РОЗДІЛ 1. БІОЛОГІЧНА БЕЗПЕКА ТА ГРОМАДСЬКЕ ЗДОРОВ'Я В УМОВАХ ВОЄННОГО ЧАСУ

CHAPTER 1. BIOLOGICAL SAFETY AND PUBLIC HEALTH IN WARTIME

ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PREPAREDNESS OF NURSING AND EMERGENCY MEDICAL SERVICES STUDENTS TO COUNTERACT BIOLOGICAL THREATS

ОЦІНКА ЗНАНЬ, СТАВЛЕННЯ ТА ГОТОВНІСТЬ СТУДЕНТІВ, ЯКІ НАВЧАЮТЬСЯ ЗА ФАХОМ МЕДИЧНА СЕСТРА ТА МЕДИЧНИЙ РЯТІВНИК ДО ПРОТИСТОЯННЯ БІОЛОГІЧНИМ ЗАГРОЗАМ

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Abstract. In the face of increasing global biological threats in the modern period, including emerging infectious diseases and biological terrorism, the preparedness of frontline medical personnel is crucial. Nurses and emergency medical service responders play a vital role in detecting, isolating, and containing different biological hazards.

This study aimed to evaluate nursing and emergency medical service students' knowledge, attitudes, and preparedness at the Cavalry Captain Witold Pilecki State University of Małopolska in Oswiecim, Poland, to respond effectively to biological threats.

A cross-sectional study using the Knowledge–Attitude–Practice (KAP) model was conducted during two educational years between 2023 and 2025. Nurses and emergency medical service students completed full coursework in microbiology, infectious diseases, epidemiology, and public health. Depending on their activities, their competencies were assessed through a 5-point scale test covering biological threat response protocols.

For the first time, we investigated the effectiveness of teaching biosafety issues and identified areas for further improvement of the educational process. The average knowledge score was 4.4 for nursing students and 4.2 for emergency medical service students. All respondents expressed a strong willingness to engage in emergency response during a biological terrorism event. Post-training assessment showed high

levels of competence (4.0 for nursing, 4.3 for emergency medical service students), despite the limited duration of practical training hours of the courses.

The results of our investigation indicated a strong baseline of theoretical and practical readiness among both groups of nurses and emergency medical service students. However, incorporating simulation-based and virtual training modules is recommended to further improve preparedness. Educational programs for nurses and emergency medical service responders should continue evolving to address the growing complexity of biological threats.

Keywords: biological threats, nursing/emergency medical service students, biosafety education.

Анотація. З огляду на зростання глобальних біологічних загроз, включаючи нові інфекційні захворювання та біологічний тероризм, готовність медичного персоналу першої ланки надання медичної допомоги має вирішальне значення. Медичні сестри та працівники екстреної медичної допомоги відіграють життєво важливу роль у ранньому виявленні, ізолюванні та стримуванні біологічних небезпек.

Це дослідження мало на меті оцінити знання, ставлення та готовність студентів-медсестер та студентів за напрямом екстреної медичної допомоги Інституту здоров'я Малопольського державного університету імені підпоручика Вітольда Пілецького в Освенцімі, Польща до ефективного реагування на біологічні загрози.

Впродовж двох навчальних років у період з 2023 по 2025 роки було проведено перехресне дослідження з використанням моделі «Знання-Ставлення-Практика» (ЗСП). Учасники виконали програму з вивчення курсів з мікробіології, інфекційних захворювань, епідеміології та громадського здоров'я. Їхні компетенції оцінювалися за допомогою 5-бального тесту, що охоплював протоколи реагування на біологічні загрози.

Вперше ми дослідили результативність викладання питань біобезпеки і визначили напрями подальшого вдосконалення навчального процесу. Середній бал знань становив 4,4 для студентів-медичних сестер та 4,2 для студентів-екстреної медичної допомоги. Усі респонденти продемонстрували високу готовність брати участь у реагуванні на надзвичайні ситуації під час біотерористичного інциденту. Оцінювання після навчання показало високий рівень компетентності (4,0 для медичних сестер, 4,3 для екстреної медичної допомоги), незважаючи на обмежену кількість годин практичного навчання.

Результати вказують на високу базову теоретичну та практичну готовність студентів обох груп медсестер і екстреної медичної допомоги. Однак, для подальшого покращення готовності рекомендується впровадження навчальних модулів на основі симуляцій та віртуальних методів. Освітні програми для студентів-медсестер і екстреної медичної допомоги повинні продовжувати розвиватися, враховуючи зростаючу складність біологічних загроз.

Ключові слова: біологічні загрози, студенти-медичні сестри і екстреної медичної допомоги, освіта з біобезпеки.

INTRODUCTION

In recent years, the threat of bioterrorism, long marginalized in public discourse, has significantly increased. The world is currently facing various biological threats, including emerging infectious diseases,

bioterrorist attacks, and the potential use of biological weapons [1,2,3]. Unlike other types of weapons, biological agents are difficult to detect or diagnose in their early stages, and their use often results in the rapid and widespread transmission of diseases, numerous casualties, and social destabilization[4,5].

The emergence of new, highly contagious biological agents poses a serious challenge to the healthcare system. It requires substantial changes in medical care organization, infrastructure planning (including the design of healthcare facilities), ensuring adequate resources, ongoing sanitary-epidemiological surveillance, and effective communication. Timely and appropriate medical assistance is of key importance in this context.

In our opinion, one of the most critical factors determining the healthcare system's capacity to respond to biological threats is the level of preparedness and training of medical personnel. The first line of contact with patients includes emergency medical responders and mid-level healthcare staff – they are the first to identify threats and initiate countermeasures. Therefore, assessing their ability to respond to biological incidents is essential[6].

Nurses constitute the largest professional group in the healthcare system. They play a key role in emergency preparedness, management, response, and patient care. In the event of a bioterrorist attack, nurses must possess appropriate knowledge, attitudes, and competencies to quickly assess the situation, isolate potential cases, and prevent further spread of infection[7,8,9,10].

The significance of mid-level medical personnel in combating biological threats lies in the diversity of their roles. Nurses are responsible for direct patient care, including monitoring vital signs, symptom control, medication administration, and ensuring patient comfort and safety. They also implement infection control procedures, educate patients and their families, coordinate care among different professionals, participate in preventive campaigns, and monitor emerging infectious disease cases.

Given the above, this study aimed to assess the level of knowledge, attitudes, and preparedness of nursing and emergency medical services students at the Cavalry Captain Witold Pilecki State University of Małopolska in Oswiecim to respond to biological threats.

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METHODOLOGY

The methodological basis of our study was the "Knowledge–Attitude–Practice" (KAP) model [11]. We analysed the knowledge, attitudes, and practical skills of students necessary for an effective response in biosafety-related situations. The study was conducted between 2023 and 2025 among students who completed courses such as microbiology and parasitology, tropical diseases, infectious diseases, hospital infections, epidemiology, and public health. The curricula included content on hazardous biological agents, anti-epidemic measures, and population protection.

RESULTS

Classes included lectures, practical exercises, problem-based learning, situational simulations, and remote education. The program also prepared students to care for patients with infectious diseases caused by bioterrorism agents, including: bioterrorism characteristics, response systems, procedures in suspected infection cases, clinical symptoms, diagnostics, isolation principles, and initial and preventive treatment.

DISCUSSION

The assessment was based on a 5-point scale test. Questions covered symptom recognition, identification of bioterrorism agents, response algorithms to epidemiological threats, sequence of preventive and intervention actions, and proper handling, transport, and disposal of biological materials, as well as personal protection during rescue operations. A higher score indicated a better level of knowledge and competence. The average score obtained by nursing students was 4.4±0,31, and by emergency medical services students was 4.2±0,4. Students' willingness to participate in rescue operations during a bioterrorist attack was rated high; all respondents expressed readiness for active involvement.

Competence levels assessed after completing the training cycle also showed high results, despite a limited number of practical hours devoted to the subject. Nursing students scored an average of 4.0±0,34, and emergency medical students scored 4.3±0,41.

CONCLUSIONS

To achieve an even more objective assessment of training effectiveness, we recommend implementing simulation-based training methods, such as virtual educational modules for learning to care for patients with infectious diseases caused by bioterrorism agents.

Our study highlights the need to modify and enhance educational programs by emphasizing the availability, repeatability, and effectiveness of training, especially in the context of increasing biological threats.

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