster response efforts. This is a supervisory body responsible for leading operational activities in response to various types of hazards. If no coordinated disaster management mechanism is in place, the hospital director should immediately convene a meeting with all department heads to establish such a Command Group. This group is essential for the effective development and management of hospital structures and activities required for a coordinated response.

When organizing the Command Group, representatives from the following departments should be included:

- Hospital Administration
- Communications
- Security
- Clinical Staff
- Human Resources
- Pharmacists
- Infection Control
- Oxygen Therapy
- Engineering and Maintenance
- Laboratory Personnel
- Sanitation Staff
- Finance and Accounting

Activities:

- Designate a Hospital Command Center-a dedicated space prepared for convening and coordinating emergency response activities throughout the hospital, equipped with effective communication systems.
- For each key component, appoint an individual with the appropriate knowledge, skills, and competencies to ensure proper management and coordination of related response activities.
- Assign deputies for each role to ensure command and control continuity and structural succession.
- Consult relevant internal and external documents (e.g., Health Act, Medical Institutions Act, National Disaster Risk Reduction Strategy, etc.) related to disaster management to ensure alignment with established strategies and core principles in planning and implementing the Hospital Emergency Protection Plan.

- Implement or develop a "Checklist" (Appendix 1).
- All members of the Command Group must undergo training on the system's functioning and receive clear instructions regarding their duties and the operational tasks they are expected to perform.

Component 2: Communications

Recommendations:

Accurate, clear, and timely communication is essential to ensure effective collaboration, informed decision-making, public awareness, and trust

Activities:

- Appoint a Public Information Officer to coordinate hospital communications with the public, health authorities, and the media.
- Designate a location for press briefings (at a distance from emergency departments, triage/waiting areas, and the command center).
- Prepare brief, key messages for target audiences (e.g., patients, staff, public) in anticipation of possible disaster scenarios.
- All communications directed to the public, media, staff, and health authorities must be approved by the leadership of the Command Group.
- Establish streamlined mechanisms for information exchange between hospital administration, department/unit heads, and facility staff.
- Inform hospital personnel of their roles and responsibilities within the incident action plan.
- Create mechanisms for timely and appropriate collection, processing, and reporting of information to supervisory stakeholders (e.g., government, health authorities), and through them, to neighboring hospitals, private practitioners, and pre-hospital networks.
- All decisions related to patient prioritization (e.g., adapted admission and discharge criteria, triage methods, infection prevention and control measures) must be communicated to all relevant staff.
- Ensure the availability of resilient primary and backup communication systems (e.g., satellite phones, mobile devices, landlines, internet access), as well as access to an up-to-date contact list.

Component 3: Safety and security

Recommendations:

Procedures for safety and security should be developed to maintain hospital operations and respond effectively to incidents during disasters.

Activities:

- Appoint a hospital security team responsible for all safety and security activities within the facility.

- Prioritize safety in collaboration with the hospital's Command Group. Identify areas with increased vulnerability (e.g., entry/exit points, access to food/water, pharmaceutical stockpiles).
- Ensure control of access points to the healthcare facility, triage areas, and other patient-flow locations. Limit visitor access during epidemic situations.
- Establish reliable methods for monitoring and managing hospital staff, patients, and visitors.
- Provide mechanisms for transporting essential medical personnel and their families to patient care areas.
- Develop clear and precise safety measures required for the safe and effective evacuation of the hospital.
- Establish clearly defined protocols for population control (management of large groups of people).
- Require regular updates from the hospital security team to identify potential safety and security challenges and limitations, including gaps in hazardous material management and infection prevention and control.
- Identify risks related to information security. Implement procedures to ensure secure collection, storage, and reporting of confidential information.
- Define thresholds for integrating local law enforcement and military security operations within hospitals.
- Identify and, where necessary, establish zones for radioactive, biological, and chemical decontamination and isolation.

Component 4: Capacity

Recommendations:

Capacity is defined as the ability of the healthcare service to expand beyond its normal operational limits in order to meet an increased demand for clinical care—an essential factor in disaster response within healthcare facilities. It should be considered early in the planning process.

Activities:

- Calculate the maximum capacity needed to admit and care for patients, based not only on the total number of beds but also on the availability of medical and essential resources, as well as the adaptability of the healthcare facility.
- Assess the projected increase in demand for hospital services using available planning tools, assumptions, and forecasting instruments.
- Identify methods for expanding the hospital's inpatient capacity.
- Designate additional care zones to be used when standard facility capacity is exceeded (e.g., auditoriums, lobbies).
- Increase hospital capacity by outsourcing care for patients with mild conditions to external contractors, where transportation to alternative care sites is feasible (e.g., converted outpatient units for inpatient use, home care for mild cases, and chronic care institutions for severely ill patients).
- Review and update the availability of transport vehicles and other necessary resources required for patient transfer.

- Plan for patient relocation to nearby healthcare facilities during disaster scenarios if conventional transport methods are unavailable.
- Identify potential gaps in medical care provision, with a focus on critical and emergency surgical services, and address these in coordination with authorities and neighboring regional hospitals.
- In coordination with local authorities, identify additional facilities that could be converted into patient care units (e.g., rehabilitation centers, hotels, schools, sports halls).
- Prioritize or suspend non-essential services (e.g., elective surgery) when necessary (e.g., during pandemics).
- Adapt hospital admission and discharge criteria accordingly.
- Prioritize clinical interventions based on treatment capacity and demand.
- Designate an area to serve as a temporary morgue. Appoint a suitable person to liaise with families and ensure the provision of adequate body bags and covering sheets.
- Develop an emergency plan for post-clinical (mortuary) care in collaboration with appropriate partners (e.g., funeral services, medical examiners, pathologists).

Component 5: Triage

Recommendations:

Triage activities for patients should be maintained based on well-functioning protocols during mass casualty incidents. This is essential for ensuring appropriate care for patients.

Activities:

- An experienced triage specialist should be designated to oversee all triage operations (e.g., trauma physician or emergency care specialist).
- Reception and waiting areas for patients should be assessed to determine if they are effectively covered and protected from potential environmental hazards and provided with adequate working space, lighting, and access to auxiliary power supply.
- Triage zones should be evaluated in proximity to core personnel, medical supplies, and key departments (e.g., Emergency Department, operating rooms, Intensive Care Unit).
- Entry and exit routes to/from the triage area should be clearly defined and marked.
- Locations for receiving and sorting mass casualties during emergencies (triage area) should be identified.
- An alternative waiting area should be designated for ambulatory injured patients.
- Mass casualty triage protocols should be developed based on severity of illness/injury, survivability, and hospital capacity, following internationally accepted principles and guidelines.
- A clear patient triage identification method should be established.
- An adequate supply of triage tags should be ensured.
- A mechanism should be established whereby the hospital emergency response plan can be activated from the Emergency Department or the triage site.
- Ensure that protocols for hospital admission, discharge, referral, and access to this information are adapted and freely available when the disaster plan is activated to facilitate effective patient processing.

Component 6: Continuity of Medical services

Recommendations:

Disasters do not eliminate the daily requirements for essential medical and surgical services (e.g., emergency care, urgent surgeries, maternal and child care) that exist under normal circumstances. These services must continue concurrently with the activation of the hospital emergency response plan.

Activities:

- Identify and maintain core hospital services, i.e., those that must be available at all times under any circumstances.
- Determine the resources necessary to ensure continuity of essential hospital services, particularly those for critically ill and other vulnerable groups (e.g., pediatric, elderly patients, and patients with disabilities).
- Develop a systematic and applicable evacuation plan aimed at preserving the continuity of critical care (including, for example, access to mechanical ventilation and life-sustaining medications).
- Develop a plan with health authorities, neighboring hospitals, and private practitioners to define the roles and responsibilities of each member of the local healthcare network to ensure uninterrupted provision of essential medical services throughout the community.
- Ensure availability of appropriate reserves of vital supplies, including water, energy, and oxygen.
- Anticipate the impact of the most likely disasters on hospital food and water supplies. Take measures to ensure adequate stockpiles of these supplies.
- Provide mechanisms for emergency collection and disposal of hazardous and other hospital waste.

Component 7: Logistics and Supply management

Recommendations:

The continuous use, supply, and availability of medical supplies is a frequently underestimated challenge during disasters, requiring careful planning and emergency response.

Activities:

- Ensure and maintain an up-to-date inventory of all equipment, consumables, and pharmaceuticals.
- Establish an early warning mechanism for shortages.
- Assess the consumption of essential consumables and pharmaceuticals (e.g., weekly usage), based on the most probable disaster scenarios.
- Plan and guarantee continuous provision of essential items — medications and supplies (for example, those provided from institutional and central stocks and through emergency agreements with local suppliers and national and international aid agencies).
- Establish disaster agreements (e.g., mutual aid agreements) with suppliers to guarantee delivery and rapid supply of equipment, consumables, and other resources during shortages.

- Evaluate the quality of all items prior to purchase by requiring quality certification.
- Designate physical space within the hospital for storage and stockpiling of additional consumables, facilitating access, security, temperature, ventilation, and humidity control. Ensure continuous cold chain for essential items requiring refrigeration.
- Collect essential consumables and pharmaceuticals in accordance with national guidelines.
- Ensure timely use of stockpiled items to avoid losses due to expiration.
- Define the role of the hospital pharmacy in providing medications to patients treated at home or at alternative care sites.
- Provide a mechanism for rapid maintenance and repair of equipment necessary for essential services.
- Coordinate an emergency transportation strategy with pre-hospital networks and transport services to ensure uninterrupted patient transfer.

Component 8: Human Resources

Recommendations:

Effective management of human resources is essential to ensure adequate staffing capacity and continuity of operations during disaster situations.

Activities:

- Monitor and continuously track staff absences.
- Update the hospital staff contact list annually.
- Establish a clear staff sick leave policy, including contingencies for sick or injured family members or dependents of staff.
- Determine minimum staffing requirements for healthcare workers and other hospital personnel to ensure operation of each hospital department.
- Develop an emergency plan to provide food, water, and rest areas for hospital personnel.
- Ensure sufficient staffing levels for hospital departments.
- Recruit and train additional personnel (e.g., retired staff, reserve military personnel, university affiliates/students, and volunteers) based on anticipated disaster needs.
- Address issues of liability, insurance, and temporary licensing related to additional staff and volunteers who may be required to work outside their usual scope of practice or licensing.
- Establish a system for rapid deployment of healthcare workers (e.g., medical personnel) with necessary qualifications during emergencies, in accordance with hospital and health authority policies.
- Provide healthcare professionals in high-demand services (e.g., emergency care, surgical, and intensive care units).
- Offer training and drills in areas with potential increased clinical demand, including emergency and intensive care, to ensure adequate staff capacity and competence.

Component 9: Disaster Recovery

Recommendations:

Recovery planning should commence at the start of response activities. Prompt implementation of recovery measures can help mitigate the long-term impact of disasters on hospital operations.

Activities:

- Appoint a disaster recovery officer responsible for overseeing hospital and recovery operations.
- Define key criteria and processes for incident demobilization and system recovery.
- In the event of hospital building damage, ensure a comprehensive assessment of structural integrity and safety is conducted.
- If evacuation is required, determine the time and resources needed to complete repairs and replacements before the facility can be reopened.
- Organize a hospital staff team to conduct post-event inventory assessment; team members should be familiar with the location and inventory of equipment and supplies.
- Appoint specialists to evaluate the condition of medical equipment, which may require repair or replacement.
- Arrange professionally conducted staff debriefings within 24–72 hours post-disaster to aid coping and recovery. Provide access to mental health resources and productivity enhancement.
- Submit a report after response actions to hospital administration, emergency leaders, and relevant stakeholders, including an incident summary, response evaluation, and cost accounting.
- Provide appropriate recognition for services rendered by staff, volunteers, external personnel, and donors during the disaster and recovery.
- Establish an employee assistance program post-disaster according to staff needs, including, for example, counseling and family support services.

VII. CONTRIBUTIONS

Scientific-Theoretical Contributions:

1. **Enhanced the theoretical framework regarding natural and anthropogenic hazards** through a detailed classification of risks to hospital healthcare facilities, based on up-to-date data and international classifications.
2. **Advanced the scientific understanding of the vulnerability of hospital healthcare facilities** to natural and anthropogenic hazards by defining specific vulnerabilities related to infrastructure, logistics, human resources, and communication systems.
3. **Developed a novel approach for assessing the preparedness of hospital healthcare facilities**, based on an integrated analysis of capacity, available resources, response procedures, and staff training.
4. **Designed a methodology for investigating the disaster preparedness** of hospital healthcare facilities.
5. **Established a new system of risk reduction measures for hospital healthcare facilities**, including structural and organizational activities specifically adapted for these facilities.
6. **Scientifically substantiated the need for integrated and systematically updated protection plans for hospital healthcare facilities**, combining risk analysis, capacity assessment, and recovery planning, in accordance with contemporary guidelines from international organizations.

Practical-Applied Contributions:

1. **Developed specific measures to mitigate the impacts of landslides**, floods, earthquakes, and fires, adapted to the conditions of specific outpatient healthcare facilities in Varna and the region.
2. **Created a model for assessing the preparedness of hospital healthcare facilities** in Varna District, including key indicators of structural resilience, resource provision, and organizational readiness.
3. **Prepared a self-assessment checklist for disaster preparedness of hospital healthcare facilities**, assisting administrators in identifying critical weaknesses and prioritizing improvement measures.
4. **Formulated concrete recommendations to enhance the response capacity of hospital healthcare facilities** to natural and anthropogenic hazards, focusing on resource optimization, staff training, and coordination with external services and contractors.
5. **Proposed the establishment of a hospital command center** within hospital healthcare facilities for disaster management.

IX. Scientific Publications Related to the Dissertation Work

1. Георгиев, Я., Радева, Н., Романова, Х. (2023). Уязвимост на лечебните заведения при земетресения. СБОРНИК ДОКЛАДИ ШЕСТА НАУЧНА КОНФЕРЕНЦИЯ НА БНДОЗ „ОБЩЕСТВЕНОТО ЗДРАВЕ: ПРЕДИЗВИКАТЕЛСТВА ПРЕД ЗДРАВНАТА СИСТЕМА“, МЕДИЦИНСКИ УНИВЕРСИТЕТ – ПЛЕВЕН, 26 - 27 МАЙ 2023 Г. ИЗДАТЕЛСКИ ЦЕНТЪР НА МУ – ПЛЕВЕН, 448-456.
2. Георгиев, Я., Радева, Н., Романова, Х. (2022). РИСК ОТ ПОЖАРИ В ЛЕЧЕБНИТЕ ЗАВЕДЕНИЯ В УСЛОВИЯТА НА COVID-19. Black Sea Journal of Medicine and Public Health, ISSN: 2738-8654 Vol. 2, 38-47.
3. Licht S., Georgiev Y. Stress influence on the health of seafarers. Varna Medical Forum, Medical University of Varna, Bulgaria, ABSTRACTS and PROCEEDINGS from the VIII Edition of the “SEA AND HEALTH” Festival. 2022 Hybrid Scientific Conference “SEA AND HEALTH” Dedicated to the European Maritime Day 20 May 2022, volume 11, 2022, supplement 1, 79-80.