SAFETY AND RELIABILITY
https://doi.org/10.1080/09617353.2025.2500776

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Continuous professional development of rescue personnel

Mykhaylo Kozyar[a], Ihor Koval[b], Larysa Rudenko[a], Roman Lavretski[c] and Roman Velykyi[d]

[a]Department of Applied Psychology and Pedagogy, Lviv State University of Life Safety, Lviv, Ukraine; [b]Sector of Psychological Support, Lviv State University of Life Safety, Lviv, Ukraine; [c]Lviv State University of Life Safety, Lviv, Ukraine; [d]Department of Ukrainian Studies and Intercultural Communication, Lviv State University of Life Safety, Lviv, Ukraine

ABSTRACT

The purpose of this study was to investigate the continuous professional self-development of rescue personnel in the field of human security in Ukraine in comparison with European countries. The research methodology was based on an integrated approach, which provided a deep study of the process of specialist development and the development of effective strategies for its continuous improvement. This included the analysis of national and international programmes and the collection and analysis of statistical data. The results obtained indicate significant differences in approaches to professional training of future specialists and the effectiveness of rescue services between Ukraine and European countries. European countries have demonstrated a high level of readiness of rescuers through the integration of the latest technologies, regular practical training and international exchange of experience. An analysis of the annual reports of rescuers confirms that European rescue services actively use the practice of continuous training and development, including participation in international trainings and seminars. The findings asserted the need to improve the system of professional development of rescue personnel in Ukraine by introducing the best international practices, increasing the level of support from the state, and expanding access to modern training resources and practical training.

Abbreviation: State Emergency Service of Ukraine (SESU)

ARTICLE HISTORY Received 6 September 2024; Revised 21 March 2025; Accepted 9 April 2025

KEYWORDS Professional self-development; human security; emergency; safety; rescue services

CONTACT Mykhaylo Kozyar myk.kozyar@gmail.com Department of Applied Psychology and Pedagogy, Lviv State University of Life Safety, Lviv, Ukraine

1. Introduction

Rescuers play a vital role in ensuring public safety during emergencies, such as fires, floods, and anthropogenic disasters. In Ukraine, the State Emergency Service of Ukraine (SESU) personnel are tasked with operating under extreme conditions created by ongoing armed conflict, including artillery bombardments, destroyed infrastructure and the threat of hazardous material exposure. Their preparedness and professionalism are crucial to the success of rescue operations and the protection of lives and health. As the world constantly evolves, new challenges necessitate the continuous updating of rescuers' skills and knowledge, particularly through the integration of modern technologies and new operational methods. The process of professional self-development allows rescuers to remain effective and competent, directly contributing to the broader framework of human security, which focuses on ensuring the protection of individuals from threats, such as violence, disasters and health risks. However, the Ukrainian training system faces challenges, such as limited access to resources, a lack of practical training opportunities and insufficient managerial support. By examining international practices, especially in European countries, Ukraine can adopt best practices that improve the level of professional training for rescuers, ultimately enhancing public safety. Furthermore, continuous self-development in rescuers includes not only technical training but also psychosocial support and physical conditioning, all of which contribute to higher operational efficiency and reduced risk during emergency response. By addressing gaps in training and resource access, Ukraine can significantly improve the safety and readiness of its rescuers, ensuring a more effective response to future crises and reinforcing the human security of society.

The modern world is constantly changing, and new challenges require constant updating of the knowledge and skills of rescue personnel. The integration of the latest technologies, the development of new methods of rescue operations and the improvement of technical equipment require constant training and professional growth from rescuers. Continuous professional self-development allows rescuers to remain competent and effective in their work.

Exploring the issue of self-development of rescue personnel in the field of human security helps to identify existing problems and barriers in the rescue training system, such as limited access to resources, lack of practical training, lack of support from management, etc. The study of international experience allows borrowing best practices and implementing them in the Ukrainian system of training rescuers. Improving the level of professional training of rescuers contributes to an overall increase in the level of safety in society. Well-trained rescuers can respond more effectively to emergencies, reducing the risk of casualties and minimising property damage.

The study of continuous professional self-development of rescuers is important for improving the security system in the country, improving the professional level of rescuers and ensuring a more effective response to emergencies. The topic of continuous professional self-development of rescuers in the field of human security has been studied by numerous researchers. In particular, Martínez-Fiestas et al. (2020) emphasised the importance of continuous training and adaptation to new technologies in the training of rescue personnel. The researchers claim that regular training improves operational readiness and efficiency. Yaylaci et al. (2022) investigated the physical training of rescuers and its role in professional development. It is believed that physical endurance and specialised training are key to successful rescue operations. Binytska et al. (2023) analysed existing training programmes, their compliance with modern challenges, and compared them with international practices. Understanding the best international practices helps to improve the Ukrainian system of training rescuers, increasing their professional competence and reducing risks during emergencies.

Delaney et al. (2022) analysed risk management and the impact of continuing education on rescuers' ability to respond to emergencies. The researchers note that constant updating of knowledge on risk management increases the effectiveness of rescuers' actions. The article by Banu et al. (2024) also includes the study of the psychological aspects of rescuers' work, which is important for preventing professional burnout. Due to a comprehensive approach to self-development, rescuers will be able to perform their duties more effectively, which will increase the level of overall safety in society.

Issues of the psychosocial aspect of professional development of rescuers were investigated by Kong et al. (2024). They found that psychological training and support helped reduce stress levels and increase resistance to burnout. Cao et al. (2023) investigated the impact of continuing education on emergency preparedness. The researchers emphasised that regular training and practical simulations increase the level of training of rescuers.

Fonseca et al. (2023) examined the effectiveness of rescue training programmes. It was argued that the integration of the latest technologies and training methods significantly improves the professional level of rescue personnel. The researchers emphasised that aspects of continuous professional development of rescuers should include physical training, psychosocial support, risk management, the use of the latest technologies and the effectiveness of training programmes. Their study highlights the importance of continuous training to improve the readiness and effectiveness of rescue services.

Franklin Edwards et al. (2023) investigated the social aspects of professional development of rescuers. Interpersonal skills and teamwork are important components of successful rescue activities. The researchers emphasised the importance of continuous learning for effective

management of major crisis events. The study found that psychosocial support for rescuers and its impact on professional development helps maintain the mental health of rescuers.

The study by Fomych (2023) analysed the professional development of rescuers in the field of human security and identified a number of problems that previously did not receive proper attention. One of these problems is the insufficient integration of modern technologies into the educational process. While rescuers have access to basic equipment, the latest technologies, such as drones, virtual reality simulations and state-of-the-art communication systems are often out of their reach. Another problem is uneven access to quality education in different regions. In large cities, training and training programmes are more accessible, while in remote regions, rescuers face limited opportunities for professional development. There is also the problem of insufficient motivation among rescuers for continuous training, which is often caused by the lack of proper support from management and the underestimation of the importance of continuous professional development. This requires more emphasis on motivational programmes and psychological support.

As of today, 93 professional rescuers have been killed and 374 others injured in the war. These are tragic losses that highlight the importance and danger of the rescue profession, especially in the context of armed conflict (Koziar & Koval, 2024). Rescuers risk their lives on a daily basis, providing assistance to victims, evacuating people from dangerous areas, eliminating the consequences of shelling and performing other tasks that are critical for the safety and saving the lives of citizens.

These losses highlight the need for high-quality training and support for rescuers, both at the state level and at the level of public organisations and volunteers. Professional training, continuous professional development, psychological support and provision of modern equipment and protective equipment are just some of the aspects that should be a priority for preserving the life and health of rescuers (Koval, 2023).

The purpose of the study was to investigate the effectiveness of continuous professional self-development of human security rescuers in Ukraine in comparison with the practice of other countries to develop methods of improvement in the system of professional development of specialists. Objectives of the study:

1. Analyse existing programmes and methods of professional development of rescue personnel in Ukraine.
2. Compare the professional development systems of rescue personnel in Ukraine with similar systems in other countries.
3. Identify methods for improving the system of professional development of rescue personnel in Ukraine.

2. Materials and methods

To investigate the problem of continuous professional self-development of rescue personnel in the field of human security, several stages were included to allow a comprehensive study of this process. The first stage included an analysis of existing training programmes in such disciplines as fire safety and fire extinguishing, rescue operations, civil defence and medical training. The process of professional development was analysed, efficiency was evaluated and the needs of rescuers for additional knowledge and skills were considered.

To investigate the improvement of the system of professional development of rescuers in Ukraine, the following documents were used: the curriculum of the State Emergency Service of Ukraine (SESU), the schedule of exercises and training and the programme 'Professional training of rescuers'. These documents were chosen for analysis because they provide a systematic approach to rescue training, reflecting current standards and requirements. Studying the curriculum of the SESU helped to detail the theoretical and practical aspects of training. This included investigating the theory of rescue operations, practical exercises using special equipment and training in conditions that are as close as possible to real situations. This approach provided comprehensive training for rescuers, which is critical for the effective performance of their duties. Analysis of the exercise and training schedule determined the frequency and types of exercises, which contributed to the regular updating of rescuers' skills. The use of these documents allowed assessing the effectiveness of existing programmes and identifying areas for their improvement.

A comparative analysis of countries, such as Sweden, Germany and Ukraine was carried out based on their results in rescue services. The experience of countries with high performance indicators of rescue operations and the application of best practices in the Ukrainian system was examined. This helped to identify the strengths and weaknesses of the Ukrainian system and identify possible ways to improve it.

The second stage included an analysis of statistical data, which was carried out on indicators of success and safety. Success rates included studying statistics on the number of successful rescue operations, response time, and the number of lives saved. Comparison of these indicators with similar data from other countries revealed the effectiveness of the activities of Ukrainian rescuers. Safety indicators included an analysis of data on the number of accidents and injuries during the performance of official duties, which helped to assess the level of safety of rescuers themselves during work.

The third stage included the development of methods based on comparative analysis to improve the system of professional development of rescuers in Ukraine. The main areas for improvement were identified, including the integration of the latest technologies into the educational process, improving the level of practical training, expanding international

cooperation and exchange of experience. The methodology for studying the continuous professional self-development of rescue personnel in the field of human security included an integrated approach that allowed comprehensively investigating this process and developing effective strategies for its improvement. This included the analysis of national and international programmes, the collection and analysis of statistical data and the development of practical recommendations based on the results obtained.

3. Results

3.1. Theoretical foundations of improving the activities of specialists in the field of human security

In Ukraine, rescuers work under the orders of the SESU. They are engaged in emergency response, search and rescue operations, first aid and evacuation of victims. The main requirements for rescue personnel are high physical fitness, resistance to stress, the ability to make quick decisions in extreme conditions and work in a team. An important component of the work is also knowledge of first aid and psychological support for victims. Training of rescuers in Ukraine includes basic courses that cover the theoretical knowledge and practical skills necessary to perform rescue operations. Training programmes include trainings on fire safety, risk management, elimination of chemical and radiation accidents, diving operations and other specialised areas. Rescuers regularly take advanced training courses, participate in exercises and simulations of real situations, which allows them to constantly improve their skills.

In European countries, the approach to training rescuers is somewhat different, due to both differences in resources, traditions and the level of technological development. For example, in Germany, rescue personnel receive thorough training in specialised training centres that use state-of-the-art simulation technologies, such as virtual reality, to practice their skills in controlled environments. In addition, considerable attention is paid to psychosocial support for rescuers, because they often face situations that can lead to professional burnout. In Sweden, rescue personnel also receive intensive training, which includes physical training, training using the latest technologies and regular practical training. An important component is international cooperation, participation in international trainings and exchange of experience with colleagues from other countries. This allows Swedish rescuers to keep up to date with the latest techniques and technologies used in world practice. The principles of work of rescuers in different countries, although they may differ, have common features. First of all, this is the principle of rapid response, which requires rescuers to be constantly ready to go to the scene of an emergency. The second important principle is teamwork, because the effectiveness of a rescue operation depends on the coherence of actions of all participants. The

third principle is continuous learning and self-improvement, which includes both physical training and the development of new technologies and methods of work.

In the work of rescuers in modern conditions, both positive and negative trends can be distinguished. Changes in technology, social expectations and environmental conditions affect how rescuers perform their duties. Positive trends include innovation and technological progress. Modern technologies have significantly improved the efficiency and safety of rescue operations. The use of drones for aerial surveillance allows rescuers to quickly gain information about the scale and nature of emergencies. Thermal imagers and other sensors help detect people under rubble or in poor visibility conditions. Automated management and coordination systems allow for more efficient allocation of resources and interaction between different services. Another positive trend is increased attention to the physical and psychological training of rescuers. Understanding the importance of health and stress tolerance has led to the introduction of mental health and fitness support programmes. This helps rescuers stay in good shape and reduces the risk of professional burnout. International cooperation is also an important positive trend. Rescuers from different countries participate in joint exercises, exchange experience and knowledge. This promotes the implementation of best practices and increases the level of emergency preparedness (Fedoryshyn & Kytsmen, 2020).

However, along with the positive ones, there are also negative trends. One of them is the increasing number and complexity of emergencies faced by rescue personnel. Climate change is leading to an increase in the frequency of natural disasters, such as floods, wildfires and hurricanes. These events require rescuers not only to have physical endurance, but also high skills and the ability to quickly adapt to new conditions. Another negative trend is insufficient funding and limited resources. In many countries, including Ukraine, rescue services face a shortage of modern equipment and insufficient funding for training programmes. This can reduce the effectiveness of rescue operations and increase the risks for rescuers themselves. Social expectations also put additional pressure on rescuers. Society expects a rapid and effective response to emergencies, which is sometimes difficult to ensure in conditions of limited resources and difficult circumstances. This can lead to additional stress and psychological stress on rescuers.

Professional burnout is another serious problem. Constant stress, difficult working conditions and frequent contact with tragedies and human suffering can lead to emotional exhaustion and reduced motivation. The lack of proper psychological support only worsens this situation. Ultimately, an important negative trend is the uneven distribution of resources and learning opportunities. In large cities, rescuers usually have better access to modern training and equipment, while in remote regions these opportunities are limited. This creates an imbalance in the training and effectiveness of rescuers in different parts of the country. The work of rescuers in modern

conditions is characterised by both positive and negative trends. Innovation and technological progress significantly improve the efficiency and safety of rescue operations, and international cooperation and attention to physical and psychological training contribute to increased readiness. At the same time, the increasing number and complexity of emergencies, insufficient funding, social expectations, professional burnout and uneven distribution of resources pose serious challenges. Addressing these challenges requires a comprehensive approach that includes increased funding, the introduction of new technologies, support for mental health and equal opportunities for learning and development in all regions.

Rescue personnel can develop in modern conditions through a variety of methods and approaches that contribute to improving their professional competence, physical fitness and psychological stability. One of the main ways is continuous training and professional development. Modern technologies allow rescuers to participate in online courses and webinars that cover a wide range of topics, from the basic principles of first aid to the use of the latest technologies in rescue operations. These courses often offer a certificate confirming advanced training. Practical training and simulation are another important element of professional development. Rescuers can participate in regular exercises that simulate real-world emergencies. Such trainings help you develop skills in teamwork, making quick decisions and using specialised equipment. Using virtual reality for simulations allows creating detailed and realistic scenarios that help rescuers prepare for any challenges. Physical training is an integral part of the professional development of rescuers. Regular exercises, which include cardio, strength training and specialised workouts, help maintain a high level of physical endurance. This is especially important because rescuers often work in difficult conditions that require a lot of physical strength and endurance.

Psychological support and developing resilience to stress are also critical. Rescuers can participate in psychological support programmes that include stress management training, relaxation techniques and psychological counselling. This helps reduce the risk of professional burnout and improves overall psychological state. International cooperation and exchange of experience are important for the professional development of rescuers. Participation in international trainings, conferences and seminars allows sharing knowledge and best practices with colleagues from other countries. This contributes to the introduction of new techniques and technologies in rescue activities. The integration of the latest technologies into everyday work is another important aspect. The use of drones for reconnaissance and search of victims, thermal imagers for detecting people under rubble and automated control systems helps to increase the efficiency of rescue operations. Rescuers must be constantly trained to use these technologies in order to apply them as effectively as possible. Developing leadership skills is also important for rescue personnel, especially for individuals in leadership positions. Leadership and management training helps to

improve leadership skills, which is essential for coordinating actions during emergencies. Engaging in volunteer activities can be an additional way to develop. Participation in volunteer programmes allows rescuers to gain additional experience and skills and helps strengthen communication and organisational skills. Thus, rescuers have many opportunities for development and improvement in modern conditions. Continuous training, practical training, physical training, psychological support, international cooperation, integration of the latest technologies, development of leadership skills and participation in volunteer programmes contribute to improving their professional competence and readiness to act in any emergency situations.

3.2. Comparative analysis of statistical indicators of success and safety in the work of rescuers in different countries

Comparing the activities of the rescue services of different states reveals opportunities for unification of standards and procedures, which will help to improve their effectiveness. The analysis of training standards in force in Sweden and Germany helps to improve Ukrainian rescue training programmes, and the study of accident reduction practices in these countries can help reduce the number of injuries and deaths among Ukrainian rescue personnel.

Different countries operate in accordance with their own standards governing the activities of rescue services. Sweden has the Swedish Civil Contingencies Agency, which is responsible for training and coordinating rescue services. They issue various recommendations and standards to improve the effectiveness of rescue operations. Rescue services in Sweden are organised at the municipal level, under the management of local authorities. The Fire and Rescue Service Act regulates the activities of fire and rescue services, defining safety and operational readiness standards. These services are financed primarily from municipal budgets, with partial funding from the national government. The country is actively implementing modern technologies, such as search and rescue drones, and automated warning systems.

In Germany, the German Fire Protection Association develops standards and guidelines for fire and rescue services. There are also laws governing fire protection, assistance and disaster protection. German rescue services operate at the federal, land and local levels. Rescue services are funded with additional support from local authorities. Rescue personnel are trained in specialised centres and in local educational institutions. Training programmes include basic and specialised training, in particular, for working in emergency situations.

Rescue services in Ukraine are organised at the national and regional levels, under the management of the SESU. It coordinates the activities of local rescue services and ensures the implementation of national security

policies. Funding is provided from the state budget, with additional funding from local authorities and international donors. Rescuers are trained in specialised training centres of the SESU. Training programmes cover theoretical knowledge and practical skills, in particular, in the areas of civil defence and emergency response (Table 1).

Each of these three countries has its own unique approaches and challenges in the field of rescue services, which can be used to improve appropriate emergency response systems. In Sweden and Germany, rescue services have a decentralised structure that allows them to respond quickly at the local level. In Ukraine, the structure is more centralised, which requires effective coordination between national and regional levels. Germany has the most developed system of financing rescue services with support at all levels of government. Sweden also has stable funding, while Ukraine depends on international aid. All three countries pay great attention to the training of rescuers, but Sweden and Germany have more developed systems of interdisciplinary training. As for technologies and equipment, Germany and Sweden have advanced technical means, while Ukraine needs to modernise this base. All three countries actively cooperate internationally, participate in rescue operations and share experiences (Table 2).

Indicators of the number of accidents and successful rescue operations are presented for the pre-war period, since it is difficult to record accurate data during active hostilities. In Ukraine, accidents among rescuers have increased now due to the war, as the country is in a hot phase of conflict. The war creates extreme conditions for rescuers who are forced to work under fire, in war zones and in constant danger. This significantly increases the risk of accidents and injuries among them. During the war, rescuers often find themselves on the front line, performing their duties during shelling and airstrikes. This significantly increases the risk of injury and death. In the conditions of active hostilities, the number of accidents among rescuers is significantly higher than in peacetime, because the number of accidents among rescuers has increased due to constant shelling and mining of territories.

In order to reduce the number of accidents and improve the efficiency of rescue operations in all three countries, it is important to ensure the continuous development of rescue personnel. This includes forms of advanced training (Figure 1).

Each of these forms is important for continuous development, improvement and acquisition of new knowledge and skills. This can include additional practical exercises, virtual simulations and training using the latest technologies, such as drones and thermal imagers. It is necessary to implement psychological health support programmes to reduce professional burnout and stress among rescuers. Equally important is participation in international training and experience exchange programmes to borrow best practices from other countries. For successful work, there must be sufficient funding to purchase modern equipment and conduct high-quality training programmes. An important aspect is the use of modern

Table 1. Characteristics of the main documents regulating the development of rescuers' activities.

Document name	Characteristics
1 SESU training plan	The document includes various modules that provide comprehensive training for rescue personnel. The plan is designed to combine theoretical knowledge with practical skills necessary for successful rescue operations. The fundamentals of rescue cover the basic knowledge and principles of rescue. The main topics include the history of rescue operations; the main types of rescue operations; the legal and organisational basis for the work of rescuers; requirements for rescuers, their rights and obligations. The module 'Tactics of rescue operations' is aimed at learning the tactics and strategies necessary for successful rescue operations. The main topics include planning and organising rescue operations, using special equipment, assessing the situation and making decisions during rescue operations, coordinating the actions of rescuers and interacting with other services. The first aid module provides rescuers with knowledge and skills in providing first aid to victims. The main topics include the basics of human anatomy and physiology; resuscitation and first aid techniques for various types of injuries; the use of medical equipment and equipment, and psychological support for victims. Other important modules include: fire safety (learning of fire extinguishing methods, fire prevention, use of fire equipment), evacuation of the population (planning and organisation of evacuation of people during emergencies), natural and man-made disasters (learning of types of disasters, their causes and consequences, measures to prevent and eliminate consequences), psychological training (development of stress resistance and psychological readiness to work in extreme conditions). The curriculum of the State Emergency Service is aimed at training highly qualified specialists who are able to act effectively in emergency situations and ensure the safety of the population.
2 Exercise and training schedule	The schedule of exercises and training of rescuers of the State Emergency Service of Ukraine is an annually updated document that defines the schedule and topics of training for the year. This document provides systematic training of rescuers, advanced training, and readiness for action in emergency situations. The structure and content of the schedule includes the goals and objectives of the exercise. These include improving the professional training of rescue personnel, working out new methods and technologies of rescue operations, and improving coordination between different departments and services. There are monthly training sessions, i.e. regular practice sessions aimed at maintaining skills and knowledge. There are quarterly training sessions, that is, complex training sessions that include theoretical classes and practical scenario development. There are also annual exercises – large-scale exercises that involve simulating real-world emergencies involving all services and departments. The plan defines various topics of training, in particular, the fundamentals of rescue, fire safety, first aid; water rescue techniques, mountain rescue operations; interaction with other services and organisations, teamwork, management of rescue operations. Every year, based on the analysis of previous training sessions, and considering new challenges and threats, the schedule is updated and adjusted. The latest technologies, techniques, and international experience are taken into consideration to ensure a high level of training of rescuers of the State Emergency Service.

(*Continued*)

Table 1. Continued.

Document name	Characteristics
3 Programme 'Professional training of rescuers'	The programme is designed to provide comprehensive training and advanced training of rescue personnel. It consists of courses and trainings aimed at developing the necessary theoretical knowledge and practical skills, and developing stress tolerance and psychological readiness to act in extreme conditions. The main components of the programme include the following elements: 1. Fundamentals of rescue aims to provide basic knowledge about rescue activities, development history, legal and organisational foundations. For this purpose, lectures, seminars and thematic discussions are held. Therefore, rescuers will know the basic principles of rescue work, their rights and obligations. 2. Fire safety requires to master the knowledge of fire prevention and methods of extinguishing them. The expected results are the ability of rescuers to effectively fight fires and prevent their occurrence. 3. The purpose of rescue operations tactics is to study the tactics and strategies of conducting rescue operations. This is done through simulations, practical exercises and team training. The expected results are the ability of rescuers to plan and organise rescue operations, and coordinate actions with other services. 4. First aid aims to teach the basics of providing first aid to victims. After that, rescuers will be able to provide effective medical care at the scene. 5. Water rescue means mastering water rescue techniques. Specialists are able to conduct rescue operations on the reservoir. 6. Mountain rescue operations mean preparing for rescue operations in mountain conditions. The expected results determine the ability of specialists to conduct rescue operations in difficult mountain conditions. The programme defines training methods, in particular, lectures and seminars (provide theoretical training), practical classes (develop specific skills), simulations and training (simulate real situations for practical training of actions), psychological trainings (development of stress resistance and psychological readiness). This programme is comprehensive and integrates various aspects of training, allowing rescuers to act effectively in a variety of emergency situations.

Source: compiled by the authors based on data from the State Emergency Service of Ukraine (n.d.).

technologies to improve the efficiency of rescue operations, and increase the level of safety of rescuers. Continuous development and improvement of rescuers is critical to reducing the number of accidents and improving the overall efficiency of rescue services in Sweden, Germany and Ukraine. This will ensure a high level of emergency preparedness and save the lives of many people (Figure 2).

According to the above information, the percentage of rescuers trained annually in Sweden is approximately 90%. This includes annual trainings and advanced training courses with regular practical exercises, using the latest technologies to simulate real situations. A high level of participation ensures continuous improvement of professional skills and emergency preparedness. In Germany, about 85% of rescuers take part in trainings

and advanced training courses every year. Programmes include intensive practical training, virtual simulations and training using state-of-the-art technologies, such as drones and thermal imaging systems. This approach ensures a high level of training for rescuers. In Ukraine, this figure is much lower and amounts to about 60%. The main reasons include limited funding, insufficient access to modern equipment and a less developed training system. However, in recent years, there has been a tendency to increase the participation of rescuers in international training and experience exchange programmes, which gradually improves their professional training.

A number of methods should be used to improve the system of advanced training of rescuers in Ukraine, which lags behind Sweden and Germany in terms of the above indicators and needs to be developed in the context of a full-scale war. First of all, it is an analysis of needs and competencies. Regular assessment of training and development needs among rescuers is required to determine the necessary competencies and knowledge. Identification of priority areas of development based on the analysis of current challenges and risks in the field of rescue operations. It is important to create and implement state-of-the-art training programmes focused on the specific needs of rescue services, including risk management, the latest rescue technologies and methods. The use of international experience and best practices will help in the development of training materials. The next step is to introduce a modular approach to training, allowing rescuers to take individual courses and trainings at their convenience. Regular trainings and exercises with practical tasks and simulations of real situations contribute to the development of the rescue service. The organisation of internships and exchanges of experience with other rescue services both in Ukraine and abroad will facilitate this. It is also important to integrate digital platforms for distance learning and online courses, and use virtual reality and augmented reality to simulate learning situations. It is necessary to introduce a modern system of certification of rescuers to confirm their professional skills and knowledge, and in accordance with this, to develop new requirements for certification, considering international norms and standards. Regular feedback from rescuers on the quality of the training programmes and their practical usefulness helps to understand the effectiveness of the training itself. This organisation of new skills development programmes for rescue management will promote effective communication, making the right decisions and managing stress.

These methods can help to improve the skills of rescue personnel, improve their readiness to perform professional duties and ensure more effective work of rescue services in Ukraine.

4. Discussion

The results show that the continuous self-development of rescue personnel is a critical aspect in the field of human security. This topic covers not

Table 2. Comparative analysis of rescuers' activities in Europe, 2023.

Countries	Response time	Number of accidents	Number of successful rescue operations	Success factors
Germany	8 min	1.2 per 100,000 people	45,000 operations	Highly intensive training and advanced technology
Ukraine	15 min	2.5 per 100,000 people	60,000 operations	Limited funding and lack of access to modern technologies
Sweden	10 min	1.2 per 100,000 people	28,000 operations	Introduction of modern technologies and regular trainings

Source: compiled by the authors based on Eurostat (2023).

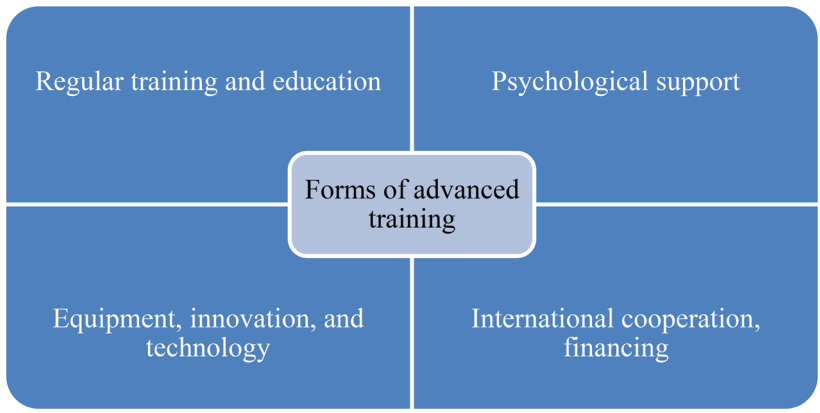

Figure 1. Basic forms of advanced training of rescue services. Source: compiled by the authors.

only professional training and skills improvement, but also the development of psychological stability, physical fitness and personal growth. One of the key aspects of the continuous self-development of rescue personnel is their professional training and improvement of skills. This study showed that regular training and advanced training courses significantly improve the ability of rescuers to respond to emergencies. This is confirmed by the findings of Ilie et al. (2019) and Nicolescu et al. (2022). Researchers have studied the impact of trainings on the development of leadership qualities and communication skills on rescuers. Their study has shown that such training significantly improves the ability of rescuers to coordinate teamwork and interact effectively with victims.

The results obtained regarding the continuous training of rescuers, which is necessary to maintain their readiness for any unforeseen situations, coincide with the findings of Franklin Edwards et al. (2020) and Pedram et al. (2021). They noted that rescuers who regularly participate in training programmes demonstrate a higher level of professional competence and

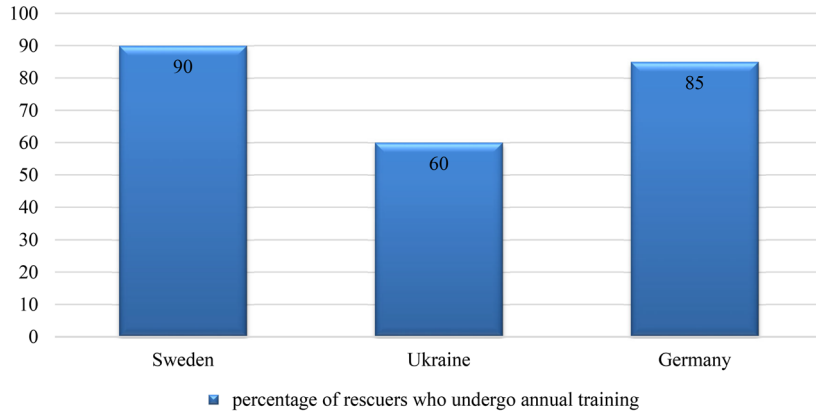

Figure 2. Comparison of the work of rescue services in Sweden, Ukraine and Germany by improvement indicators, %. Source: compiled by the authors based on Eurostat (2023).

confidence in their actions. As it turned out, rescue personnel who undergo regular training are better able to navigate difficult situations and make the right decisions faster. Vilendrer et al. (2021) noted that training should be adapted to the actual working conditions of rescuers. They emphasised the importance of simulation training that is as close as possible to real emergencies. This study also found that rescuers who participate in simulation training demonstrate a higher level of readiness and ability to act in critical conditions.

The results of the study showed that rescuers who develop their psychological resilience are better able to cope with the stress and emotional stress associated with their professional activities. This is consistent with the study by Berg et al. (2021). LaPrad et al. (2024) noted that developing psychological resilience helps rescuers deal with stressful situations more effectively and reduces the risk of professional burnout. They emphasise the importance of psychological training, which includes relaxation, meditation and emotional self-regulation techniques, as well as various methods aimed at reproducing real mental loads during specially organised training sessions. It is important in the process of psychological training to rely on the latest achievements of psychological science, including knowledge about the functioning of the human psyche at the conscious (Varii, 2020a), subconscious, unconscious and superconsciousness levels (Varii, 2020b) in emergency situations. The results of the study support these findings, as rescuers who regularly practice these techniques and techniques note a reduction in stress levels and an improvement in overall psychological state when performing tasks in emergency situations.

Schroll et al. (2020) determined that developing psychological resilience should also include emotional support from colleagues and management.

They noted that rescuers who feel supported and understood by their colleagues are less likely to experience stress and burnout. This study supplemented this view and determined that rescuers working in a team with a high level of mutual support demonstrate a higher level of psychological stability and satisfaction with their work.

This study showed that rescuers who maintain a high level of physical fitness are more effective in performing their professional duties and are less likely to be injured. This is consistent with the findings of Vavryniv and Yaremko (2022). They emphasised the importance of regular physical training for rescue personnel, noting that physical training helps them maintain high levels of endurance, strength and flexibility. They also noted that rescuers who exercise regularly are less susceptible to injuries and illnesses, which allows them to perform their duties more effectively. Professionals who maintain a high level of physical fitness note an improvement in overall well-being and a reduction in the frequency of injuries. Simon (2021) adds that physical training for rescuers should include both aerobic and anaerobic exercise to ensure comprehensive development of physical abilities. He emphasises the importance of specialised training that considers the specifics of the work of rescuers. This study also found that rescuers who undergo specialised training show a higher level of readiness to perform physically complex tasks.

The results show that rescuers' personal development includes developing leadership skills, communication skills and decision-making abilities under stressful conditions. These conclusions are consistent with the findings of Stoykov et al. (2019) and Pedram et al. (2020), who determined that rescuers involved in personal development are better able to cope with the challenges of their profession and achieve higher results in their work. As it turned out, the development of leadership qualities is an important aspect of the work of rescuers, because they often find themselves in situations where it is necessary to make quick and responsible decisions. Kovacz et al. (2020) stressed the importance of leadership trainings that help rescuers to develop confidence in their actions and the ability to organise teamwork. Rescue personnel who have received leadership training demonstrate a higher level of confidence in their decisions and the ability to effectively coordinate team actions. Toft et al. (2022) added that developing communication skills is key to the success of rescuers. They emphasised that rescuers who have effective communication skills are better able to cope with tasks that require interaction with colleagues and survivors.

While the continuous self-development of rescue personnel is extremely important, there are certain challenges associated with its implementation. One of the main problems is limited resources, such as time and financial resources, which can prevent rescuers from completing the necessary training and courses. This question is also raised by Arrogante et al. (2021) and Lac and Donaldson (2022). The results support the assumption that many rescuers experience a lack of time for self-development due to the

intensive work schedule and the need to perform a large number of professional duties. The researchers emphasised the importance of finding a balance between work and self-development to ensure the effective performance of official duties and maintain a high level of professional competence. This study confirms these conclusions, because rescuers who resort to continuous self-development often face the problem of lack of time to attend trainings and courses. Ballesteros-Pena et al. (2022) supplemented this data. They noted that rescuers do not have sufficient financial resources to pay for advanced training courses and participate in training. Specialists often express the need for additional funding and support from employers to ensure the possibility of continuous self-development.

The results showed that it is necessary to improve the process of continuous self-development of rescue personnel. Educational institutions that train these specialists should develop flexible training programmes that consider the intensive work schedule of rescuers and allow them to engage in self-development at a convenient time. These findings are consistent with the study by Chirico et al. (2021). As noted, it is important to integrate elements of self-development into the work process of rescue personnel so that they can improve their skills without interrupting their main activities. This may include organising internal trainings and seminars. It is important to provide rescuers with the opportunity to develop leadership and communication skills through specialised trainings and courses. This will help them coordinate team actions more effectively and interact with those affected.

This study, in comparison with the findings of other researchers, shows that the continuous self-development of rescue personnel is critical for their professional activities and overall well-being. Professional development, psychological stability, physical fitness and personal development are the main components of this process. Rescuers who regularly engage in self-development show a higher level of professional competence, better emergency response readiness and less exposure to stress and professional burnout. It is important that employers and government agencies provide the necessary support to rescuers, enabling them to engage in continuous self-development and creating favourable conditions for this.

5. Conclusions

The study conducted a comparative analysis of the continuous professional self-development of rescue personnel in the field of human security in three countries: Sweden, Germany and Ukraine. The analysis revealed that Ukraine is lagging behind in many indicators, particularly due to the ongoing war, which has significantly complicated the situation. Conversely, Sweden has achieved notable success in this domain, attributable to the

integration of advanced technologies and systematic training programmes. The response time of Swedish rescuers averages approximately 10 min, contributing to a high survival rate for victims. Germany has also been found to demonstrate a high level of success in rescue operations, thanks to advanced technologies, such as reconnaissance drones and thermal imaging systems, as well as effective coordination among services, with an urban response time of approximately 8 min. In Ukraine, however, the situation is considerably more complex, especially in the context of the ongoing armed conflict. The response time is approximately 15 min on average, which has a detrimental effect on the outcomes of rescue operations. The number of accidents among Ukrainian rescuers is also notably higher, estimated at approximately 2.5 per 100,000 people. The challenges experienced by these rescuers are compounded by limited funding, inadequate access to contemporary equipment, and a less advanced training system, which collectively engender a professional environment characterised by difficulties and elevated risks of injury and fatality.

To reduce the number of accidents and improve the efficiency of rescue operations in Ukraine, it is necessary to ensure the continuous development and improvement of rescue personnel. This includes regular training, psychological support, international cooperation, sufficient funding and the use of the latest technologies. Implementing best practices from Sweden and Germany, such as using virtual simulations for training and state-of-the-art technologies for rescue operations, can significantly improve the situation. Comparative analysis showed that the rescue services of Sweden and Germany have a high level of training and safety due to regular training and the use of modern technologies. There are significant opportunities for improvement in Ukraine, which can be implemented through the introduction of best international practices and increased funding. The continuous development and improvement of rescuers is critical to reducing the number of accidents and improving the overall efficiency of rescue services, which will ultimately help save the lives of many people. A limitation of the study was the small number of countries to compare the continuous professional self-development of rescuers in the field of human security. The prospect of further research is to increase the sample of states and methods for improving the system of professional development of such specialists in Ukraine.

Glossary

Advanced training – A structured process of acquiring updated knowledge and practical skills beyond initial professional education, aimed at enhancing the competencies of rescue personnel through continuous education, practical exercises, and specialised courses. Continuous professional development – A systematic, ongoing process through which rescue personnel enhance their professional qualifications, adapt to evolving challenges, and maintain operational readiness through formal education, informal learning, and self-directed improvement activities. Human

security – A multidimensional concept that shifts the focus of security from the protection of states to the protection of individuals, encompassing freedom from fear, want, and indignity, particularly in the face of emergencies, conflicts, and disasters. Physical conditioning – A component of professional training that involves regular physical exercises designed to improve strength, endurance, and overall fitness of rescue personnel, enabling them to meet the demands of physically challenging rescue operations. Professional competence – The combination of knowledge, skills, abilities, and ethical standards that enables rescue personnel to perform their duties effectively in high-pressure and life-threatening environments. Psychological resilience – The capacity of individuals, particularly rescuers, to adapt to stress, adversity, and trauma while maintaining mental well-being and professional effectiveness during and after emergency situations. Rescue operations – Coordinated activities carried out by trained personnel aimed at saving lives, preventing further harm, and mitigating damage during emergencies such as natural disasters, technological accidents, and armed conflicts. Simulation training – A training method that uses virtual or physical scenarios to mimic real-life emergencies, enabling rescue personnel to practise responses in controlled environments that closely replicate field conditions. State Emergency Service of Ukraine (SESU) – The central executive body responsible for civil protection, emergency response, and disaster risk reduction in Ukraine, including the training and management of rescue personnel. Training programme – A formal curriculum or structured plan encompassing theoretical instruction, practical exercises, and evaluation methods, designed to develop and assess the knowledge and operational skills of rescue workers.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

None.

Notes on contributors

Mykhaylo Kozyar is a Full Doctor, Professor at the Department of Applied Psychology and Pedagogy, Lviv State University of Life Safety. His research interests are professional training for activities in extreme conditions and safety psychopedagogy.

Ihor Koval is a PhD, Head of the Sector of Psychological Support, Lviv State University of Life Safety. His research interests include psychological and pedagogical training of future rescuers, innovative methods and technologies for training future rescuers, and features of the professional activities of rescuers.

Larysa Rudenko is a Full Doctor, Professor at the Department of Applied Psychology and Pedagogy, Lviv State University of Life Safety. Her research interests are the psychology of communication, features of the communicative culture of a specialist's personality, and the specifics of the formation of professional qualities among civil defence specialists.

Roman Lavretski is a Scientific Secretary at the Lviv State University of Life Safety. His research interest is professional self-development of rescue personnel in the field of human security.

Roman Velykyi is a PhD, Associate Professor at the Department of Ukrainian Studies and Intercultural Communication, Lviv State University of Life Safety. His research interests include the history of Ukraine, the formation of the spirituality of a military serviceman, and spiritual and patriotic education.

ORCID

Mykhaylo Kozyar http://orcid.org/0009-0003-6905-0559
Ihor Koval http://orcid.org/0009-0002-3686-2131
Larysa Rudenko http://orcid.org/0009-0002-5080-0316
Roman Lavretski http://orcid.org/0009-0008-3275-1569
Roman Velykyi http://orcid.org/0009-0004-1046-1916

References

Arrogante, O., Ríos-Díaz, J., Carrión-García, L., Samith, S., María González-Romero, G., & Manuel Caperos, J. (2021). Deliberate practice in resuscitation training using a feedback device, and the effects of the physical characteristics of the rescuer on the acquisition and retention of cardiopulmonary resuscitation skills: Randomized clinical trial. *International Emergency Nursing*, *58*, 101037. https://doi.org/10.1016/j.ienj.2021.101037

Ballesteros-Pena, S., Vallejo-de la Hoz, G., Fernández-Aedo, I., Etayo-Sancho, A., Berasaluze-Sanz, L., & Domínguez-García, J. (2022). Rescuers' characteristics associated with the correct chest compression during cardiopulmonary resuscitation. *Enfermería Intensiva*, *33*(3), 126–131. https://doi.org/10.1016/j.enfi.2021.05.002

Banu, N. T., Darmody, A., & Neilson, L. C. (2024). RESCUER: Combining passive and active learning techniques to teach food sustainability. *Journal of Marketing Education*, *46*(2), 123–139. https://doi.org/10.1177/02734753241226669

Berg, I., Haveman, B., Markovic, O., van de Schoot, D., Dikken, J., Goettinger, M., & Peden, A. (2021). Characteristics of surfers as bystander rescuers in Europe. *The American Journal of Emergency Medicine*, *49*, 209–215. https://doi.org/10.1016/j.ajem.2021.06.018

Binytska, K., Bilyakovska, O., Yankovych, O., Buchkivska, G., Binytska, O., Greskova, V., & Ocheretna, I. (2023). Exploring the potential of immersive technologies in university education worldwide. *CEUR Workshop Proceedings* (pp. 203–217), CEUR-WS.org.

Cao, P., Zheng, J., & Li, M. (2023). Post-earthquake scheduling of rescuers: A method considering multiple disaster areas and rescuer collaboration. *Sustainability*, *15*(15), 11586. https://doi.org/10.3390/su151511586

Chirico, F., Sacco, A., Szarpak, L., & Nucera, G. (2021). Training first aid rescuers at workplace during the COVID-19 pandemic in Italy: Challenges and opportunities. *Epidemiologia & Prevenzione*, *45*(6), 434–435. https://doi.org/10.19191/EP21.6.110

Delaney, P., Eisner, Z., Bustos, A., Hancock, C., Thullah, A., Jayaraman, S., & Raghavendran, K. (2022). Cost-effectiveness of lay first responders addressing

road traffic injury in Sub-Saharan Africa. *The Journal of Surgical Research*, *270*, 104–112. https://doi.org/10.1016/j.jss.2021.08.032

Eurostat. (2023). *Database.* https://ec.europa.eu/eurostat/web/health/database

Fedoryshyn, H. M., & Kytsmen, N. Z. (2020). Social and psychological factors of professional burnout of the personnel of state emergency service of Ukraine. *Social and Legal Studios*, *3*(2), 178–185. https://doi.org/10.32518/2617-4162-2020-2-178-185

Fomych, M. V. (2023). Checking the effectiveness of modern technologies in the work of a psychologist with firefighters-rescuers. *Insight: The Psychological Dimensions of Society*, *9*, 169–189. https://doi.org/10.32999/KSU2663-970X/2023-9-10

Fonseca, S. M., Cunha, S., Silva, M., Ramos, M. J., Azevedo, G., Campos, R., Faria, S., & Queirós, C. (2023). The psychological experience of medical rescuers during the COVID-19 pandemic. *Psicologia*, *37*(1), 1–11. https://doi.org/10.17575/psicologia.1679

Franklin Edwards, G., Mierisch, C., Strauss, A., Mutcheson, B., Coleman, K., Horn, K., & Henrickson Parker, S. (2020). A review of performance assessment tools for rescuer response in opioid overdose simulations and training programs. *Preventive Medicine Reports*, *20*, 101232. https://doi.org/10.1016/j.pmedr.2020.101232

Franklin Edwards, G., Mierisch, C., Strauss, A., Mutcheson, B., Coleman, K., Horn, K., & Henrickson Parker, S. (2023). Evaluating rescuer performance in response to opioid overdose in a community setting: Evidence for medically appropriate process measures. *Preventive Medicine Reports*, *32*, 102145. https://doi.org/10.1016/j.pmedr.2023.102145

Ilie, C., Gaman, G., Pupazan, D., Nicolescu, C., & Gireada, A. (2019). *Research on development of practical abilities of rescuers in interventions in high temperature and humidity environments* [Paper presentation]. Exploration and Mining, Conference: 19th SGEM International Multidisciplinary Scientific GeoConference; Dates: 30 June – 6 July 2019; Albena, Bulgaria, (p. 19). https://doi.org/10.5593/sgem2019/1.3/S03.069

Kong, W., Ren, M., Wang, H., Sun, X., & Feng, D. (2024). Development of a health problem prevention and control strategies scale for medical rescuers fighting epidemics. *Evaluation & the Health Professions*, vol. 1, 1632787241246130. https://doi.org/10.1177/01632787241246130

Kovacz, I., Nicolescu, C., Toth, L., Gireada, A., & Irimia, A. (2020). *Cognitive and compartmental coping strategies used by under training mine rescuers* [Paper presentation]. Exploration and Mining, Conference: 20th SGEM International Multidisciplinary Scientific GeoConference; Dates: 28 June – 4 July 2020; Albena, Bulgaria, (Vol. 20). https://doi.org/10.5593/sgem2020/1.2/s03.005

Koval, I. (2023). Terminological analysis of the essence of continuous professional self-development of future rescuers in the field of human security. *Adult Education: Theory, Experience, Prospects*, *2*(24), 78–88. https://doi.org/10.35387/od.2(24).2023.78-88

Koziar, M. M., & Koval, I. S. (2024). *Psychopedagogy of professional and extreme training*. Lviv State University of Life Safety.

Lac, A., & Donaldson, C. D. (2022). Development and validation of the drama triangle scale: Are you a victim, rescuer, or persecutor? *Journal of Interpersonal Violence*, *37*(7–8), NP4057–NP4081. https://doi.org/10.1177/0886260520957696

LaPrad, A., Joseph, B., Chokshi, S., Aldrich, K., Kessler, D., & Oppenheimer, B. (2024). A smartwatch-based CPR feedback device improves chest compression quality among health care professionals and lay rescuers. *Cardiovascular Digital Health Journal*, *5*(3), 122–131. https://doi.org/10.1016/j.cvdhj.2024.03.006

Martínez-Fiestas, M., Rodríguez-Garzón, I., & Delgado-Padial, A. (2020). Firefighter perception of risk: A multinational analysis. *Safety Science*, *123*, 104545. https://doi.org/10.1016/j.ssci.2019.104545

Nicolescu, C., Kovacs, I., Gaman, A. G., Pupazan, D., & Gireada, A. (2022). *Studies practical training of intervention and rescue personnel in toxic/explosive/flammable environments using virtual reality* [Paper presentation]. Exploration and Mining Conference: 22nd SGEM International Multidisciplinary Scientific GeoConference; Dates: 4-10 July 2022; Albena, Bulgaria, (p. 22). https://doi.org/10.5593/sgem2022/1.1/s03.048

Pedram, S., Skarbez, R., Palmisano, S., Farrelly, M., & Perez, P. (2021). Lessons learned from immersive and desktop VR training of mines rescuers. *Frontiers in Virtual Reality*, *2*, 627333. https://doi.org/10.3389/frvir.2021.627333

Pedram, S., Skarbez, R., Palmisano, S., Farrelly, M., Perez, P., & Farrelly, M. (2020). Investigating the process of mine rescuers' safety training with immersive virtual reality: A structural equation modelling approach. *Computers & Education*, *153*, 103891. https://doi.org/10.1016/j.compedu.2020.103891

Schroll, R., Smith, A., Morgan, M., Zeoli, T., Hoof, M., Duchesne, J., Greiffenstein, P., & Avegno, J. (2020). Stop the bleed training: Rescuer skills, knowledge, and attitudes of hemorrhage control techniques. *The Journal of Surgical Research*, *245*, 636–642. https://doi.org/10.1016/j.jss.2019.08.011

Simon, T. (2021). Revolution and stability in the study of the human factor in the security of information systems field: A systematic literature review over 30 years of publication. *International Conference on Cyber Situational Awareness* (pp. 1–8). IEEE. https://doi.org/10.1109/CyberSA52016.2021.9478219

State Emergency Service of Ukraine. (n.d). *Educational programmes and working curricula by profession*. https://kr.dsns.gov.ua/navchalniy-punkt/profesiyna-osvita/osvitni-programi-ta-robochi-navchalni-plani-za-profesiyami

Stoykov, S., Dimitrova, S., & Marinov, R. (2019). The development of educational capacity of human resources in the field of security – main priority of national security. *International Conference on Creative Business for Smart and Sustainable Growth (CREBUS)* (pp. 1–5). IEEE. https://doi.org/10.1109/CREBUS.2019.8840062

Toft, L., Richie, J., Wright, J., Amraotkar, A., Katrapati, P., Fulmer, S., Dainty, K., Chugh, S., & Halperin, H. (2022). A new era of lay rescuer CPR training: An interactive approach for engaging high schoolers. *Journal of the American College of Cardiology*, *80*(23), 2251–2253. https://doi.org/10.1016/j.jacc.2022.09.040

Varii, M. Y. (2020a). Human consciousness: Psychic and energetic approach. *Journal of Intellectual Disability – Diagnosis and Treatment*, *8*(2), 219–224. https://doi.org/10.6000/2292-2598.2020.08.02.18

Varii, M. Y. (2020b). Human psyche in modern psycho-energetic conception. *ASTRA Salvensis*, *1*, 291–305. URL: https://astrasalvensis.eu/blog/mdocs-posts/18-myron-y-variihuman-psyche-in-modern-psycho-energetic-conception/

Vavryniv, O. S., & Yaremko, R. Y. (2022). Empathy as a factor in the development of personal components of future rescuers' professional self-realization. *Insight: The Psychological Dimensions of Society*, *8*, 56–69. https://doi.org/10.32999/2663-970X/2022-8-5

Vilendrer, S., Amano, A., Brown Johnson, C., Favet, M., Safaeinili, N., Villasenor, J., Shaw, J., Hertelendy, A., Asch, S., & Mahoney, M. (2021). An app-based intervention to support first responders and essential workers during the COVID-19 pandemic: Needs assessment and mixed methods implementation study. *Journal of Medical Internet Research*, *23*(5), e26573. https://doi.org/10.2196/26573

Yaylaci, S., Kayayurt, K., Aldinc, H., Gun, C., & Sekuri, A. (2022). The immediate effect of deliberate practice and real-time feedback on high-quality CPR training in intern doctors, acute care providers, and lay rescuers. *Signa Vitae*, *18*(2), 48–55. https://doi.org/10.22514/sv.2021.119