

Review

From Prof. Dr. Hristianna Angelova Romanova, MD, PhD, DSc
Department of Disaster Medicine and Maritime Medicine
Faculty of Public Health
Medical University "Prof. Dr. Paraskev Stoyanov" – Varna
Member of the NJ appointed by order № P-109-346/19.08.2021

Subject: *Dissertation for the award of the Scientific degree "Doctor of Science"*

Author: *Assoc. Prof. Dimitar Georgiev Stavrev, MD, PhD*

Topic: *Medical aspects of water injuries at sea*

Scientific specialty: *Disaster medicine*

Professional field: *7.1. Medicine*

Assoc. Prof. Dimitar Georgiev Stavrev was born on September 27, 1961. In 1987 he graduated from Medical University – Varna, and in 2011 he received the educational and scientific degree "Doctor of Medicine". In 1993 he acquired a Medical specialty in "Anatomy, Histology and Cytology" at Medical University – Sofia. In 1996 he received the qualification "Modern methods of resuscitation in case of water accidents" at the Bulgarian Red Cross, and in 1999 – "Health Management in case of health provision" at the Institute of Management and Entrepreneurship – Sofia.

In 2008 Assoc. Prof. Stavrev acquired the qualification "Fundamentals of Diving and Hyperbaric Medicine" at the Military Medical Academy – Varna, and in 2011 – "Maritime Instructor" at the Maritime Qualification Center – Varna to Maritime Administration at the Ministry of Transport.

From 1987 to 1990 Assoc. Prof. Stavrev worked as a District Pediatrician at the Municipal Hospital – Gen. Toshevo.

From 1990 to 2016 he held the position of Assistant, then Senior Assistant and Chief Assistant at the Medical University "Prof. Dr. Paraskev Stoyanov" – Varna, where he continues to work, holding the position of "Associate Professor" in the scientific specialty "Disaster Medicine (Marine Medicine)".

From 2004 to 2008 and from 2012 to 2015. Assoc. Prof. Stavrev is a lecturer in anatomy at the University of Ruse "Angel Kanchev".

In 2008 he held the position of Manager of the Home Care Center at the General Assembly of the Bulgarian Red Cross – Varna, where he currently works.

In 2013 he was appointed as a Lecturer at the National Training Center of the Bulgarian Red Cross, where he continues to work.

Assoc. Prof. Stavrev has numerous participations in research projects, forums and editorial boards.

During the years of active work Assoc. Prof. Stavrev has received many awards and distinctions: Honorary Badge "Bulgarian Doctor" (October 19, 1999) – Bulgarian Medical Union and the newspaper "Bulgarian Doctor", Title "Honored Worker of the Bulgarian Red Cross" (May 8, 2009), Medal of Merit to the Bulgarian Red Cross – bronze (May 8, 2016) by the National Council of the Bulgarian Red Cross, Award for high responsibility and dedication (09.06.2012) – Student Tourist Association and others.

He is a member of the Bulgarian Anatomic Society, the Union of Scientists in Bulgaria – Varna branch, the Society of Water Rescue Specialists, the Bulgarian Association of Aviation, Maritime and Space Medicine, the Varna Society of Medical History, the Bulgarian Association of Hyperbaric Oxygenation and the Bulgarian Scientific Society of public health.

The dissertation contains 254 pages and 44 pages of annexes. It is illustrated with 17 figures, 14 tables and 28 graphs. There are 56 applications.

The introduction is 2 pages, literary review – 69 pages, material and methods – 12 pages, own research – 128 pages, literary sources – 363. Announced publications on the topic – 37 and 7 participations in scientific forums in 2020.

According to Assoc. Prof. Stavrev, water trauma is not a problem that can be finally solved, but a reality that cannot be ignored.

The aquatic environment affects the human body with its specific physico-chemical characteristics – density, pressure, temperature, chemical composition and biological factors. In a situation of maritime accident, this impact can lead to serious injuries, drowning, hypothermia (hypothermia) and traumatic injuries from the seawater itself or objects and substances in them. Survival in the face of adversity at sea depends on both natural factors and the physical and mental preparation of the person in distress.

The development of methods, both for reducing the damage to human health at the time of trauma and for providing assistance, requires their constant updating. The analysis of the risks for the rescuers themselves is especially important, in order to improve their training, maintain the systems for providing medical care and equipment.

People from various categories take part in the rescue operations in case of disaster at sea: professionals – sea rescuers; professionals in other fields with training to provide assistance, incl. medical – police officers, firefighters, maritime specialists, etc. trained volunteers - members of the voluntary teams at the Bulgarian Red Cross, voluntary structures at the Fire Protection of the Population, at municipalities, etc. organizations; spontaneous volunteers, who are most often the first at the scene of a disaster.

The Bulgarian healthcare system has established structures in the Black Sea region with opportunities for providing qualified assistance in case of water injuries. Structures outside

the healthcare system – Bulgarian Red Cross, BULSAR, Bulgarian National Maritime Consortium also successfully contribute to counteracting injuries at sea.

Assoc. Prof. Stavrev has well formulated the goal and tasks.

The goal is to analyze the maritime incidents related to the health of those affected and based on the conclusions to identify measures to reduce and overcome water injuries at sea.

To achieve this goal, **five tasks** are set:

1. To study, describe and analyze the situations of extreme impact of the maritime environment on the human body and their possible manifestation in Bulgaria.
2. To analyze and summarize the accumulated medical experience from maritime experiments for extreme residence in the marine environment. To plan and carry out new experiments.
3. To propose a model for studying the effect of living in an aquatic environment under normal and extreme situations. To determine the relevant equipment, perform research and analyze the results.
4. To analyze the medical training of all categories of participants in rescue operations and identify ideas to increase its effectiveness.
5. To propose new forms for the development of the systems for reaction and protection of the health of those affected by an accident with marine injuries.

The material and methods are sufficient in volume and content. Following methods have been used:

- Documentary and bibliographic method – research and analysis of 373 sources, distributed to 347 paper and 26 Web-based materials;
- Direct obtaining of reliable information from specialists with many years of experience in the subject through interview and direct communication;
- Laboratory method – measurements of anthropological and physiological parameters were performed on 240 volunteers from among maritime professionals;
- Questionnaire method – in the period 2019-2020, 492 volunteers from different target groups were interviewed with specially prepared questionnaires related to the issue of water injuries;
- Graphic method, etc.

His own research on the topic examines the various aspects of maritime injuries (causes, mechanisms, medical damage) and the overcoming of medical injuries at different stages (prevention of injuries, actions during an accident, overcoming injuries in the following periods).

First task: Study of extreme situations at sea leading to water injuries on a global scale and their manifestation in Bulgaria ends with significant conclusions:

- Medical damages in accidents and catastrophes at sea not only do not decrease, but diversify with new types and options.
- Natural disasters are becoming more frequent and involving more and more people, both due to the increase in world population and due to its large relocation along the shores of the seas and oceans.
- Anthropogenic accidents increase their size and scope. More and more spectacular facilities are being created, both along the coast and far from the coast.
- Passenger shipping, especially for recreational purposes, is already carried out on cruise ships with a capacity of more than 3000 passengers
- Sea sports, recreational fishing, professional and amateur diving are also growing.
- The Republic of Bulgaria is not isolated from the global threat of maritime terrorism and overseas migration and related medical problems, incl. water injury.
- Globally, the most massive cases of water injuries are associated with natural disasters, such as tsunamis following earthquakes in the world's oceans. The risk of water injury continues to be high in countries with low altitudes and rising monsoon seasons (10% of Bangladesh's territory is below 1 m above sea level).
- Of the anthropogenic causes, the leading are the shipwrecks with passenger liners.
- The long-term systematic targeted activity of state, municipal and civil society organizations maintains a positive trend of reducing water injuries, as in the last two years 2019 and 2021 the number of drownings has fallen below 100 (98 and 83 respectively), and according to WHO standard 1,2 per 100,000 population.

Second task: Study of the medical needs in a marine experiment and development of a model for medical provision is also developed in detail and ends with important conclusions such as:

- The best way to accumulate scientific knowledge is to observe the processes in their natural development or in case of impossibility – their experimental imitation.

- In Bulgaria there is a rich experience in marine experiments, and most of them include medical research. New experiments are planned and carried out. They are evolving, upgrading with new methods and technologies.

Third task: Creating a model for research in marine physiology, organizing a marine medical research laboratory and the results of own research in a marine research program is very well solved. The main conclusions are:

- A model has been created to study the effect of living in an maritime environment under normal and extreme situations. It includes new approaches and research that have not been done so far.
- For the assessment of the impact of the marine environment, the parameters of the physiological manifestations of the respiratory, cardiovascular systems and musculoskeletal system are taken into account. The obtained results are archived, analyzed, entered in tables and presented graphically.
- No less important are the psychological processes at the individual level and group level of potential victims and rescuers in a maritime accident with water injuries. Statistically significant results have been established: positive significant correlation was found ($r_s = 0.516$) between the rigidity and the level of stress resilience measured at the beginning of the rescuer training course; negative moderate correlation ($r_s = - 0.403$) between exercise and the level of frustration; positive significant significant correlation ($r_s = 0.695$) between the stress level measured at the beginning of the lifeguard course and the stress level measured at the end of the course.

Fourth task: Study of the readiness of the population to provide assistance in case of water injuries. Identification of measures to increase the competence of the population to act in case of maritime accidents and catastrophes. The most important conclusions are:

- The summary of the results of the comparison of the different categories of subjects shows a relatively high readiness for first aid in the general case of 68.4% and a lower one for water injuries in the marine environment 43.6%.
- The training for assistance and self-help the respondents received mainly from the BRC system, less from educational institutions and to a very low extent from the family and the mass media.
- No significant differences in the results are found depending on the place of residence in the different areas or according to the size of the settlements.

- The existing system for preparing the population for prevention and counteraction of water injuries at sea is diverse, comprehensive and effective. Proof of this finding is the decrease in the number of deaths from water injuries at sea on the Bulgarian coast reached a level of 1.2 per 100,000 by WHO measurement.

Fifth task: Research of the possibilities for creating a model for inter-institutional interaction in case of incidents, accidents and catastrophes along the coast. The most significant conclusions proposed by Assoc. Prof. Stavrev are:

- The good communication between the Bulgarian Red Cross-Varna, Medical University-Varna, structures of the health system, Ministry of Transportation, Ministry of Defense and others related to water injuries in accidents at sea are realized in the simulated play of episodes with rescue in the area of responsibility of the Republic of Bulgaria.
- The analysis of the nationally and regionally played situations of incidents with water injuries in the Varna Bay, as well as the specially organized measurements in the course of the present study give grounds to develop sample models and algorithms.
- The existing system for reducing water injuries can successfully include various structures of informal civic organizations – touristic and sports clubs, business structures, associations with scientific and humanitarian goals, etc.

Maritime injuries are undoubtedly a major global public health problem with significant potential for impact. Effective prevention requires programs and policies that address certain risk factors. Local data collection or monitoring is needed to identify specific factors related to water injury in different regions. There may be large variations in time and place, as water injuries can be associated with several types of daily and / or recreational activities (e.g. fishing, boating, swimming), different types of water exposure (e.g. in the oceans, gardening wells, lakes, swimming pools and bathtubs) and other risk factors (e.g. behavioral risk factors, including alcohol use and product safety factors). Ensuring safety for those living in the marine environment is directly linked to ensuring safety for emergency responders. This is done through measures based on a comprehensive research program.

The main Contributions from the dissertation are:

- Identification, analysis and generalization of the damaging impact of the marine environment on the human body.
- Expanding the perimeter of training and research in maritime medicine to cover different aspects of the human-sea relationship and the different people, potential victims of

water injuries – marine professionals on shore and on the high seas, traveling, practicing water sports, researchers from various fields of marine sciences, vacationers and others.

- Analysis of the readiness of different categories of Bulgarian citizens, potential rescuers to provide assistance in case of water injuries at sea.
- Summary and analysis of the causes leading to injuries at sea on a global scale and their dimensions in Bulgaria.
- Analysis of the medical aspects of the marine experiments carried out in Bulgaria with a view to reducing and / or avoiding water injuries.
- Summarizing the contributions of the Bulgarian marine experiments. Creating an example scheme for studying the changes occurring in the body during a marine experiment and corresponding laboratory equipment.
- Creating a model for the organization of a laboratory in marine medicine, which is partially equipped. Research related to the safety of maritime professionals has begun.
- Creation and implementation of comprehensive measures for prevention and counteraction of water injuries, including practically all age and social groups of the society.
- Creation of printed and electronic materials on topics including water trauma, its prevention and measures and ways to overcome medical injuries.
- Experimentation, reporting and analysis of options in the planning and management of medical activities in maritime accidents, complementing the existing systems of action in maritime accidents.

There are 56 annexes to the dissertation, presented on 44 pages in a separate form. Most of them are tables, photos and figures presenting: the mechanism of drowning, basic chemical elements of the sea, equipment of lifeboats, maps of seismic areas, tsunamis, etc., which have no scientific value because they are not by the author and are not systematized or analyzed, but can be used as materials for students from "Marine Medicine" elective course.

Conclusion:

1. The analysis of the presented dissertation on the topic "Medical aspects of water injuries at sea", the evaluation of the studies, as well as my personal impressions of Assoc. Prof. Dimitar Stavrev give me reason to give a positive evaluation.
2. The dissertation work meets the requirements of national and Varna Medical University's Regulations for obtaining scientific degree "Doctor of Science" in "Disaster Medicine".

3. Based on the above mentioned, I give my positive assessment and propose to the members of the Scientific Jury, Assoc. Prof. Dimitar Georgiev Stavrev to be awarded with Scientific degree "Doctor of Science" in the scientific specialty "Disaster Medicine" in higher education 7. Healthcare and sport, Professional field 7.1. Medicine.

Reviewer:



Prof. Hr. Romanova, MD, PhD, DSc