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Pregled
Review

PUBLIC HEALTH RISKS IN CRISIS SITUATIONS

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Public health crises pose a global challenge that can result from natural disasters, armed conflicts, environmental incidents, or pandemics. In such situations, the risk of infectious disease transmission, food and water contamination, supply chain disruptions, and psychological and social impacts among affected populations significantly increases. Bosnia and Herzegovina (B&H), with its complex political-administrative structure and vulnerable infrastructure, is especially prone to the public health consequences of crisis situations. This review paper aimed to analyse existing knowledge on public health risks during crises, with a focus on BiH and other countries in the region, and to identify key challenges and measures to strengthen the public health system's resilience. The methodology included a literature review of international databases (PubMed, Scopus, Google Scholar) and an analysis of national reports, legal documents, and strategies. The results show that the main risks in B&H are related to infectious diseases following floods and migration, food and water poisoning caused by poor sanitary conditions, and psychological trauma resulting from crises. Key measures to improve the system include strengthening laboratory capacities, mandating the implementation of international food and water safety standards, enhancing inter-institutional coordination, developing crisis response plans, and providing ongoing education for the population and healthcare workers. It is concluded that a multidisciplinary approach, which combines international experience with local specificities, can significantly lessen the public health impact of crisis situations in B&H.

Keywords: PUBLIC HEALTH, CRISIS SITUATIONS, BOSNIA AND HERZEGOVINA, INFECTIOUS DISEASES, FOOD SAFETY, MENTAL HEALTH

INTRODUCTION

According to data from the World Health Organisation (WHO), a disaster is defined as a severe disruption in the functioning of a society that causes widespread human, material, economic, or environmental losses, which may exceed the society's capacity to cope with these losses using its own resources. The United Nations General Assembly (UNGA) designated October 13 as the International Day for Disaster Reduction (IDDR) to emphasise the importance of reducing disaster risks through prevention, mitigation, and preparedness at all levels, from individual to national, with active participation across society (1).

The initiative began in 1989 following a UNGA resolution, which recognised the International Day for Disaster Reduction as a means of promoting a culture of risk awareness and reduction, including disaster prevention, mitigation of consequences, and readiness to respond. The Sendai Framework for Disaster Risk Reduction 2015-2030, which builds upon the previous Hyogo Framework for Action, provides guidelines and priorities for global action over the next 15 years. The main goals of this framework are to: reduce disaster-related mortality and the number of affected people by 2030, decrease direct economic losses, damage to critical infrastructure, and disruption of essential services, and increase the number of countries with national and local disaster risk reduction strategies. Enhance international cooperation with developing countries through appropriate and sustainable support, and improve the availability and accessibility of early warning systems, disaster information, and risk assessments (2-4). Crises represent one of the most significant challenges for modern health systems, as they can endanger the population's basic living needs, disrupt public health, and cause long-term social consequences (1, 5, 6).

The World Health Organisation (WHO) estimates that natural disasters, armed conflicts, and pandemics directly threaten the health of millions of people each year, with a significant proportion of cases resulting in death or long-term disability (2). Bosnia and Herzegovina (B&H) has experienced several crisis situations over the past three decades

Bosnia and Herzegovina (B&H) is ranked among the countries with a high exposure to natural disasters. Out of 145 local self-government units (LSGs) in the country, 91 are considered to be

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at very high risk of floods and landslides, while 27 are at high risk. The Law on the Protection and Rescue of People and Material Goods from Natural and Other Disasters, which came into force in August 2003, established institutions responsible for protection and rescue operations at all levels of government in the Federation of B&H, including the Federal Administration of Civil Protection, cantonal civil protection administrations (in all 10 cantons), and local self-government units with their civil protection services. The catastrophic floods of May 2014 and October 2024 affected a quarter of the country's territory and around one million people, representing approximately 27% of its population. The total damage was estimated at 1.7 billion USD, while economic losses exceeded 1.5 billion USD. In addition to these, other crises, such as droughts, forest fires, earthquakes, and finally the COVID-19 pandemic, caused significant damage and losses (3, 4, 7-9).

Disaster risk reduction involves accurately identifying, regularly assessing, and monitoring disaster risks to keep them under control; reducing the effects of factors that cause or increase disaster risks through responsible and appropriate environmental management; mitigating harmful consequences through a comprehensive understanding of risk; and improving preparedness and response planning. The Strategy for Disaster Risk Reduction and Emergency Management is a fundamental strategic document that defines policies and guides the activities of state authorities and other entities in risk management. It facilitates the exchange of opinions, knowledge, innovation, and experience in disaster risk reduction, proposes measures and activities for risk management, considers development strategies, plans, and programs relevant to disaster reduction, and strengthens mechanisms of cooperation and coordination at the national and international levels (7, 10-12).

Human resource management in health crisis situations poses challenges that require agile, adaptable, and innovative strategies. Crisis situations - such as infectious disease outbreaks, air and water pollution, droughts, storms, heavy snowfall, earthquakes, erosion and landslides, floods, forest fires, and wars-create unprecedented challenges for public health systems. They also define the guidelines for mobilising human and material resources to reduce risks and ensure effective responses (3, 7).

Risk assessment for crisis situations is periodically updated based on needs and new circumstances- comprehensively every three years or sooner if conditions significantly change or new risks emerge. The disaster risk reduction plan determines concrete preventive, organisational, technical, financial, normative, supervisory, educational, and other measures that competent state authorities and other entities must implement to reduce disaster risks and mitigate their consequences. A skilled workforce, with high competence and good organisational abilities, plays a key role in public health emergency preparedness planning (3, 14-16).

An organisation's preparedness depends on trained professionals who can respond effectively to public health emergencies. Training activities and exercises help develop, assess, and enhance functional capabilities and procedures, enabling an efficient response to disease outbreaks or public health emergencies. Risk assessment is defined as a systematic process that assigns a risk level to a potential public health threat based on alerts and early warnings from surveillance systems. Thus, it involves collecting, evaluating, and documenting relevant information to support decision-making. Risk ranking can also help prioritise actions and interventions. Crisis response management encompasses all strategies and actions aimed at addressing sudden and significant public health emergencies. Public health events demonstrate whether an organisation can make timely, appropriate, and well-informed decisions based on accurate situation assessments and the best available evidence (17-21).

The purpose of response management is to minimise the adverse effects of public health emergencies and facilitate a return to normalcy. Those accountable for public health planning must develop effective cooperation systems at the regional, national, and international levels. These efforts require strong communication, information sharing, and transparent decision-making. Legal frameworks for these activities are outlined in national legislation, the EU Decision 1082/2013 on serious cross-border health threats, and the International Health Regulations (IHR) (2-4, 8, 22, 23).

Following a public health emergency, it is crucial to carry out a post-event assessment. Such evaluations offer an opportunity to gauge a country or region's preparedness and identify weaknesses and potential areas for improvement. Once strengths and weaknesses are identified, the findings must be translated into practice by applying the lessons learned (24, 25).

Public health risks in crisis situations can be divided into several basic categories: infectious diseases (epidemics and pandemics), food and water safety (contamination and poisoning), mental health (stress, depression, post-traumatic disorders), and secondary consequences related to the disruption of health services and reduced access to care (3, 8, 15, 17).

Bosnia and Herzegovina has formally adopted the key international frameworks for crisis management and disaster risk reduction, the Sendai Framework for Disaster Risk Reduction (2015-2030), relevant United Nations General Assembly (UNGA) resolutions on resilience-building, and WHO recommendations for public health preparedness. However, available analyses indicate that the actual level of implementation is partial and inconsistent, with notable differences across entities and administrative levels.

1. Sendai framework - partial and fragmented implementation

Bosnia and Herzegovina has aligned several strategic documents with the Sendai priorities (risk assessment, disaster management, capacity strengthening). Still, there is no unified state-level platform for disaster risk reduction, risk assessments are not harmonised across entities and cantons, and centralised early warning systems and integrated data platforms are lacking. Implementation largely relies on donor-supported projects (UNDP, EU), indicating that Sendai principles are applied only partially and without complete institutional consolidation (3, 7).

2. UNGA resolutions on risk reduction and resilience-normatively adopted, operationally limited

Bosnia and Herzegovina adheres to international commitments to strengthen community resilience, improve public health and population protection, and develop civil protection systems. However, UNGA frameworks emphasise multisectoral coordination and unified national crisis management structures that are still not fully operational in B&H. The complex administrative system results in slow decision-making and inconsistent policy implementation. Consequently, the implementation level of UNGA principles in BiH can be considered limited (3, 27-29).

3. WHO recommendations for public health preparedness - partially implemented

WHO and ECDC recommend establishing: interdisciplinary emergency response teams (including epidemiology, microbiology, psychology, logistics, and risk communication), a national health emergency operations centre, regular simulation exercises, capacity-building, and an integrated surveillance and data-sharing system (1-4, 28, 29, 31).

In Bosnia and Herzegovina, this model is only partially implemented, as evidenced by the absence of a unified national platform for managing health emergencies, unevenly developed laboratory capacities, irregular simulation exercises, and reliance on ad hoc crisis headquarters formed only after an emergency emerges.

Based on available evidence, the implementation of the Sendai, UNGA, and WHO frameworks in BiH can be described as normatively adopted, formally aligned with international standards, operationally partial, fragmented, and insufficient in practice, and strategically in need of further harmonisation, digitalisation, and institutional strengthening. In other words, Bosnia and Herzegovina has indeed endorsed international standards, but their practical implementation remains moderate to low, mainly due to the complex institutional structure, limited coordination, and constrained capacities.

Purpose of this study

The aim of this paper is to analyse public health risks in crisis situations, with a particular focus on Bosnia and Herzegovina, and to offer recommendations to strengthen institutional resilience and improve public health security. By examining existing challenges, capacities, and experiences, the paper highlights key areas for systemic improvement that would enable timely response, reduce harmful consequences, and protect population health in future crises (3, 29, 31).

METHODOLOGY

For this review paper, a literature search was carried out in the electronic databases PubMed, Scopus, and Google Scholar. A total of 33 publications were analysed, along with an examination of available national reports, laws, strategies, and documents related to public health risks and crisis situations in Bosnia and Herzegovina and the wider region. Ten papers were excluded.

The keywords used included: "public health risks", "crisis situations", "foodborne diseases", "Bosnia and Herzegovina", "infectious diseases", "mental health" and "laboratory capacity."

Publications from 2013 to 2024 were included, with a particular focus on the last decade, during which there has been a significant increase in the number of publications addressing public health crises. In addition to international sources, domestic reports were also analysed, including those from the Food Safety Agency of Bosnia and Herzegovina, the Public Health Institute of the Federation of B&H, and the Public Health Institute of Republika Srpska, as well as documents from international organisations such as WHO, ECDC, FAO, and UNICEF.

Inclusion criteria:

- Studies and reports related to public health risks in crisis situations.
- Papers written in English, Bosnian, Croatian, or Serbian.
- Research addressing Bosnia and Herzegovina and neighbouring countries, with the possibility of comparison to global experiences.

Exclusion criteria:

- Papers published before 2013.
- Studies not directly related to public health risks in crisis contexts (e.g., purely economic or political analyses).

Criteria used for assessing the quality of selected sources

When selecting publications and other documents for this review paper, predefined quality criteria were applied to ensure the sources' relevance, credibility, and appropriateness. The quality assessment included the following elements:

1. Relevance of content

Sources were chosen based on their direct link to public health risks and crises. Priority was given to work on epidemics, laboratory capacity, mental health, food safety, and other public health threats in emergencies. Publications with content only partially related to the topic (e.g., works mainly focused on economic or political issues) were excluded from further analysis.

2. Geographical focus

Since the research subject concerns Bosnia and Herzegovina and neighbouring countries, priority was given to works on public health risks in these states. International studies were included only if they provided comparable experience or contributed to a clearer understanding of the local context.

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3. Type of source and data availability

Various types of sources were included (scientific articles, institutional reports, strategies, laws, technical documents), provided that the information was methodologically transparent, clearly interpreted, and available for analysis. Studies with insufficient data or unclear methodology were not included.

RESULTS AND DISCUSSION

1. Infectious Diseases as a Major Risk

Infectious diseases are the most common and serious public health threat in crisis situations because they spread quickly, have high rates of illness and death, and place a heavy strain on healthcare systems. During the 2014 floods in Bosnia and Herzegovina, there was an increase in cases of enteritis and hepatitis A, which was directly linked to contaminated drinking water sources and inadequate disinfection measures. Epidemiological surveillance after the floods showed that more than 30% of household water samples were microbiologically unsafe, and some settlements were without safe water for several weeks (19). In crisis conditions, disruptions to the cold chain and the suspension of routine immunisation often occur, raising the risk that infectious diseases previously brought under control, such as measles, diphtheria, or poliomyelitis, re-emerge. Interruptions to healthcare services in rural areas, combined with population displacement, further contribute to epidemic clusters. Experiences from Croatia and Serbia after the 2014 floods showed similar patterns, with reports of intestinal infections, acute respiratory illnesses, and local outbreaks of scabies and lice, reflecting shared regional challenges(13, 14). Tuberculosis remains a significant public health issue in Bosnia and Herzegovina. According to WHO data, BiH has higher tuberculosis incidence rates than the EU average among Southeast European countries. During the migration crisis of 2015-2020, many TB cases were reported among migrants,

Table 1.
Summary of key reviewed sources

Source Category	Document / Author	Institution / Country	Year	Brief Note on Relevance
International Frameworks	Sendai Framework for Disaster Risk Reduction 2015-2030	UNDRR / UN	2015	Global DRR framework; emphasises risk governance, community resilience, and multisectoral coordination.
	International Health Regulations (IHR)	WHO	2016	Binding public health instruments to strengthen preparedness, surveillance, and coordination.
	WHO Emergency Response Framework	WHO	2017	Guidance for emergency response organisations, multisectoral teams, and operational coordination.
	ECDC Public Health Emergency Preparedness Framework	ECDC	2017	Framework defining institutional capacities, interoperability, and standardised emergency procedures.
EU / Regional Sources	EU Civil Protection Mechanism	European Commission	2013/2021	Standards for coordinated disaster response and cross-border threats.
National Laws & Strategies (BiH)	Risk Assessment, Protection, and Rescue Plan	Ministry of Security B&H	2020	National DRR planning document defining responsibilities and operational mechanisms.
	Law on Protection and Rescue of People and Material Goods from Natural and Other Disasters	FB&H	2017	Key civil protection legislation at the entity level.
	Law on Protection and Rescue	RS	2012	Governs institutional responsibilities for emergencies in RS.
	Disaster Risk Reduction Strategy in B&H	Council of Ministers B&H	2017	Defines DRR priorities aligned with the Sendai Framework.
Entity & Local Level Documents	Protection and Rescue Plans (cantonal and municipal levels)	Cantons & Municipalities	Various	Operational plans vary widely in quality and alignment with international standards.
	Assessment of Local Community Capacities	SDC B&H	2019	Evaluates DRR planning and capacities; points to systemic fragmentation.
Research & Academic Sources	Public health preparedness studies	WHO, ECDC, EU, universities	2015-2024	Analyses of epidemiological, institutional and logistical capacities; EU/Balkan comparisons.
	Multisectoral crisis team studies	Italy, Germany, UK	2015-2022	Emphasise regular exercises, clear procedures, and intersectoral coordination.

especially in camps with poor hygiene infrastructure. These findings confirm that crises heighten the vulnerability of marginalised populations and emphasise the need for integrating public health and humanitarian responses (21, 22).

Additionally, the COVID-19 pandemic confirmed existing weaknesses in the BiH health system, including laboratory capacity, risk communication, and coordination between entity and cantonal authorities. Despite swift responses, the absence of standardised procedures led to inconsistent measures and unequal access to testing and vaccines across cantons. This demonstrates the need for a unified national crisis management system (23-25).

2. Food and water contamination

Crisis situations often disrupt food and water supply systems, increasing the risk of poisoning and infection. Microbiological contamination of food is the leading cause of illness, with pathogens such as Salmonella spp., Escherichia coli O157:H7, Listeria monocytogenes, and Campylobacter spp. being the most frequently isolated (21).

In Bosnia and Herzegovina, during and after the 2014 floods, an increase in gastroenteritis cases was observed, particularly in areas where stored food products were exposed to moisture and contamination. Epidemiological analyses identified key risk factors, including inadequate food storage, disruption of the cold chain, and the distribution of food aid packages without proper quality control (14, 19, 20).

Chemical hazards are an additional public health concern during crises. Floods can mobilise pesticides, heavy metals, and organic pollutants from the soil, contaminating agricultural products, groundwater, and riverbeds. After the 2014 floods, studies showed elevated concentrations of arsenic, lead, and mercury in soil and water in the Posavina and Tuzla Canton areas. These findings emphasise the need for long-term monitoring of food and water quality following crisis events, as the effects can last for years and have chronic health consequences (19, 20, 23, 24).

Similar situations have been recorded in neighbouring countries. In Croatia and Serbia, following major floods, laboratories confirmed the presence of mycotoxins in cereals and corn, leading to economic losses and potential consumer exposure to aflatoxins. These cases show that food-related risks in crises require a multidisciplinary approach involving veterinary supervision, inspection services, and public health institutions (20, 21, 23, 24).

3. Mental health and psychotrauma

Crisis situations impact not only physical health but also the mental well-being of individuals and communities. Psychological stress, loss of home, family members, or safety, and prolonged exposure to uncertainty can lead to a wide range of mental disorders, from anxiety to post-traumatic stress disorder (PTSD). Studies conducted in Bosnia and Herzegovina after the 1992-1995 war revealed that over 40% of respondents exhibited symptoms of PTSD and depression. During the 2014 floods, similar issues were reported again-many affected families experienced chronic stress, insomnia, and feelings of helplessness (15).

Mental health is often overlooked in crises because of the focus on physical and logistical responses. However, the long-term consequences of psychological trauma can be more severe than physical damage. Particularly vulnerable groups include children, adolescents, the elderly, and people with disabilities. Research conducted in Croatia and Serbia after the floods showed that children who lost their homes or witnessed evacuations were at significantly higher risk of developing anxiety disorders and learning difficulties (3, 15, 19). In Bosnia and Herzegovina, institutional support for mental health during crises remains inadequate. Although mental health centres exist within primary healthcare providers, their involvement in crisis response plans is not formalised. Mechanisms for integrating psychosocial support into the public health system need to be developed, and healthcare workers should be trained to recognise and treat crisis-related trauma (15, 19).

4. Institutional and Laboratory Capacities

Bosnia and Herzegovina has a complex public health institutional structure, with responsibilities divided among the state, entity, and cantonal levels. This fragmentation often leads to overlapping mandates and inefficient coordination. For example, while the Food Safety Agency of B&H is responsible for the legal framework and international cooperation, entity-level public health institutes conduct field activities, which can delay information sharing and decision-making. Laboratory capacities were enhanced during the COVID-19 pandemic, but challenges persist in standardising methods, accreditation, and inter-laboratory data exchange. According to WHO reports, the laboratory system in B&H is not fully interconnected, and many laboratories lack adequately trained personnel and modern equipment. The limited number of reference laboratories further hampers timely diagnosis during crises, especially in rural areas (25). To strengthen capacities, it is vital to establish a centralised information system for monitoring public health indicators, develop a network of reference laboratories, and improve institutional cooperation across all levels of governance. Ongoing staff training and alignment with EU standards are essential prerequisites for boosting public health security (11, 17).

5. Regional and international experiences

Experiences from the region and the world demonstrate that an integrated and proactive approach is essential for effective crisis management. Croatia, as an EU member state, has developed a network of reference laboratories linked to the ECDC, enabling rapid information exchange and the implementation of unified standards (20, 22-24).

Following the 2014 floods, Serbia modernised its food safety legislation and introduced mandatory HACCP implementation, significantly reducing the number of reported cases of food poisoning (21, 22, 33).

At the international level, WHO and ECDC recommend establishing interdisciplinary crisis teams comprising epidemiologists, microbiologists, psychologists, logistics experts, and crisis communication specialists (26-29). These teams enable coordinated responses and faster decision-making. Bosnia and Herzegovina only partially applies this model, as it lacks a unified national platform for health crisis management. Experiences from countries such as Italy and Germany show that the keys to success are regular crisis team exercises, emergency simulations, and a clear division of responsibilities. Implementing similar mechanisms in B&H would help strengthen public trust and improve the country's ability to respond more effectively to future challenges (3, 8, 24-26).

The results show that infectious diseases, food and water contamination, and mental health represent the most significant public health risks during crisis situations in Bosnia and Herzegovina. The 2014 floods and the COVID-19 pandemic clearly demonstrated the vulnerability of the system - from disruptions in immunisation and the emergence of waterborne and gastrointestinal infections to limited laboratory capacity and inconsistent coordination between levels of government. Chemical and microbiological risks related to food and water require continuous monitoring and stronger intersectoral collaboration, while mental health remains neglected and insufficiently integrated into crisis planning. Comparisons with regional experiences confirm that countries such as Croatia and Serbia have progressed due to clear protocols, well-developed laboratory networks, and interdisciplinary crisis teams. The implementation of WHO and ECDC recommendations, strengthening coordination, standardising procedures, and integrating psychosocial support represent key steps that Bosnia and Herzegovina needs to take to improve preparedness and response to future public health crises (17, 26-30).

Table 2.
Summary of key findings from review studies on public health risks in crisis situations

Thematic area	Main findings	Key evidence/examples	Implications for Bosnia and Herzegovina
1. Infectious diseases as a dominant risk	Infectious diseases spread rapidly in crises due to unsafe water, disrupted healthcare services, and population displacement.	• 2014 B&H floods: >30% of water samples microbiologically unsafe; increased hepatitis A and enteritis cases. • Regional floods (Croatia/Serbia): intestinal infections, respiratory illnesses, scabies outbreaks. • TB cases increased during the migration crisis due to poor hygiene in camps. • COVID-19 exposed weaknesses in lab capacity and coordination.	• High epidemic potential during crises. • Need for unified surveillance, stronger immunisation programs, and harmonised crisis protocols.
2. Food and water contamination	Crises disrupt food safety and water systems, increasing microbiological and chemical hazards.	• Frequent pathogens: Salmonella spp., E. coli O157:H7, Listeria monocytogenes, Campylobacter spp. • 2014 floods: increased gastroenteritis linked to contaminated food and water; cold chain failures; inadequate control of food aid. • Presence of heavy metals (As, Pb, Hg) in Posavina/Tuzla areas after floods. • Croatia/Serbia: flooded crops contaminated with mycotoxins.	• Requires long-term monitoring of water and soil. • Strengthen food inspection systems and emergency water safety protocols.
3. Mental health and psychotrauma	Crises cause widespread psychological distress, often overlooked in response plans.	• Post-war studies: >40% report PTSD/depression. • 2014 floods: chronic stress, insomnia, helplessness among affected families. • Regional floods: children are at higher risk for anxiety disorders and learning difficulties.	• Mental health is insufficiently integrated into crisis response. • Need structured psychosocial support programs and trained staff.
4. Institutional and laboratory capacities	The public health system is fragmented across state, entity, and cantonal levels. Laboratory capacities remain uneven.	• Overlapping mandates lead to slow decision-making. • Many labs lack accreditation, staffing, and standardised methods. • Limited reference labs; weak inter-lab data exchange. • COVID-19 prompted some improvements, but gaps remain	• Need a centralised public health information system. • Develop a network of accredited reference laboratories. • Improve coordination between institutions.
5. Regional and international experiences	Countries with integrated crisis systems respond more effectively.	• Croatia: ECDC-linked reference lab network enables rapid information flow. • Serbia: post-2014 HACCP reforms reduced food poisoning. • WHO/ECDC recommend interdisciplinary crisis teams (epidemiology, microbiology, logistics, communication). • Italy/Germany: success due to regular simulations and clear responsibilities.	

CONCLUSION

Public health risks in crisis situations pose a complex, multidimensional challenge that requires coordinated action among health institutions, civil protection authorities, local governments, non-governmental organisations, and international partners. Crises-whether caused by natural disasters, armed conflicts, pandemics, or industrial accidents-disrupt the fundamental functions of society and directly affect population health, quality of life, and community safety. The analysis presented in this paper shows that infectious diseases, biological incidents, food and water contamination, mental health of affected populations, and institutional weaknesses are among the key challenges Bosnia and Herzegovina faces. It is particularly concerning that crises over the past decades, such as the 1990s war, the 2014 floods, and the COVID-19 pandemic, have revealed deeply rooted deficiencies in the public health system, including insufficient coordination, lack of equipment and personnel, and fragmented decision-making mechanisms. Infectious epidemics remain the dominant public health risk, as crises often disrupt vaccination chains, disturb the distribution of medicines, and reduce access to laboratory diagnostics. The lack of adequate sanitation infrastructure and water contamination following floods further increases the risk of gastrointestinal infections and food poisoning. At the same time, chemical hazards and exposure to heavy metals pose long-term threats to population health, whose importance is often underestimated. In addition to physical risks, the mental health of the population during and after crises deserves special attention. Psychological consequences such as post-traumatic stress disorder (PTSD), depression, and anxiety affect large numbers of people, particularly children, the elderly, and healthcare workers. The lack of systemic psychological support further hinders community recovery, emphasising the need for long-term mental rehabilitation and psychosocial assistance programs (3, 15, 17).

Protecting health in crisis conditions requires an integrated and multidisciplinary approach that connects epidemiology, microbiology, clinical medicine, social work, psychology, logistics, and information technology. Establishing a network of reference laboratories, standardising diagnostic and procedural protocols, and developing digital early warning systems would enable timely detection and response to threats. Continuous education of healthcare workers and simulation exercises are crucial for strengthening preparedness and system resilience. Equally important is enhancing communication between national and local institutions and cooperation with international organisations such as the WHO, ECDC, and UNICEF. The implementation of the One Health concept, which links human, animal, and environmental health, can significantly contribute to early prevention and coordinated responses to public health threats (1-3, 22, 31, 32).

Based on this analysis, it can be concluded that the future development of public health security in Bosnia and Herzegovina should focus on: creating an integrated crisis management system in healthcare, modernising and accrediting laboratory infrastructure, digitalising public health surveillance and real-time data exchange, developing a national mental health programme for crisis situations, and strengthening institutional capacities through legislative and organisational reforms. Bosnia and Herzegovina has a realistic potential, with the support of international partners and strategic planning, to build a more resilient health system capable of effectively responding to future crises. The key to success lies in linking scientific evidence, institutional readiness, and cross-sectoral cooperation. Only through such an approach can population health be protected, social stability preserved, and a sustainable system of public health security established - one that will be resilient to the challenges of the modern era (3, 8, 18, 19, 21, 23).

Based on the conducted research and the identified systemic shortcomings, several directions emerge in which future studies could contribute to strengthening public health security in Bosnia and Herzegovina. First, there is a need to develop more detailed epidemiological research on the occurrence and spread of infectious diseases during different types of crises, particularly in situations involving disruptions of immunisation programmes, shortages of medicines and medical supplies, and limited laboratory capacity. The focus should be on identifying factors that contribute to epidemic spread and evaluating the effectiveness of existing response measures. Second, studies are recommended on water, food, and environmental quality in post-crisis periods, with an emphasis on chemical risks and long-term exposure to heavy metals and pollutants. Such research should also include an assessment of the impact of climate change on the frequency of floods, droughts, and resource contamination. Third, future research should address the mental health of the population during crises, especially children, older adults, migrants, and healthcare workers. It is necessary to develop models for early psychological intervention and assess the effectiveness of existing support systems. Fourth, research on institutional capacities is essential, including coordination among different levels of government, the effectiveness of crisis headquarters, the functioning of risk communication, and the preparedness of civil protection sectors. Special emphasis should be placed on mechanisms of intersectoral cooperation and the implementation of the "One Health" concept. Fifth, it is recommended to analyse opportunities to digitalise public health surveillance, including implementing early warning systems, enabling real-time data exchange, and developing national information platforms. Such studies could support the modernisation of laboratory systems and the standardisation of protocols. Finally, research is needed to connect extreme climate events to public health outcomes, particularly in the context of Bosnia and Herzegovina's increasing exposure to natural disasters. These studies may serve as a foundation for developing preventive policies, educational

programmes, and community resilience assessments. Overall, the findings indicate a broad scope for multidisciplinary research to improve knowledge, practice, and strategic planning in public health risk management during crisis situations (3, 7-9, 30, 33).

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Nema/*None*

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Nije potrebno/*None*

SUKOB INTERESA/*CONFLICT OF INTEREST*
Autori su popunili *the Unified Competing Interest form na www.icmje.org/coi_disclosure.pdf (dostupno na zahtjev)* obrazac i izjavljuju: nemaju potporu niti jedne organizacije za objavljeni rad; nemaju financijsku potporu niti jedne organizacije koja bi mogla imati interes za objavu ovog rada u posljednje 3 godine; nemaju drugih veza ili aktivnosti koje bi mogle utjecati na objavljeni rad./ *All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.*

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Sažetak

JAVNOZDRAVSTVENI RIZICI U KRIZNIM SITUACIJAMA

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Javnozdravstvene krize predstavljaju globalni izazov koji može nastati kao posljedica prirodnih katastrofa, ratnih sukoba, ekoloških incidenata ili pandemija. U takvim okolnostima povećava se rizik od širenja zaraznih bolesti, kontaminacije hrane i vode, poremećaja u lancima opskrbe te pojave psiholoških i socijalnih posljedica među pogođenim stanovništvom. Bosna i Hercegovina (BiH), zbog složenog političko-administrativnog ustroja i osjetljive infrastrukture, posebno je ranjiva na javnozdravstvene posljedice kriznih situacija. Cilj ovog preglednog rada bio je analizirati postojeća saznanja o javnozdravstvenim rizicima u kriznim situacijama, s naglaskom na BiH i zemlje regije, te identificirati ključne izazove i mjere za unaprjeđenje otpornosti javnozdravstvenog sustava. Metodologija je obuhvatila pregled literature u međunarodnim bazama podataka (PubMed, Scopus, Google Scholar) te analizu domaćih izvješća, zakonskih dokumenata i strategija. Rezultati pokazuju da su najznačajniji rizici u BiH povezani sa zaraznim bolestima nakon poplava i migracija, trovanjem hranom i vodom uslijed narušenih sanitarnih uvjeta te psihološkim traumama koje su izazvane krizama. Ključne mjere za unaprjeđenje sustava uključuju jačanje laboratorijskih kapaciteta, obveznu primjenu međunarodnih standarda sigurnosti hrane i vode, bolju međuinstitucionalnu suradnju, razvoj kriznih planova te kontinuiranu edukaciju stanovništva i zdravstvenih djelatnika. Zaključuje se da multidisciplinarni pristup, temeljen na kombinaciji međunarodnih iskustava i lokalnih specifičnosti, može značajno smanjiti javnozdravstvene posljedice kriznih situacija u BiH.

Ključne riječi: JAVNO ZDRAVLJE, KRIZNE SITUACIJE, BOSNA I HERCEGOVINA, ZARAZNE BOLESTI, SIGURNOST HRANE, MENTALNO ZDRAVLJE

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