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CONFERENCE ABSTRACTS

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Military and emergency pharmacy

Disaster management among healthcare practitioners: Implications for pharmacy practice and interprofessional health system resilience in Qatar

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Background: The increasing frequency and complexity of disasters require healthcare practitioners (HCPs) to be well prepared to maintain healthcare services and protect population health. Pharmacists and other HCPs play critical roles in ensuring continuity of medicines supply, patient care, and public health response during emergencies. However, research on HCPs' perceptions of disaster management often lacks the comprehensive scope needed to address diverse healthcare challenges and the integration of multidisciplinary healthcare teams within resilient health systems. This study aimed to assess HCPs' perceptions of their disaster management capabilities, focusing on their knowledge, attitudes, and practices, as well as their willingness to continue practicing during disasters. The study also explored organisational preparedness and the role of interdisciplinary collaboration, including pharmacy services, in strengthening resilient healthcare systems.

Method: An explanatory mixed-methods design informed by the Disaster Management Framework was employed. Quantitative data were gathered through a self-administered questionnaire distributed to a stratified random sample of 771 HCPs from multiple healthcare institutions in Qatar. A total of 436 responses were received (response rate: 56.5%), of which 403 were included in the final analysis. Participants represented various healthcare professions, including physicians, pharmacists, nurses, and allied health professionals. The achieved sample size exceeded the minimum required sample (n = 379), ensuring sufficient statistical power. Qualitative data were collected through six online focus group discussions conducted via Microsoft Teams with 41 purposively selected practitioners who had experience in disaster response or healthcare service provision during national emergencies. The qualitative data were analysed using thematic analysis, and recruitment continued until thematic saturation was achieved. Quantitative and qualitative findings were integrated during interpretation using a contiguous narrative approach.

Results: Quantitative findings indicated positive perceptions among HCPs regarding their knowledge (median [IQR] = 41 [34–44], Min–Max = 18–55), attitude (median [IQR] = 46 [43–50], Min–Max = 10–55), willingness to practice (median [IQR] = 23 [1–24], Min–Max = 6–30), and organisation-based disaster management (median [IQR] = 43 [40–50], Min–Max = 10–50). However, participants reported lower engagement in practical disaster preparedness activities, with practices scoring lower (median [IQR] = 31 [24–39], Min–Max = 2–50). Higher disaster management perceptions were significantly associated with prior disaster training, administrative roles, experience during national emergencies, gender, years of experience, profession, and workplace ($p < 0.05$). Qualitative findings emphasised the importance of practical simulation training, technological innovations such as telehealth, mental health support for healthcare teams, interdisciplinary collaboration, and strong leadership and planning to enhance health system resilience.

Conclusion: The findings highlight the need for integrated disaster preparedness strategies that strengthen the role of pharmacists and other HCPs within multidisciplinary teams. Healthcare organisations should prioritise proactive disaster readiness through continuous training, interprofessional collaboration, technological innovation, and community

engagement. Such approaches can support resilient health systems and advance the One Health vision by bridging science, practice, and education to protect population health during disasters.

Development of a drug list and stockpile strategy for acute poisoning treatment: A retrospective analysis of 5,330 clinical cases

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Background: Ensuring the availability of medicines for acute poisoning is fundamental to establishing an effective poisoning treatment system. The required armamentarium includes specific antidotes, supportive care agents, and drugs for managing complications. Developing a clinically oriented drug list for emergency poisoning response has substantial practical value in guiding precise pharmacotherapy and optimizing stockpile allocation.

Purpose: To analyze real-world medication data from 5,330 acute poisoning cases treated at the poisoning treatment center of a Beijing tertiary hospital between 2021 and 2025, formulate an essential drug list for poisoning emergencies, and explore feasible strategies for the management of poisoning-related pharmaceutical stockpiles.

Method: A retrospective study was conducted using data extracted from the hospital information system, including clinical diagnoses, admission times, and drug therapies. Poisoning types, case numbers, temporal distributions, and treatment regimens were systematically examined. Drugs were classified according to the New Materia Medica (18th edition). Pareto analysis was applied to identify high-frequency drugs (cumulative usage frequency ≥ 80%).

Results: Over the five-year period, the three most common poisoning categories were pharmaceutical poisoning, pesticide poisoning, and poisoning from botulinum toxin injections, with a marked increase in the latter during the past two years. Distinct seasonal patterns were observed: pharmaceutical poisoning peaked in March-May and November-December, pesticide poisoning occurred mainly from March to October, and botulinum toxin injection poisoning peaked in April-June. Based on real-world clinical data, 16 drug categories were identified, yielding a list that covers both supportive care and specific antidote therapies.

Conclusion: The resulting drug list, derived from the local poisoning profile and real-world prescription data, comprehensively addresses clinical treatment needs and provides an evidence-based foundation for the rational stockpiling of poisoning-treatment medicines in healthcare institutions. The observed shifts in poisoning patterns and seasonal variations underscore the necessity for dynamic, time-phased stockpile strategies and strengthened inter-hospital coordination to enhance emergency response capacity while minimizing resource waste.

Development of a competency framework for pharmacists in emergencies: A systematic content analysis

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Background: The escalating frequency and complexity of global disasters and emergencies are placing unprecedented strain on public health and social stability. This reality underscores the urgent need to strengthen emergency systems and professionalize rescue teams. As an indispensable member of teams, pharmacists play a vital role across the full cycle of emergency management. However, standardized and systematic competency evaluation framework for pharmacists in emergencies has yet to be established, and targeted training for pharmacists remains insufficient, restricting the advancement of emergency pharmaceutical services.

Purpose: To systematically identify the core competency elements required for pharmacists engaged in emergencies and construct a scientific and comprehensive emergency competency indicator system for pharmacists.

Method: A literature search was conducted across several databases, including PubMed, Embase, and Medline, to identify studies related to pharmacist's role, duties and competency requirements in disaster and emergency. Content analysis was adopted to inductively integrate and thematically refine core data extracted from the included studies.

Results: A total of 31 studies were included, covering four major categories emergencies: natural disasters, man-made accidents, public health emergencies, and social security incidents, as well as the full emergency management cycle (prevention, preparedness, response and recovery). Based on systematic content analysis and thematic refinement, a multi-dimensional emergency competency indicator system for pharmacists was preliminarily constructed, consisting of 4 first-level indicators, 12 second-level indicators, and 32 third-level indicators. The framework comprises 4 core domains: ① Professional background, including personal basic qualifications and emergency rescue experience; ② Knowledge reserve, covering pharmaceutical expertise, disaster medicine and public health knowledge; ③ Professional skills, including competencies required for emergency prevention, preparedness, response and recovery

across the full management cycle; ④ Competency qualities, involving general abilities, physical fitness, psychological resilience, and spiritual traits.

Conclusion: This study identifies the core competency elements for pharmacists engaged in emergencies. The constructed indicator system fully addresses the professional requirements for pharmacists across all emergency categories and the prevention, preparedness, response, recovery cycle. These findings provide theoretical foundation for refining pharmacist emergency competency evaluation frameworks, developing specialist emergency pharmacy workforce, and advancing the quality of emergency pharmaceutical services globally.

Emergency pharmacy practices in extreme environments and sudden-onset disasters: Current research and future perspectives

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Background: The increasing frequency of extreme environmental events and sudden-onset disasters poses severe threats to human health. Effective emergency pharmacy practices are critical for safeguarding life and reducing mortality, underscoring their growing strategic importance.

Purpose: This paper aims to systematically review the current state of research in emergency pharmacy practice, analyze key advancements and challenges across various dimensions, and propose future directions. The goal is to provide a theoretical basis and practical reference for developing an emergency pharmacy system adapted to extreme conditions.

Method: A retrospective analysis was conducted, integrating relevant domestic and international literature with practical industry experience. The current state of emergency pharmacy development was summarized across six dimensions: pharmaceutical management, drug supply, pharmaceutical care, pharmacist training, public education, and drug research and development. Real-world challenges and future opportunities within the field were identified and discussed.

Results: (1) Pharmaceutical Management: Emergency plans can be developed using the 5M1E analysis method, establishing an organizational structure encompassing human resources, drug supply, dispensing, clinical pharmacy, and information management. The application of artificial intelligence (AI) in this domain provides robust decision support for healthcare administrators during emergencies.
(2) Drug Supply: Following a technical pathway of "injury analysis — disease spectrum identification — drug module construction," an essential emergency drug list can be formulated, categorized into resuscitation, general, and specific-use medications. Reserve strategies employ a modular design integrating institutional allocation, forward-team carry, and supplier/government-managed stockpiles. AI, through multi-dimensional data integration, assists pharmacists in assessing regional and temporal medication needs and optimizing the distribution routes for relief supplies.
(3) Pharmaceutical Care: "Internet + Pharmacy" technologies enhance emergency response efficiency and medication safety, particularly by reducing cross-infection risks during infectious disease outbreaks. AI agents based on natural language processing and professional knowledge bases can effectively alleviate the burden on frontline pharmacists by offering clinical pharmacy services and patient medication guidance.
(4) Pharmacist Training: Developing a comprehensive competency framework, with explicit skills as "hard power" and implicit qualities as "soft power," is key to enhancing pharmacists' emergency response capabilities. AI shows significant potential in pharmacy education for applications such as virtual simulations, virtual standardized patients, and generating educational resources. However, critical teaching content still requires human expert review.
(5) Public Education: Generative AI can efficiently produce educational materials, including text, images, and videos, lowering the barrier to content creation. However, pharmacists must conduct professional reviews to ensure scientific accuracy and reliability.
(6) Pharmaceutical Research: AI-assisted drug design tools (e.g., AlphaFold) accelerate the discovery of emergency-use drugs through structure prediction and virtual screening. While large language models can improve the efficiency of drafting scientific manuscripts, it is imperative that all generated content is grounded in authentic and reliable research data.

Conclusion: Developing the discipline of emergency pharmacy requires a system adaptable to a three-tiered response ("peacetime—emergency—conflict") throughout the entire process of "pre-event preparedness—intra-event response—post-event recovery." The deep integration of AI into emergency pharmacy practice will inject innovative momentum, driving its continued advancement toward greater intelligence and systematization.

Competency indicators for pharmacists in public health emergencies: A qualitative study

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Background: Public health emergency responses place extraordinary demands on pharmaceutical care and logistics. As essential members of rescue teams, the professional competencies of pharmacists critically influence the quality of disaster response. However, standardized and systematic tools for evaluating pharmacists' core competencies in emergency medical rescue remain lacking globally.

Purpose: This study aimed to develop a scientifically grounded, multi-dimensional, and practical competency indicator system for pharmacists delivering emergency pharmaceutical care, based on insights from those with direct field experience. The system is intended to support the training, assessment, and deployment of emergency pharmacy personnel worldwide.

Method: Using a phenomenological qualitative design, semi-structured in-depth interviews were conducted with 12 purposively sampled hospital pharmacists between September 2025 and February 2026. Eligible participants each possessed over three years of professional experience and prior involvement in provincial-level or higher emergency medical rescue operations. The interview guide was developed based on a literature review of emergency medicine and disaster response, supplemented by the research team's practical knowledge, logical reasoning, and preliminary consultations with senior pharmacists. Key topics explored included: dynamic shifts in disease patterns and corresponding pharmaceutical responses across diverse disaster types and geographic-climatic settings; resource allocation and clinical decision-making under disaster-induced constraints; and competency requirements for the full-cycle management of public health emergencies. Data were analyzed using Colaizzi's seven-step method for thematic analysis, with investigator triangulation employed to enhance trustworthiness and credibility.

Results: The analysis yielded a three-tiered competency framework comprising 3 primary dimensions, 9 secondary indicators, and 36 specific behavioral indicators: (1) Task Attributes: This dimension captures pharmacists' ability to anticipate medication needs based on disaster profiles and ensure drug stability under varying environmental conditions, encompassing two indicators—"Disease Spectrum–Pharmaceutical Service Capacity" and "Environment–Drug Adaptability." (2) Task Difficulty: This dimension reflects capabilities in resource optimization under extreme conditions, supply chain adaptation, and team leadership, encompassing three indicators—"Dynamic Assessment of Resource Gaps," "Real-time Pharmaceutical Supply Chain Reconstruction," and "Emergency Command and Psychological Resilience." (3) Task Process: This dimension defines specific actions and developmental pathways throughout the emergency lifecycle, comprising four indicators—"Preparedness," "Response," "Recovery and Improvement," and "Self-Psychological Resilience." Notably, experienced pharmacists consistently identified "clinical decision-making under resource scarcity" and "multi-sectoral coordination capacity" as the key differentiating features of highly competent emergency pharmacists.

Conclusion: This study presents a competency framework that extends beyond traditional pharmaceutical care, systematically capturing the environmental adaptability, constrained resource management, and end-to-end process capabilities essential for complex disaster settings. The framework provides a practical evidence base for the selection, training, and performance evaluation of emergency pharmacy personnel, thereby strengthening pharmaceutical preparedness and response in global public health emergencies.

The role of pharmacists in the management of infections

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Background: The recent conflicts have stressed again a well-known fact: combat wounds are prone to be infected and the phenomenal increase in antibiotic resistance is a key challenge for the appropriate management of combat casualties, both in the field and in role 4 hospitals. The management of infections in injured patients encompasses all areas of hospital pharmacy practice – from the dispensing of antibiotics by hospital pharmacists to dosage optimization and the performance of antibiograms by clinical biology pharmacists. This multidisciplinary approach has enabled the implementation of therapeutic drug monitoring (TDM) in a few hospitals.

Purpose: The aim of this work is to present the experience of Percy national military teaching hospital. Aminoglycosides (amikacin -AK, gentamicin-GM) TDM has been performed over the past 15 years. More recently beta-lactam antibiotics (cefepime- FEP, ceftazidime - CAZ, piperacillin - PIP, meropenem MEM) has begun since 2025.

Method: This study includes 150 military and civilian patients treated either by aminoglycosides (AK or GM) or beta-lactam antibiotics (FEP, CAZ, PIP, MEM) for microbiologically

documented infections or not between 2025 and 2026. The administered doses, the peak and/or trough concentrations are documented for each patient as well as the time of sampling and administration, their age, sex, weight and creatinemia. For each patient, if the first dose is effective, an optimal dosage regimen for the subsequent injections is proposed.

Results: [this study is on progress – these are preliminary results]. First results show that for the first dose, the target peak and trough are not reached in many cases. Pharmacokinetics is complex in polytrauma patient. Individual pharmacokinetic follow-up is useful to optimize treatment and to reach therapeutic levels. A synthesis of the different recommendations from scientific societies will be presented and compared to our national guidelines.

Conclusion: Therapeutic drug monitoring is a useful tool to manage severe hospitalized casualties. It requires a close collaboration between pharmacists and clinicians. Unfortunately, TDM has also limitations: it cannot be used in the field and it is time consuming. A possible compromise would be to design a simple prescribing support tool, such as a tutorial or a basic application, usable on a tablet or smartphone without requiring an internet connection

Fentanyl and analogues detection in urine: Comparison of three screening methods

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Background: Fentanyl and analogs have been used in terrorist attacks and could represent a threat in the near future. In this context, some medical laboratories need to be able to detect fentanyl and related compounds, quickly. Fentanyl and analogs are not detected by standard screening urine assays. Besides, lethal concentrations can be low, making it challenging to detect. Mass spectrometry methods are the reference but cannot be used in emergency. Therefore, three immunoassay methods which can detect shortly fentanyl and analogs have been evaluated.

Method: two immunoassays ; DRI® Fentanyl Enzyme Immunoassay (ThermoFisher®) and FEN2 assay (Roche®), and the immunochromatographic strip kit, Surestep® urine test (Abbott®) were studied. Analytical performances were determined : precisions for the two immunoassays, sensibility and specificity of for the three methods. Twenty patients under fentanyl treatment (effentora® or durogesic®) were included. In addition, the ability to detect carfentanil, thiafentanyl and sufentanyl by the three methods was tested, using a commercial reference material (carfentanil LGC®) or animal biological samples (sufentanyl, thiafentanyl).

Results: For fentanyl, the calculated sensitivity and specificity were 65% and 100% for the DRI assay, 100% and 100% for the FEN2 Roche assay, and 94% and 100% for the Surestep®. The only test able to detect carfentanil in urine was the DRI® assay, at concentrations between 12 and 15 ng/mL. In plasma, the DRI assay detects lower concentrations of carfentanil (from 10 ng/mL), but remains too high. Actually, carfentanil concentrations in blood, after an overdose, were reported to be from 0.010 to 10.0 ng/mL. Nonetheless, this could be relevant for the documentation of an exposure but must be confirmed by separative methods hyphenated to mass spectrometry. Sufentanyl and thiafentanil were not detected, whatever the method used.

Discussion: These tests are rapid and simple. The positivity thresholds observed are consistent with those described for comparable tests but remain higher than those obtained with chromatography. To be useful in case of therapeutic doses of fentanyl, the combination of two assays is needed. False negatives cannot be excluded, in particular in case of low doses or delayed urine sampling. For other fentanyl derivatives, in particular carfentanil, these tests do not allow detection of low doses.

Pioneering Shariah-compliant governance in military healthcare and pharmaceutical supply chains: The Malaysian Armed Forces as a global halal healthcare excellence model

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Background: The growing demand for ethnocentric healthcare systems has become increasingly significant in multicultural societies and global pharmaceutical markets. Over the past decade, the Malaysian Armed Forces Health Services (MAFHS) has undertaken a structured transformation to embed halal integrity within its healthcare delivery and pharmaceutical supply chain. This initiative aimed to ensure Shariah compliance, strengthen governance,

and enhance patient trust without compromising operational efficiency. These efforts were internationally recognized when MAFHS received the Muslim-Friendly Healthcare Excellence Award at the World Halal Excellence Awards 2024.

Objective: This case study describes the development, implementation, and evaluation of a comprehensive Shariah-compliant healthcare and pharmaceutical supply chain framework within military setting in Malaysia.

Method: A structured implementation strategy was developed under a Shariah-Compliant Pharmacy Practice framework encompassing four key domains: procurement, storage, distribution, and utilization. Procurement policies integrated -27 Shariah based criteria- into national contract specifications. Halal certification was achieved for the 93 Armed Forces Medical and Dental Depot (93 AFMDD) using the Malaysian Standard for Halal Supply Chain Management System - Warehousing. Capacity building included training pharmacists as certified halal professionals to establish a robust Halal Assurance System.

A noble Halal Pharmaceutical Decision Tree (HPDT) was introduced to systematically classify approximately 1,500 pharmaceutical and medical logistic items into permissible, non-permissible, and doubtful categories. Internal audits and management reviews were conducted to identify halal risks, halal critical control points and implement preventive measures across logistics processes. In parallel, the Ibadah-Friendly Military Hospital (IFMH) concept was implemented to integrate spiritual care, including prayer facilities, staff training, and religious support services.

Results: The implementation of this framework improved traceability, segregation, and risk management across the pharmaceutical supply chain. Certification of 93 AFMDD as Halal Pharmaceutical and Medical Logistic Warehouse - first of its kind - enhanced governance transparency and strengthened supplier accountability. The HPDT system reduced contamination risks, improved compliance with documentation standards, and supported evidence-based procurement decisions. Increasing demands from external organizations to adopt this model reflects its scalability and sustainability. Additionally, trained pharmacists have contributed as subject matter experts in global halal initiatives.

Conclusion: MAFHS demonstrates that Shariah-compliant pharmaceutical governance can be effectively operationalized within a complex military healthcare system while maintaining universal quality standards. Beyond regulatory compliance, this model promotes medication adherence, reduces wastage, supports environmental sustainability, and aligns with the higher objectives of Islamic law (Maqasid Shariah), including the preservation of faith, life, intellect, lineage, and wealth.

Urgency and irreplaceability of military pharmacists' responsibilities in natural disaster response: Perspectives from Taiwan's military pharmacists and healthcare professionals

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Background: The urgency for military pharmacists to make meaningful contributions to disaster care has increased due to the high frequency of natural disasters in Taiwan. In recent decades, typhoons and earthquakes have repeatedly struck the island, causing severe consequences such as landslides, building collapses, and widespread power outages. Consequently, military pharmacists are frequently deployed to participate in disaster relief operations, aiming to provide timely medical support and save lives under extreme environmental conditions. They are often confronted with multiple challenges, including supporting resuscitation teams, implementing disease control measures, and managing complex infectious cases. To enhance the capability of military pharmacists to respond effectively to humanitarian assistance missions, it is essential to investigate the urgency, irreplaceability and scope of their responsibilities during emergency situations.

Method: The urgency of the contributions that military pharmacists can make in disaster care was evaluated using a 5-point Likert scale (1–5). A questionnaire survey was conducted from January to February in 2026, with perceived irreplaceability assessed as an auxiliary measure. Participants were randomly selected from military pharmacists and healthcare practitioners currently serving in military hospitals across Taiwan.

Results: A total of 102 respondents participated in the survey. The results revealed three particularly urgent responsibilities of military pharmacists during disaster response. First, providing timely health education and medication instructions to soldiers and disaster victims was considered the most critical measure for improving self-care and strengthening unit cohesion under extreme pressure (Likert score: 4.86). Given the limited availability of medical resources in disaster settings, meticulous preparation of first aid kits (4.75), including quality assurance, as well as the development of simplified antibiotic treatment guidelines (4.69), were identified as fundamental priorities. Other responsibilities, such as possessing certified skills and knowledge in emergency care (4.43), were also regarded as crucial, particularly in situations where shortages of physicians and nurses may occur, followed by establishing disease prevention plans (4.37) and collaborating with physicians to evaluate the use of psychotropic medications

(4.24), both of which were considered essential for maintaining soldiers' physical and psychological readiness for mission execution.
In terms of irreplaceability, leading stewardship programs for controlled medications to ensure legal compliance and appropriate dosing received the highest score (4.78). The second-highest scoring function was building extensive networks with civilian hospitals and non-profit organizations (4.71). Owing to their unique professional background, military pharmacists demonstrate a distinct capacity for resource integration and allocation, which ensures sustainable resilience of medical supply chains during large-scale or prolonged disasters.

Conclusion: Beyond providing pharmaceutical support to military personnel on the front lines, military pharmacists shoulder increasingly comprehensive responsibilities. They serve as indispensable responders during disasters and play pivotal roles in emergency care missions. By recognizing the urgency and uniqueness of these responsibilities and continuously strengthening their professional competencies in humanitarian settings, military pharmacists can make even greater contributions to national resilience. In doing so, they not only support mission success but also provide essential medical support and safeguard the well-being of displaced populations during natural crises.

Advancing mobile field laboratory capabilities based on insights from the Russia-Ukraine war: Proof of concept for AI-supported toxicological assessment of drinking water

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Background: Armed conflicts can affect the natural environment by damaging infrastructure and releasing hazardous substances into ecosystems. The ongoing Russian invasion of Ukraine has involved extensive artillery use, destruction of industrial facilities, and large-scale troop movements. As a result, water resources are particularly vulnerable to environmental contamination, potentially threatening drinking water safety and food quality. Rapid detection and toxicological risk assessment are therefore essential components of preventive health protection in crisis settings. Pharmacists contribute to these processes through expertise in toxicology, risk evaluation, and public health. On-site analysis using mobile field laboratories enables environmental monitoring under challenging conditions, where time is a critical factor. Integrating digital decision-support tools and artificial intelligence (AI) may further improve the speed and precision of toxicological risk evaluation.

Purpose: This contribution presents a literature review on water contamination caused by military activities during the Russia–Ukraine War and introduces a proof-of-concept for AI-supported toxicological assessment of drinking water samples in mobile field laboratories.

Method: A literature review was conducted to identify evidence on environmental contaminant release related to military activities in the Russia–Ukraine War, with a focus on water pollution and potential impacts on food safety. Scientific publications and reports addressing contamination sources, pollutant types, and toxicological implications were analysed. Based on these findings, requirements for expanding the analytical capabilities of mobile field laboratories were derived. In addition, a proof-of-concept was developed for integrating AI-supported data analysis into the toxicological evaluation of drinking water samples.

Results: The literature review indicates that military activities during the conflict significantly affect water quality through infrastructure damage and pollutant release. Reported contaminants include explosives, heavy metals, and radionuclides. These substances may enter water systems and agricultural environments, potentially affecting drinking water safety and food production. Mobile field laboratories allow rapid on-site chemical analysis and risk assessment. The proposed AI-supported data evaluation demonstrates potential to improve interpretation of analytical results and accelerate toxicological assessment during crisis response.

Conclusion: Environmental contamination during armed conflict represents a major public health challenge. Combining systematic evidence on contamination risks with mobile analytical infrastructure and AI-supported data analysis may strengthen crisis preparedness and preventive health protection. Such approaches can support pharmacists in rapid risk assessment, public health decision-making, and protection of water and food safety within a One Health framework during military and humanitarian crises.

Gaps in Canadian provincial anthrax guidelines: Limited integration of post-exposure prophylaxis (PEP) vaccination and antitoxin treatment recommendations

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Background: Anthrax remains a rare but high-impact infectious disease with significant implications for public health preparedness, particularly given its potential for aerosolized release and use in bioterrorism. In Canada, the federal government provides the overarching public health framework for infectious diseases, while provincial and

territorial authorities operationalize guidelines to local contexts and implement region-specific interventions. Analysis of current provincial and territorial guidelines reveals inconsistencies in key aspects of anthrax post-exposure management. In particular, post-exposure prophylaxis (PEP) vaccination and antitoxin therapy, which are cornerstones of modern anthrax medical countermeasure strategies, are often absent or inadequately described. Such gaps may contribute to uneven preparedness across provinces and territories.

Context and Aim: This study aimed to examine Canadian provincial and territorial anthrax guidelines to identify (1) the presence or absence of PEP vaccination recommendations, (2) the inclusion of antitoxin treatment guidance, and (3) the presence of instructions for obtaining these medical countermeasures.

Method: A descriptive analysis was conducted on anthrax guidelines from available Canadian provinces (n=11) and territories, along with federal Public Health Agency of Canada (PHAC) guidance (n=1), using a standardized Excel extraction table. Variables included publication date, references to bioterrorism, inhalational anthrax treatment, post-exposure prophylaxis (PEP) recommendations, PEP vaccination guidance, and antitoxin availability. Variables were marked as present or absent in the Excel table and analyzed to identify gaps and areas of alignment.

Results: Standalone guidelines were identified for all provinces and territories except Prince Edward Island and Yukon Territory. PEP vaccination guidance was absent from the majority of guidelines. Only a small set, such as Alberta, Quebec, Saskatchewan and federal PHAC materials, explicitly referenced vaccination as a PEP option or noted its use in combination with antimicrobials. Only Saskatchewan explicitly mentioned the availability of the anthrax vaccine through the National Emergency Strategic Stockpile (NESS).

Antitoxin therapy recommendations were even less common, with only a few provinces (e.g., Saskatchewan and Ontario) providing explicit reference to anthrax immune globulin or detailing access through the NESS. Overall, more than half of the provinces provided no reference to PEP vaccination and no mention of antitoxin therapy.

Conclusion: This analysis highlights inconsistencies in anthrax preparedness guidance across Canadian jurisdictions. The frequent omission of PEP vaccination and antitoxin therapy from provincial and territorial guidelines suggests the need for updated, standardized, and more detailed recommendations to better support frontline clinicians and enhance overall preparedness.

Terrorism and public healthcare services in Nigeria: A comprehensive narrative review (1970-2023)

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Background: Since the 1970s, Nigeria has grappled with escalating terrorism threats, which have profoundly impacted the nation's healthcare landscape. The early years saw sporadic episodes of violent unrest linked to political dissatisfaction and ethnic tensions; however, the situation worsened dramatically in the early 2000s with the emergence of organized terrorist groups, and further worsened the health indices and the possibility of attaining the health related Millenium Development Goals. By 2021, over 350,000 deaths were attributed to the direct and indirect effects of terrorism, with millions displaced internally and externally.

Objective: The study narratively reviewed the effects of terrorism on public healthcare services in Nigeria to generate data for policy and planning.

Method: The study question was, "What are the trends in incidence, prevalence, burden, issues, and effects of terrorism on healthcare service in Nigeria?" A comprehensive literature review was conducted using PubMed, Scopus, African Journals Online (AJOL) and WHO's Global Health Observatory, and targeted studies from 1970 to 2023 that examined the impacts of terrorism on healthcare services in Nigeria. Search terms included "terrorism in Nigeria," "Boko Haram healthcare impact," and "healthcare in conflict zones." Sources such as government reports, peer-reviewed journal articles, and NGO publications were included to provide a broad perspective, and reports focused on Nigeria or sub-regions within Nigeria that examined terrorism were utilized for the study.

Results: Operation drawback at Lagos in 1976 led to delayed in healthcare response and restricted emergency services. Increased Boko Haram activities from 2009 led to closure of health centers due to violence. Chibock kidnappings in 2014 led to the mass displacement of healthcare workers from the northeast region. Attack on aid convoy at Yoke in 2021 led to the disruption of vaccination programs and aid delivery.

Conclusion: The impact of terrorism on Nigeria's healthcare system is profound, ranging from infrastructure destruction to diminished public health outcomes. The study suggested prioritizing resilience, security, and consistent access to healthcare in conflict-prone regions. Strengthening partnerships with international aid organizations and

securing long-term funding for healthcare infrastructure can help mitigate the effects of terrorism on Nigeria's healthcare landscape.

Pharmaceutical triage in disaster response: Simulation-based evaluation of a pharmacist counter model

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Background: Disasters frequently disrupt access to essential medicines, and interruptions in pharmacotherapy for chronic conditions have been recognised as a contributing factor to disaster-related deaths. Ensuring continuity of pharmacotherapy is therefore an important component of disaster medical response. In Tokyo, disaster response guidelines include the establishment of a "pharmacist counter" at medical relief stations to assess medication needs and support patients who have lost access to their regular medicines. The pharmacist counter originated during the 2011 Great East Japan Earthquake, when large numbers of evacuees sought continuation of their regular medications at Ishinomaki Red Cross Hospital. Pharmacists established a counter near the hospital entrance and collaborated with physicians to support prescription preparation and medicine supply. In Japan, the concept of "pharmaceutical triage" has been incorporated into educational programmes such as the Pharmacist Disaster Life Support (PhDLS) course of the Japanese Association for Disaster Medicine. This approach involves pharmacist-led assessment of medication needs, including reviewing medication histories, prioritising physician consultation, supporting prescribing decisions and facilitating medicine supply. However, the implementation of pharmaceutical triage through pharmacist counters has rarely been evaluated in disaster response simulations, particularly within multi-professional relief team settings. This study aimed to evaluate the feasibility and operational implications of implementing pharmaceutical triage through a pharmacist counter model in a disaster medical response simulation.

Method: A disaster medical response simulation was conducted based on the Tokyo Metropolitan disaster medical response framework. Pharmacists operated a pharmacist counter to perform pharmaceutical triage and respond to evacuees' medication needs. Pharmaceutical triage followed the PhDLS framework, categorising patients into triage levels (PT1–PT4) according to the need for physician consultation, continuation of regular medications, management with over-the-counter medicines or patient listening and reassurance when pharmacological intervention was not required. Participants included disaster-designated pharmacists and multi-professional relief team members. Following the simulation, a questionnaire survey assessed operational workflows, interprofessional collaboration and operational challenges, and open-ended responses were analysed thematically.

Results: The pharmacist counter functioned effectively in addressing medication-related needs during the simulation. In particular, collaboration with a mobile pharmacy was essential for supplying medications for chronic diseases, complementing medicines not covered by essential emergency stockpiles at relief stations. Patients were appropriately managed according to pharmaceutical triage categories (PT1–PT4), with PT1 cases referred for medical evaluation and transfer when necessary, demonstrating effective patient assessment and timely referral to physician-led care. However, operational challenges were identified, including the need for clearer role delineation, improved information sharing on available medicines, more efficient patient information management, and optimisation of patient flow, highlighting the importance of prior coordination and shared operational understanding.

Conclusion: Pharmacists working on the front line of disaster response play a crucial role in supporting continuity of pharmacotherapy and managing medicine supply. Strengthening operational systems that incorporate pharmaceutical triage is therefore essential. Furthermore, pharmaceutical triage may provide a useful framework for clarifying the role of pharmacists within the multi-professional and multi-organisational collaboration in disaster response. These findings further support the role of the disaster pharmaceutical coordinator system in pharmacologistics, including medicine allocation and supply.

Schmout your brain – A serious game designed to improve knowledge of chemical contamination risk management

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Background: Chemical, biological, radiological and nuclear (CBRN) agents represent serious threats in our contemporary world. Patient exposure to toxics chemicals is rare but critical,

so identifying of toxidromes and managing them is of crucial importance. Serious games are a gamified learning format that has been shown to enhance learning in an enjoyable atmosphere.

Purpose: To evaluate the extent of improvement in participants' knowledge of chemical intoxication management after playing a dedicated board game.

Method: The board game called "Schmout your brain" was developed and tested in small groups to validate the concept (2 versions of the game were available: beginners and experts). The board game was designed to represent the key stages in a patient's hospital journey, divided into 2 zones: emergency department (patient care) and pharmacy (toxicological information, inventory management). The game simulates the arrival of patients in the emergency department presenting a toxic syndrome caused by a chemical agent. Participants must work together to identify the toxic agent and determine how to treat it. It's a cooperative and interprofessional boardgame for 3 to 6 people. Prototypes were validated by an education specialist and specialists in gamification for healthcare professionals. The scientific content was validated by a physician specialized in CBRN. Then, the 2 versions were tested using pre- and post-tests (10 multiple-choice questions for beginners, 17 for experts) to assess the impact on participants' knowledge and satisfaction with the learning format (10 questions).

Results: The beginners' version was evaluated with 54 pharmacists over four sessions (3-6 participants per game). Mean correct-answer scores increased from 45% to 87% ($p < 0.05$), corresponding to an average improvement of 4.2 correct answers per participant. Satisfaction was high, >90% of participants agree/strongly agree with the interactive format (game structure, enjoyment, learning, and overall format scored). Understanding of game rules scored 71%. The experts' version was tested with 44 professionals over two sessions (9 pharmacists, 16 physicians, 12 nurses, 7 others). Participants were divided among 4 game boards. These sessions showing an average improvement in scores from 75% to 81% ($p < 0.05$; +1.3 correct answers after the game). Satisfaction was similarly high for the gamification format (≥90% agree/strongly agree), with game rules understanding at 86%.

Conclusion: Gamification for learning is highly appreciated by participants. It significantly improves the knowledge of healthcare professionals, as demonstrated by pre- and post-test measurements, with a particularly strong impact on beginners. This method can be used to learn about rare but critical situations such as CBRN risks and particularly the chemical toxics exposure.

Implementation of public health and interprofessional disaster and emergency preparedness and response training (PH-IDEPART) initiative

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Background: Public health intervention is often reactive to an incident or occurrence. Disasters and emergencies, whether natural or human-caused, can occur anytime and anywhere. For positive outcomes, public health emergency preparedness and response requires advanced planning, comprehensive response, just-in-time training and management, as well as interprofessional collaboration, which involves two or more professions learning about, from, and with each other.

Purpose: To describe the development and implementation of virtual Public Health and Interprofessional Disaster and Emergency Preparedness And Response Training (PH-IDEPART) for health professionals for effective collaboration and service.

Method: As part of a long-standing collaboration for public health and medical missions with a global partner in Vietnam, the need for public health training for health professionals at a clinic emerged. Thus, regular meetings were scheduled to identify specific topics, develop a plan to accommodate virtual delivery during a mutually agreeable time zone, and to create training materials in both English and Vietnamese. At the same time, an interprofessional training opportunity was identified at a local level in Maryland, United States. Therefore, a planning team was convened to meet regularly and identify partners, topics, format and timelines for a virtual webinar series. Expert speakers from many organizations were invited.

Results: A public health training initiative for health professionals was developed and implemented through a series of weekly virtual webinars for a clinic in Vietnam. Training topics included public health planning and implementation, epidemiology, ethics, and health behavior models. Meanwhile, an interprofessional webinar series was planned and offered virtually in Maryland, USA for health professionals across a wide array of settings. Training topics included natural and human-caused disasters and emergencies, strategies and systems for preparedness and response, opportunities for continuing professional development, interprofessional disaster management, as well as effective teamwork and communication across disciplines during all disaster phases.

Conclusion: The implementation of virtual interprofessional workshops and webinars addressed the global and local training needs for public health and disaster preparedness and response for professionals across a variety of health-related disciplines. This PH-IDEPART model can be continued and potentially replicated to meet the demands for health professionals who are trained to collaborate interprofessionally to meet the needs of diverse global and local patient populations to prepare and respond to public health disasters and emergencies.

Gaps in Canadian botulism treatment guidelines: Timely antitoxin administration and bioterrorism considerations remain underemphasized

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Background: Botulism is a rare but life-threatening public health emergency in which rapid administration of antitoxin, within 48 hours of symptom onset, can significantly reduce the duration of hospitalization, intensive care unit (ICU) stay, and mechanical ventilation duration. Although most cases of botulism occur through foodborne exposures in Canada, botulism is also a recognized potential bioterrorism agent, making timely recognition and coordinated response essential for both clinical care and national security. As a notifiable disease in Canada, with responsibility shared across federal and provincial/territorial governments, clear and consistent guidelines across provincial and territorial governments is critical to frontline preparedness and coordinated response. This work evaluates how current provincial and territorial guidelines address bioterrorism considerations and antitoxin administration in adult botulism patients.

Purpose: The objectives were to compare provincial and territorial botulism guidelines and identify gaps in bioterrorism considerations, requesting antitoxin, antitoxin timing (≤48 hours), and guidance on initiating antitoxin based on clinical suspicion without laboratory confirmation.

Method: We conducted a structured review of provincial and territorial botulism guidelines (n=14) and one federal guidance document using a standardized extraction table in Microsoft Excel. Each guideline was reviewed for explicit guidance on antitoxin timing (within 48 hours of symptom onset), instructions for obtaining antitoxin, discussion of bioterrorism considerations, and recommendations to initiate antitoxin therapy before laboratory confirmation of botulism. Findings were coded as present or absent and synthesized to identify gaps and areas of alignment.

Results: Guidelines were identified for all provinces and territories except Prince Edward Island; Quebec guidance included provincial-specific guidance and guidance specifically for the Nunavik region. Explicit bioterrorism management considerations appeared in only three provincial guidelines: Manitoba, New Brunswick, and Saskatchewan. Only Alberta, Manitoba, and Saskatchewan explicitly specified a ≤48-hour window for antitoxin administration. While most jurisdictions emphasized urgency, they did not define an optimal treatment window.

Most jurisdictions, including Alberta, British Columbia, Manitoba, Newfoundland and Labrador, Northwest Territories, Nunavut, Ontario, Quebec (Nunavik), Saskatchewan, and Yukon, advised clinicians to initiate treatment based on clinical suspicion rather than wait for laboratory confirmation. New Brunswick, Nova Scotia, and Quebec (province) lacked this explicit guidance.

While all available guidelines provided specific instructions on how to obtain antitoxin, several had not been updated in over five years, including Manitoba (October 2016), Newfoundland and Labrador (May 2018), Nova Scotia (February 2018), Nunavut (September 2015), and Yukon Territory (January 2019).

Conclusion: Overall, our review highlights variability across Canadian provincial and territorial botulism guidelines, particularly with regard to bioterrorism considerations and the timing of antitoxin administration. While most jurisdictions emphasize urgency and support initiating antitoxin based on clinical suspicion of botulism, explicit guidance on a ≤48-hour treatment window and bioterrorism management is limited. The findings suggest a need for updated, standardized, and more detailed guidance to support frontline clinicians and strengthen preparedness.