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A Scoping Review on Health Workforce Development Strategies in Health Emergency and Disaster Risk Management (Health EDRM) in the English language literature

A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Prehospital & Emergency Care

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Abstract

Background

With the effects of climate change and rapid urbanization, there is a growing number of disasters in the world. However, there is a lack of agreement on Health EDRM training methods and curriculum.

Objectives

The objectives of this review are to 1) describe and classify the current Health EDRM training curriculum and practices in the literature and 2) identify key common elements for Health EDRM educational activities from all curriculums reviewed.

Methodology

A scoping review was conducted using three databases: CINAHL, EMBASE and MEDLINE. Keywords and medical subject headings were used in the search strategy in this review.

Results

A total of 7392 papers were identified from the three databases after duplications removed. After the inclusion and exclusion criteria applied in the initial and full text screen, 25 papers were eligible in this study. There were 18 papers on Health EDRM training and 7 papers concerning competencies and curriculum.

Findings

There was a scarcity of literature on Health EDRM training with the whole of society approach to manage risks for all hazards. This review could not identify consensus in the curriculum or competencies required.

Background

Health Emergency and Disaster Risk Management (Health EDRM) is an umbrella term described by the WHO that captures the intersection of health and disaster risk management (1). The Sendai Framework for Disaster Risk Reduction (Sendai Framework) recognized health as the center for society's efforts in the reduction of vulnerabilities and risks in order to build resilience (2) .

The Framework encompasses the disciplines of risk and emergency management, epidemic preparedness and response, alongside with health systems strengthening (1); which does not only align disaster risk reduction goals, but also the United Nations (UN) Sustainable Development Goals and the Paris Agreement for Climate Change. Intersection of these major UN agreements and health is also being promoted (3). Strengthening Health EDRM is also essential for a resilient health system. Preparedness and response capacities can be built up with bottom-up approaches at community level up to national levels by individual disaster preparedness, disease prevention knowledge and skills, household plans and NGO participation. On the other hand, top-down approaches can be achieved via policy making, health service provision, and improved road and communication infrastructure at government level.

A Health EDRM meeting named 'Emergency and Disaster Risk Management for Health: New Frontiers for Public Health Science' back in 2016 recommended the research focus of Health EDRM should utilize all-hazards, all-needs, and all-phases approaches with a specific focus on particular health needs in a population and building health resilience in all

communities (4). This multidisciplinary and multisectoral approach underscored how different health sectors work with others to reduce health risks arising from emergency situations by reducing exposure and susceptibility to hazards in addition to the building of local and national level resilience. The Bangkok Principles for implementation of health aspects of the Framework echoed the above and called for in inter-operable, multi-sectoral approach to promote systematic cooperation, integration and coherence between disaster and health risk management (5); which were built on the shared need for risk assessment, surveillance, early warning systems, resilient infrastructure and coordinated incident management.

In the field of health workforce development for Health EDRM, the WHO Thematic Platform for Health EDRM Research Network (Health EDRM RN) was established to promote concerted efforts by scholars, government officials and other relevant stakeholders to generate better evidence necessary for policy-making and to implement practice for managing health risks associated with disasters (6). Experts from this panel identified gaps in current evidence for disaster risk management training, human resources management including motivation, deployment and retention of trained personnel, the development of the local workforce and its collaboration with external workers, common knowledge and competencies for Health EDRM.

Several factors that hinder the integration of health into national disaster risk reduction strategies were identified in a commentary in 2014. These include inadequate financing and knowledge base, bureaucracy and complex governance structures within countries and a lack of interdisciplinary interaction between health and other sectors (7). It also highlighted how

a high turnover rate of staff and part-time staff in different sectors would result in a dilution of skills and expertise.

Different levels of human resources for health in terms of availability, accessibility, acceptability, quality and effective coverage were delineated by the WHO (8). The systems highlighted the integrated use of data, policy and practice to plan for human resources development (9), and provided a systematic approach to analyse, plan, implement, monitor and evaluate health workers. It is essential that health systems be prepared to respond to all possible disasters in the future.

Current State of the Literature

Disaster risk management requires well-orchestrated all societal efforts with multidisciplinary involvement. Health EDRM covers all components of the disaster risk formula namely hazards and exposure, vulnerability, and the coping capacity in the local context. Given its multiple facets, it is also important to provide guidance on the recommended basic competencies and educational methodology.

From the experience from the Ebola virus disease outbreak in West Africa, it is clear both the trained healthcare workers and population preparedness and community resilience were equally important (10,11). Therefore, it is crucial to develop a cadre of appropriately trained local and international personnel with sufficient multisectoral working experience. However, there is scarce evidence available to guide how to establish a positive collaboration between local and external workforces, albeit guidelines for registration and monitoring of external

medical teams have been developed (12). Evaluation of training with measurable goals is also not widely practiced. A systematic review done by Gallardo et al 2015 highlighted the importance of relevant competency-based training to a wider audience in addition to simply healthcare workers (13). A systematic review by Daily et al. in 2010 reported that the terminology and set of competencies were heterogeneous which hinders development of standardized frameworks for universal training of disaster healthcare workers, despite the competencies that have been set forth by governments and professional groups (14).

Competence is a commonly used term, while the definition of the term remains controversial (15). Nelson et al, 1997 defined competence as a complex combination of knowledge, skills, and abilities demonstrated by organization members that are critical to the effective and efficient function of the organization. The European Centre for Disease Prevention and Control suggested that competence refers to an individual's behaviour when they put their competence into practice. When individuals are able to demonstrate knowledge and skills required in their profession, they are competent in performing their role or tasks (16).

A systematic review published in 2015 highlighted that there is a lack of agreement on definitions on disaster response and humanitarian assistance. For this reason, a comprehensive competencies framework was not possible (13). A recent survey has identified that the lack of competency-based training limits the abilities of Foreign Medical Team's (FMT) to respond to emergencies (17). For education and training to be effective, the setup of any curriculum should be based on a set of core competencies which would be necessary for the task required.

With the close relationship between 1) curriculum and competency with 2) healthcare and volunteer training, the current study aims to address the aforementioned knowledge gap in the form of scoping review and lay down the path for future Health EDRM workforce development strategy to inform policy and practice across the world. The findings of this study are timely to prepare the world for future disasters and pandemics.

Methodology

The current study is a scoping review of health workforce development for Health EDRM, of which aim is to identify the currently available literature. The review summarized the existing evidence in published literature. In this study, disasters are defined as "A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources."(18)

Scoping Review

The Joanna Briggs Institute (JBI) Reviewers' Manual 2015, Methodology for JBI Scoping Reviews, (19) was used. This includes identification of the research objective(s) and question(s); outlining the inclusion and exclusion criteria; identifying search strategies; extraction of the results; discussion of the results and drawing conclusions, including the implications for future practice and research.

Research Question

What is the current Health EDRM training curriculum and training in the literature?

Research Objectives

The objectives were:

1. To describe and classify the current Health EDRM training curriculum and competencies in the literature.
2. To identify key common elements for Health EDRM educational activities.

Research Hypothesis

This is a hypothesis generating study, so there is no a-priori hypothesis.

Inclusion Criteria

Articles included should fulfil all of the following criteria: 1) in English language, 2) literature suited to the definition of disaster or humanitarian crisis and 3) include training or curriculum development in Health EDRM.

Exclusion Criteria

Articles that fall into any of the following categories has been excluded: 1) workforce development activities based purely on military settings, 2) descriptions of the training of one single type of clinical procedure or surgery, 3) focus on the experience of the process of conducting research in disaster settings, or 4) conference abstracts, letters or editorials without full reporting data and articles without full text.

Search Strategies

A systematic approach was used for the literature search following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (20). Data synthesis of

the comprehensive review highlighted the research priorities and models for Health EDRM workforce development, and allowed identification of any potential research gaps.

English language literature published from 1990 to 11 Mar 2020 was included. Databases including CINAHL (1980), EMBASE (1980) and MEDLINE (1966) were used to conduct the search. Although MEDLINE is the largest database, CINAHL and EMBASE may cover journals that are not in MEDLINE. CINAHL includes literature for nursing and allied health while EMBASE includes biomedical literature. Therefore, three databases were used during the search.

A combination of the following search terms was used:

(*Disaster*.tw* ***OR*** *Public health emergenc*.tw* ***OR*** *Cris?s.tw* ***OR*** *Humanitarian.tw* ***OR*** *Complex emergenc*.tw* ***OR*** *Outbreak*.tw* ***OR*** *War.tw* ***OR*** *Conflict.tw)* ***AND***

(Exp Workforce ***OR*** *Exp Health Personnel* ***OR*** *Exp Emergency Responders* ***OR*** *Exp Volunteers* ***OR*** *Exp Personnel Management* ***OR*** *Exp Surge Capacity* ***OR*** *Exp Education* ***OR*** *Exp Quality of Health Care* ***OR*** *Exp Credentialing*).

The overall identified studies were exported to Rayyan QCRI to remove duplications. Initially, titles and abstracts were screened by a single reviewer, and the full text screen was conducted by two independent reviewers.

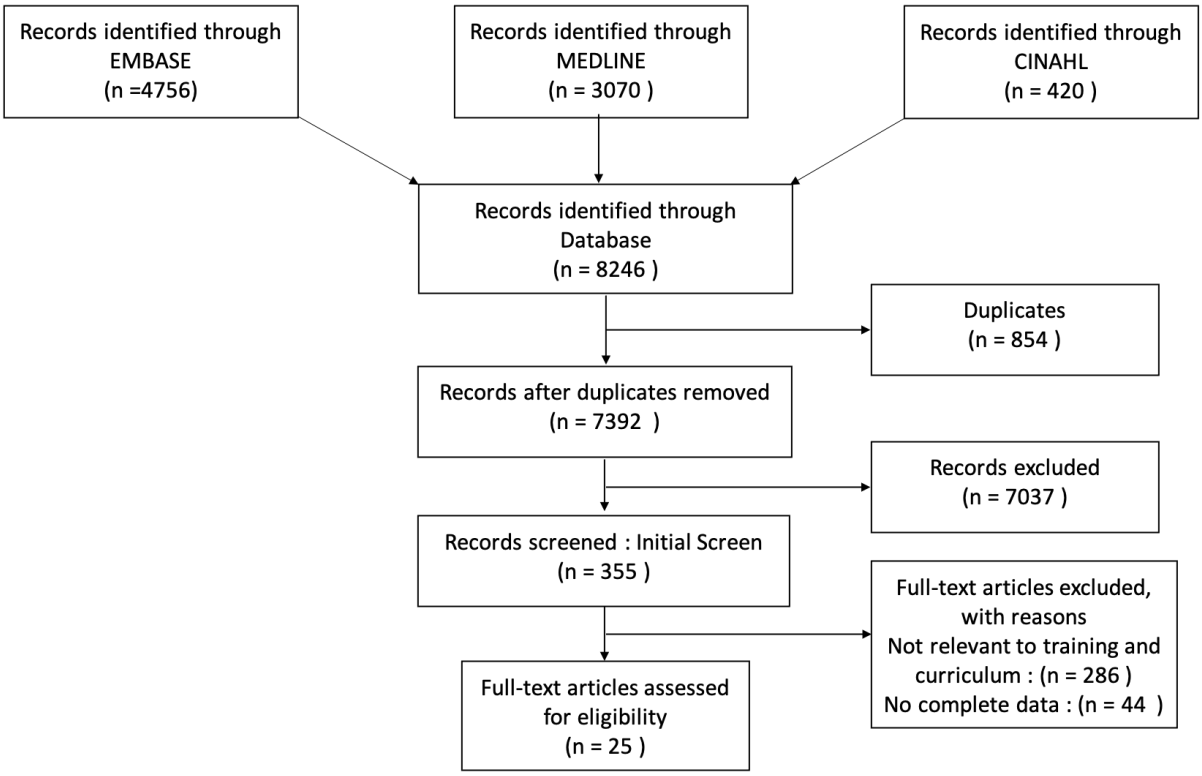

Figure 1: Literature search PRISMA flow diagram

Results

Figure 1 shows the flow diagram of the literature search. In total, 8246 records were found through databases (EMBASE, n = 4756; MEDLINE, n = 3070; CINAHL, n = 420) (Appendix 1,2,3), 854 of which were removed due to duplications. 7037 did not meet the inclusion criteria on initial screening. 330 were excluded during full text screening which were not relevant with the study, or did not have complete data and or were systematic reviews. A total of 25 papers were included in this scoping review. There were 18 papers on Health EDRM training and 7 papers concerning competencies and curriculum.

Table 1: List of papers included – Competencies and Curriculums

Author, Year, Country	Profession	Hazard	Clinical	Non-Clinical
Gebbie et al., 2002, USA (21)	Public health worker	All-hazard	1. Identify and locate the agency emergency response 2. Describe functional role(s) in emergency response and demonstrate role(s) in regular drills 3. Demonstrate correct use of all communication equipment used for emergency communication 4. Describe communication role(s) in emergency response	1. Describe the public health role in emergency response 2. Describe the chain of command in emergency response 3. Identify limits to own knowledge/skill/authority and identify key system resources for referring matters that exceed these limits 4. Apply creative problem solving and flexible thinking to unusual challenges within his/her functional responsibilities and evaluate effectiveness of all actions taken 5. Recognize deviations from the norm that might indicate an emergency and describe appropriate action
Markenson et al., 2005, USA (22)	Medical, dental, nursing and public health students	CBRNE	1. Emergency Management Principles 2. Terrorism and Public Health Emergency 3. Preparedness 4. Public Health Surveillance and Response 5. Patient Care for Disasters, Terrorism, and Public Health Emergencies 6. Risk assessment 7. Response roles 8. Decontamination procedures 9. Public health surveillance and response 10. Public health interventions 11. Take patients' medical histories 12. Conduct physical exams 13. Identify signs and symptoms 14. Interpret results 15. Perform diagnostic procedures 16. Identify signs and symptoms of stress reactions 17. Initiate physiological and psychological interventions for the treatment of CBRNE 18. Demonstrate the ability to recognize the needs of patients who may be victims of a CBRNE event	1. Have knowledge of all phases of disaster management 2. ICS 3. Integration with emergency management 4. Communication 5. Resources 6. Preparedness evaluation 7. Knowledge of CBRNE 8. List the categories of biological agents 9. List the major classes of chemical agents 10. List the types of radiation associated with potential terrorist activity 11. Principles and practice of surveillance 12. Know medications used for CBRNE
Polivka et al., 2008, USA (23)	Nursing	All-hazard	1. Identify ethical principles 2. Conduct rapid assessments 3. Respond using ICS 4. Engage in investigation and surveillance	1. Ensure personal preparedness 2. Define terminology 3. Identify risks 4. Know your roles

Author, Year, Country	Profession	Hazard	Clinical	Non-Clinical
			5. Perform public health triage 6. Identify psychological needs 7. Perform technical skills perfectly 8. Demonstrate the delivery of risk communication 9. Participate in debriefings 10. Assess psychosocial impacts 11. Identify immediate, short- and long-term impacts on community health 12. Educate communities about health issues 13. Participate in health problem solving efforts 14. Coordinate health services	5. Know all agencies that participate in disaster responses 6. Describe ICS 7. Know public health nurses' roles in a surge capacity 8. Understand communication systems 9. Know the disaster response plan 10. Collaborate with response teams 11. Identify the needs of the plan and preparedness efforts
Olson et al., 2008, USA (24)	Public health workers	Bioterrorism	1. Analytic assessment skills 2. Communication 3. Community dimensions of practice	1. Basic public health science skills 2. Cultural competency skills 3. Financial planning and management 4. Leadership and systems thinking 5. Policy development and program planning skills
Coule et al., 2009, USA (25)	Health care professionals and Emergency response personnel	All-hazard	1. DISASTER Paradigm and All-Hazards Preparedness 2. Mass Triage 3. Natural Disasters 4. Traumatic and Explosive Events 5. Nuclear and Radiological Events 6. Chemical Events 7. Biological Events (including naturally occurring infectious diseases) 8. Mass Fatality Management 9. Hazards and vulnerability assessment 10. Disaster Clinical Skills (Mass Immunization and Mass prophylaxis)	1. Medical Decontamination 2. Community Disaster Planning 3. Surveillance and public health systems 4. Mass prophylaxis distribution 5. Strategic national stockpile information 6. Regional public health and emergency management information 7. Contact information for public health and emergency management 8. Public Health and Local Disaster Response
Peller et al., 2013, Canada (26)	All health care professional in DMAT	All-hazard	NA	1. Austere environmental skills 2. Interpersonal skills 3. Cognitive skills 4. Interprofessional collaboration
Sarin et al., 2017, USA (27)	Emergency Medicine residents	All-hazard	1. Patient triage (96%) 2. Decontamination (96%) 3. Recognition and Initiation (90.67%) 4. Response team (42.67%) 5. Public health and safety (80%)	1. ICS (89.67%) 2. Communication (82.67%) 3. Resource management (85.3%) 4. Volunteer management (56%) 5. Critical thinking (85.3%)

Author, Year, Country	Profession	Hazard	Clinical	Non-Clinical
			6. Surge capacity (90.67%) 7. Patient ID and tracking (82.67%) 8. Transportation (68%) 9. Clinical consideration (84%) 10. Special needs populations (54.67%) 11. Evacuation (66.67%) 12. Psychosocial issues (66.67%) 13. Mass fatality management (73.34%)	6. Ethical principles (82.67%)

Note: CBRNE = Chemical, biological, radiological, nuclear and explosives; ICS = Incident Command System; DMAT = Disaster Medical Assistant Team

Competencies and Curriculums

Table 1 summarised the articles related to competencies and curriculum of disaster training, there are seven articles identified. Five is related to all-hazard and two is related to chemical, biological, radiological, nuclear and explosives (CBRNE) Six of the studies are from the USA and one is from Canada.

All-hazard

In the study conducted by Gebbie et al in 2002, it described how the project identified emergency preparedness and response competencies for public health workers (21). After identification of the most needed core competencies by the expert panel, the identified competencies were assessed by public health agency representatives. Nine competencies were identified for all public health workers. Public health workers should be capable to delineate public health role, chain of command, functional role and communication role in emergency response. Also, they should be able to recognise and locate the agency emergency response plan, key exceeding recourses and their own limits including knowledge, skills or authority. Besides correct use of communication equipment, creative problem-solving skills are important for public health workers in emergency response.

The study done by Polivka et al in 2008 identified 25 public health nursing competencies by an expert panel (23). The 25 competencies were categorised into three phase of disaster, Preparedness (n=9), Response (n=8) and Recovery (n=7). The competencies in Preparedness focus on personal preparedness, communication and basic knowledge and role of disaster preparedness. Response phase competencies including rapid needs assessment, outbreak analyse and surveillance and mass dispensing. Modification of disaster plan, identify the

psychosocial impact, debriefing, refer exceeding health services are the Recovery competencies.

The study done by Coule et al in 2009, there's several competencies identified in the National Disaster Life Support (NDLS) (25). The competencies include the DISASTER Paradigm, mass fatality management, mass triage, hazards and vulnerability assessment, mass dispensing, medical decontamination, community disaster planning, surveillance, public health and local disaster response and resources.

Peller et al interviewed 10 Canadian Disaster Medical Assistance (DMAT) members in 2013 to explore nonclinical core-competencies (26). Four nonclinical competencies were identified during the interview: austere environmental skills, interpersonal skills, cognitive skills and interprofessional collaboration.

Sarin et al distributed an electronic survey to 183 emergency residency medical directors in 2014 to assess the residency background and the most common taught and the least common taught competencies in the training program (27). 75 directors completed the survey and the most common competencies taught were patient triage and decontamination (96%), and the least common competencies taught were working with response teams (42.67%), special needs populations (54.67%) and volunteer management (56%)

Chemical, biological, radiological, nuclear and explosives (CBRNE)

Markenson et al developed a list of core competencies related to CBRNE with a team of experts from four health profession schools of Columbia University in New York City in 2003-

2004 (22). The competencies were mainly for teaching medical, dental, nursing and public health students. The list of competencies was identified into four categories: emergency management principles, terrorism, public health surveillance and patient care in emergencies. For emergency management principles, students should be able to describe the phases of disaster management, roles in disaster management, hazards of risk assessment, concepts of incident command system, communication principles and liaison with the government resources and authority. In the area of terrorism, students should have knowledge of CBRNE, including the categories of biological agents, major classes of chemical agents, type of radiations, basic principle of selection of personal protective equipment and the principles of decontamination.

In the area of public health surveillance and response, students should be able to describe and apply the principles of surveillance and reporting of potential or actual emergencies, collect patient data for surveillance and identify the emergency responses for the public health emergencies. Patient care in emergencies including medical history taking, physical exams, identifying the signs and symptoms for CBRNE agent exposure, interpret results, management in CBRNE agents. Although the expert team has come out the list of competencies for the health professional's students, this study also emphasizes the differences between educational competencies and occupational competencies.

In the study conducted by Olson et al in 2008 described how the University of Minnesota School of Public Health (UMNSPH) implemented a model curriculum to train public health workers (24). This study identified 68 core competencies and grouped them into eight domains: analytic assessment skills, communication, community dimensions of practice, basic

public health science skills, cultural competency skills, financial planning and management, leadership and systems thinking and policy development and program planning skills.

Table 2: List of papers included – Health EDRM training

Author, Year, Country	Hazard	Training Level	Profession	Education Method, Education Duration	Evaluation Method, Follow up time	Outcomes	Changes
Matthews et al., 2005, USA (28)	All-hazard	Community	Nurse, pharmacists, physicians, non-medical volunteers	PowerPoint presentation, video, handouts and role-play exercises, 3 hours	Pre-test and Post-test, evaluation	First session Pre-test: 55% Post-test: 93% Second session Pre-test: 64% Post-test: 92%	First session: 38% Second session: 28%
Pryor et al., 2006, USA (29)	CBRN	Professional	Healthcare professions	Table-top exercises and lecture, 4 days	Course evaluation form, Pre and post course assessment form, Not specific	Pre-course, Post-course mean: Course 1: 43.3, 72.1 Course 2: 45.8, 72.0 Course 3: 49.5, 71,8 Course 4: 51.1, 74.8 Course 5: 47.7, 67.5 Course 6: 47.8, 74.2 Course 7: 43.6, 71.8 Course 8: 48.5, 68.2 Increased self-assessed capability to respond to WMD incidents.	Course 1: 28.7 Course 2: 26.3 Course 3: 22.3 Course 4: 23.7 Course 5: 19.8 Course 6: 26.4 Course 7: 28.1 Course 8: 19.7
Leiba et al., 2007, Israel (30)	CBRN	Professional	Physicians and nurses from emergency department and internal medicine	Lectures, Not Specific	Drills, 2-6 months after the lectures were given	The average score of physicians who attended the lecture was 86%, while those who did not attend the lectures averaged 78.3% Emergency department physicians were found to be highly knowledgeable in the response to different bioterrorist threats.	7.7%
Collander et al., 2008, USA (31)	All-hazard	Professional	Physicians, nurses, administrators/ directors and other personnel (protective services, emergency medical technicians and non-clinical support)	Lectures, disaster exercises, skills sessions, and a tabletop session, 2days (16hours)	Pre and post evaluation and course evaluation survey, Not specific	Average pre-test was 69.1 ±12.8 for all positions, and the post-test score was 89.5 ±6.7. Report knowledge gain and high satisfaction of the HDLS.	20.4 (p <0.0001,17.2-23.5)

Author, Year, Country	Hazard	Training Level	Profession	Education Method, Education Duration	Evaluation Method, Follow up time	Outcomes	Changes
Fox et al., 2008, USA (32)	All-hazard	Professional	Nurses	Presentation and discussion, 80 minutes	Pre-test and post-test and follow-up survey, 2 year	The aggregate mean pretest score was 71%; the mean posttest score was 91%, and 2-year posttest score was 67%. Most of the nurses have baseline knowledge about paediatric disaster management. Increased knowledge level after program Reduction in retention of information	Post-test: 20% 2 years FU: -24%
Chandler et al., 2008, USA (33)	All-hazard	Professional	Public health workers	Online and face-to-face training, Not specific	Online Survey, pre- and post-tests	Mean pre-test score: 72.1683 Mean post-test score: 94.2544	22.0861
Nyamathi et al., 2010, USA (34)	CBRN	Professional and Undergraduate	Nurses and nursing students	Online orientation session, 20 minutes	Pre and post-test and 3 months after training	CBET group Pre-test: 2677 Post-test: 3491 SBET group Pre-test: 3,265 Post-test: 3,812	CBET: 814 SBET: 547
Hites et al., 2011, USA (35)	All-hazard	Community	Health workers, others and students	Online video seminars	Scenario-based pre and post-test	Competencies: 1. Describe the public heath role in emergency response in a range of emergencies that might arise Median pre-course scores: 2 Median post-course scores: 3 2. Describe the chain of command in emergency response Median pre-course scores: 1 Median post-course scores: 2 3. Describe his/her functional role(s) in emergency response and demonstrate his/her role(s) in regular drills Median pre-course scores: 3 Median post-course scores: 5 4. Demonstrate correct use of all	1. 1 2. 1 3. 2 4. No changes 5. 1

Author, Year, Country	Hazard	Training Level	Profession	Education Method, Education Duration	Evaluation Method, Follow up time	Outcomes	Changes
						communication equipment used for emergency communication (phone, fax, radio, etc.) Median pre-course scores: 0 Median post-course scores: 0 5. Describe communication role(s) in emergency response (within agency, media, general public, personal) Median pre-course scores: 0 Median post-course scores: 1 6. Recognize deviations from the norm that might indicate an emergency and describe appropriate action Median pre-course scores: 0 Median post-course scores: 1	
Aghaei et al., 2012, Iran (36)	CBRN	Professional	Nurses	Lectures, 4 hours	Pre- and post-self-administered questionnaires	Mean knowledge before education: 14.79 Mean knowledge after education: 94.43 Mean attitude score before education: 55.5 Mean attitude score after education: 85.46	Knowledge: 79.64 Attitude: 29.96
Jones et al., 2014, USA (37)	All-hazard	Professional	First responders	Simulation training, 5 hours	Pre-test, post-test and course assessment	The mean pre-test and post-test scored from 46.3 to 75.3(P<.0001) The mean attitude score from 55.5 to 85.46 (p<0.001)	29.0
Carlos et al., 2015, Philippines (38)	Biological	Professional	Healthcare professions	Lectures and practical sessions, 3 days	Pre- and post-workshop test, post-workshop evaluation and one-minute reflection	The median pre-test and post-test scored from 7 to 9 (P < 0.009) Knowledge about EVD increased significantly Knowledge on transmission remained suboptimal	

Author, Year, Country	Hazard	Training Level	Profession	Education Method, Education Duration	Evaluation Method, Follow up time	Outcomes	Changes
						Confidence in managing EVD increased significantly (P = 0.018)	
Patel et al., 2015, Nigeria (39)	Biological	Community	Not Specify	Two days training workshop	Pre and Post training questionnaires	Average pre-test score: 7.3 Average post-test score: 7.8 Identify hand washing is best way to prevent Ebola (93% Pre and 100% Post) Dead bodies could still be infected (83% Pre and 93% Post) Ebola should go to the nearest hospital (88% Pre and 93% Post)	Average score: 0.5
Otu et al., 2016, Nigeria (40)	Biological	Professional	Healthcare professions	Tablet computer tutorial	Before and after survey	Knowledge pre-score: 61.6% Knowledge post-score: 68.2% Willing to perform frequent hand washing, disinfection of surfaces and equipment (from 95% to 97%) Use of personal protective equipment to prevent transmission of Ebola (from 94% to 97%)	Knowledge: 6.6%
Soeters et al., 2018, Guinea (41)	Biological	Professional	Healthcare workers	Lectures and hands-on workshop, 3 to 4 days	Pre and Post multiple choices test	(a) Median Knowledge score Trainers: From 23 to 28 Supervisors: From 23 to 28 Frontline HCW: From 17 to 25 (b) Donning/doffing Personal Protective Equipment Trainers: 83% Supervisors: 97% Frontline HCW: 70% (c) Preparation of chlorinated water Trainers: 81% Supervisors: 79% Frontline HCW: 80%	Pre and Post test score Trainers: 21% Supervisors: 15% Frontline HCW: 40%
Cathcart et al., 2018, USA (42)	Biological	Professional	Healthcare professions	Just-in-time training, 2 days	Pre and Post training survey and Follow-up survey, Not specific	Pre-training survey score: 2.2 Post-training survey score: 4.0 Follow-up survey score was 4.3	Post-test: 1.8 Follow-up: 0.3

Author, Year, Country	Hazard	Training Level	Profession	Education Method, Education Duration	Evaluation Method, Follow up time	Outcomes	Changes
Greco et al., 2018, USA (43)	All-hazard	Undergraduate	Nursing students	Simulation training	Pre and post survey	Confidence Pre-simulation: 4.08 Post-simulation: 4.46 Importance Pre-simulation: 4.7 Post-simulation: 4.85	Confidence: 0.38 Importance: 0.15
Bemah et al., 2019, Liberia (44)	Biological	Professional	Healthcare professions	Lecture, simulation, practical, 8 days	Pre- and post-training knowledge assessment	The average change in knowledge was significantly higher for clinicians than for non-clinicians (p=0.006)	Mean changes Clinicians: 28.2 Non-clinician: 22.7
Noh et al., 2020, Seoul (45)	All-hazard	Professional	Nurses	Virtual simulation, mannequin simulation and table top exercise, 12 hours	Performance checklist and questionnaires	Disaster perception Preintervention: 162.87 ± 5.99 Postintervention: 224.71 ± 5.29 Triage (virtual reality) Preintervention: 24.37 ± 3.37 Postintervention: 35.33 ± 2.78 Triage (table top) Preintervention: 26.83 ± 2.71 Postintervention: 33.67 ± 1.21 Crisis management (self-assessment) Preintervention: 107.92 ± 14.63 Postintervention: 127.65 ± 9.71 Crisis management (observation) Preintervention: 30.67 ± 4.27 Postintervention: 78.83 ± 5.27 Problem solving Preintervention: 13.23 ± 0.87 Postintervention: 27.35 ± 1.45	Disaster perception 61.83 ± 8.69 Triage (virtual reality) 10.97 ± 3.20 Triage (table top) 6.84 ± 2.04 Crisis management (self-assessment) 19.73 ± 3.46 Crisis management (observation) 48.17 ± 7.11 Problem solving 14.12 ± 0.93

Note: CBRN = Chemical, biological, radiological and nuclear; HDLS = Hospital Disaster Life Support; CBET = computerized bioterrorism education and training; SBET = Standard Bioterrorism Education and Training; EVD = Ebola Virus Disease; CASPER = Community Assessment for Public Health Emergency Response

Health EDRM training

Table 2 summarized included literature for Health EDRM training based on country, hazard, training level, education method, evaluation and outcomes. A total of 18 papers were identified for this group, of which nine cover all-hazards, three cover chemical, biological, radiological and nuclear (CBRN) hazards and six cover biological hazards.

Ten of them are from USA, four of them are from Africa country Guinea, Nigeria and Liberia, two of them are from middle-east country Israel and Iran, two of them are from Asia which are Seoul and Philippines.

Training method focused in lectures, table-top exercises, simulation training, just-in-time training and online videos. Participants from the studies included physicians, nurses, students, other hospital personnel and non-medical volunteers.

All-hazards

To address the manpower shortage in nursing staff in Vermont by Matthews et al. in 2005 (28), the regional health authority developed training programs which aimed to recruit and train inactive healthcare professionals (such as those retired or having less than required practice hours over the past 5 years) and community volunteers in the event of natural or man-made disasters. The training included PowerPoint presentation handouts, videos and role-playing exercises that covered the content of capacities, namely workforce, information systems, laboratory, surveillance and response. The training also provided hands-on perspectives about volunteering in emergency situations, and personal preparedness as a citizen and a volunteer. The 3-hour training program was able to achieve improvement in 10-

questions evaluation on knowledge of general emergency preparedness questions from 55% to 93% in the first session, 64% to 92% in the second session. Participants also reported high satisfaction for the program, scoring 4.8 out of 5. The study, on the other hand, highlighted the challenge in finding a convenient time for a large group of volunteers in addition to maintaining contact and communication with volunteers to sustain their interest and skill level.

In the study conducted by Collander et al in 2008, 84 hospital employees across different job nature including non-clinical staff were given a 2-day (16-hour) course in Hospital Disaster Life Support (HDLS) including a classroom lectures, disaster exercises, skills sessions and tabletop sessions (31). A statistically significant improvement in core competencies was noted, namely recognition of potential critical events and implement initial actions, application of principles of critical event management, critical event safety principles, institutional emergency operations plan, critical event communications, incident command systems, and knowledge and skills needed for a specific role during critical events. Participants also expressed that the course fulfilled their educational needs and they felt confident in using the newly learned knowledge. Overall, the author concluded that HDLS is effective.

Fox et al in 2008 conducted a program related to pediatric disaster preparedness and provided as nursing education day's program to 45 paediatric nurses in a level one trauma center in 2005 (32). The program included the basic terms and concepts in disaster medicine, mainly focus on different types of weapons of mass destructions. Also, pediatric considerations during disaster were addressed in the program. Pre-test was done prior to the program to assess baseline knowledge of participants, post-test was performed right after

the program to assess immediate effect and two years later, same post-test were conducted to evaluate the long-term retention of knowledge. Mean pre-test score was 71%, mean post-test score was 91% and the 2-year post-test score was 67%. These shows that most of the pediatric nurses have baseline knowledge in disaster preparedness, and there's increasing knowledge after the program. However, there's 10 participants did not return the 2-year follow-up post-test, and there is a reduction of knowledge about pediatric disasters.

Research has demonstrated the benefits of competency-based training in face-to-face learning environments (33). To understand further the role of web-based teaching, the Columbia University's Center for Public Health Preparedness was designed to be delivered in two parts including an online-training program for basic knowledge of public health preparedness, and a downloadable template to guide learning and subsequent demonstration of core competencies to respective supervisors. Out of the 764 surveys collected from the public health workers, 85.8% reported being more knowledgeable about the basic emergency preparedness core competencies, 82.2% felt they had better understand of the chain of command during emergency response and 79.6% expressed gaining more knowledge about their functional role in emergency response. The mean scores for pre- and post-training test scores also showed improvement from 72.2 to a significantly higher score of 94.3.

The study conducted by Nyamathi et al in 2010 evaluated the performance of nurses responding to bioterrorism before and after a training program and further investigated the effect of computerized training as compared to standard didactic training (34). Both computerized and standard programs were shown to improve nurses' problem solving skills

related to specific biological agents. Nurses who participated in the computerized program also required less reliance on consultation, and both groups had a reduced use of unnecessary investigations after the training. Therefore, the author also suggested that independent problem-solving could be enhanced by computerized education and training program, which would be crucial in handling mass casualty situations such as in the event of biological agent terrorism.

Competency-based training is the mainstay of training for Public Health Emergency Preparedness (PHEP) training and a core set of bioterrorism competency was first released by CDC in 2001. The Arizona Center for Public Health Preparedness developed a training program for Community Health Representatives of American Indians in the format of E-learning in the form of awareness-level emergency preparedness certificate program (35). It was developed as 25-35 hours video seminar series. The study then evaluated the impact of the program which demonstrated a statistically significant improvement in five out of six core competencies assessed in the program, namely the ability to describe the public health role in emergency response in a range of emergencies, chain of command in emergency response individual functional role in emergency response and demonstrate individual's role in drills, communication roles in emergency response, and recognition of deviations from the normal that might indicate an emergency and describe the appropriate action.

In the study conducted by Jones et al in 2014, 195 first responders completed the course developed by The Center for Health Professional Training and Emergency Response (CHPTER) competency-based curriculum (37). During the 5-hours course, the participants are required to attend a brief lecture and work in small groups for scenario-based training. The self-

assessment was complete before and after the training. The mean pre-test score and post-test score increased from 46.3 to 75.3 ($p<0.0001$). This study shows that the simulation training increased participant's knowledge and improved their comfort level in handling public health emergencies during disaster situations.

Another study done in the USA by Greco et al. in 2019 involving 90 nursing students who worked in pairs and were given a 15-mins disasters simulation with supply bags of first-aid materials to assess victims, prioritize patients and communicate (43). The students were also provided with lectures on Simple Triage and Rapid Treatment (START) system, ethical reasoning and ethics of early disaster response. After the program, students' confidence in ethical reasoning improved and the perceived importance also increased. The authors therefore concluded that simulations are an effective educational approach.

The study done by Noh et al. in Korea in 2016 aimed to develop and evaluate a simulation program for enhancing hospital nurses' disaster competency, which proves how a structured and standardized training program can lead to positive change in competency (45). Multiple modalities were employed as teaching tools to simulate the complex nature of disasters. The program covered five areas of contents including triage, incident command, surge capacity, procedures and special situations. These are the competencies that were obtained via the modified Delphi survey. 40 emergency nurses were randomly selected to participate in this 12-hour training program consisting of virtual simulation, table-top exercise, part-task trainers and full-bodied mannequin. After the training program, participants' competencies improved significantly and the satisfaction score was 9.54 +/- 0.72 out of 10.

Chemical, biological, radiological, nuclear and explosives (CBRNE)

In the study done by Pryor et al, 414 health care professions including nurses, physicians and EMS personnel attended one of the eight courses offering between March and August 2003 (29). Each of the course lasted four days and included functional groups and table-top exercise, scenarios involving biological and chemical events, multiple-casualty incidents. A pre-course capability assessment was done on day one and the post-course assessment were assessed at the end of day four. The pre-course mean score varied from 43.3 to 48.5 among eight courses and the post-course mean score varied from 67.5 to 74.8 among eight courses. Overall changes of scores from 19.7 to 28.7 ($p<0.0001$), which shows increased self- assessed capability to respond to weapons of mass destruction.

In the study done by Leiba et al in 2007 showed that emergency physicians are knowledgeable in response to bioterrorism(30). This can be augmented with didactic lectures despite the pervasiveness of internet technology and can be reflected from their performance in a surprise drill even around 2-6 months after the lecture. Those who attended the lecture achieved a higher score (86%) than those who did not (78.3%), although this did not reach statistical significance ($p>0.05$). It is worthwhile to note that a high level of knowledge cannot be obtained from a single lecture or drill alone but through continued learning through exposure to different modalities of educational tools. The study highlighted the importance of emergency physicians as a carefully selected group of clinicians who also serve as the interface between individual and population health.

Aghaei et al in 2012 assessed the effect of bioterrorism education on nurse's knowledge and attitudes among 65 nurses who works in one of the emergency departments or infectious

disease wards and internal medicine wards (36). The program has two two-hours lectures, pre-course and post-course questionnaires were given to assess the attitude and knowledge of participants. A pre-course questionnaire was given to participants and a post-course questionnaire was given one month after the program. The mean knowledge score before and after education was 14.79 and 94.43 ($p=0.001$); the mean attitude score before and after education was 55.5 and 85.46 ($p<0.001$).

Biological hazard

The study conducted by Carlos et al in 2015 collaborated with the Philippine Department of Health to conduct a three days' workshop to train 364 doctors, nurses and medical technologists from 78 hospitals in Philippines to help guide their hospital for Ebola preparedness (38). The workshop consisted of lectures and small groups practical sessions, which include personal protective equipment (PPE) donning and doffing skills. The pre-and post-workshop test were given to participants on day one and day three of the workshop, which the median scored from seven to nine pre- and post-workshop respectively. For assessing the participants' level of confidence, the statement "I am confident that I can be safe when caring for a patient with Ebola virus disease (EVD)" was rated disagreed or strongly disagreed from 27.3% to 2.6% pre- and post-workshop respectively ($p=0.018$). The study concluded that the workshop could increase participants' knowledge in EVD and increased their confidence on handling EVD.

The study conducted by Patel et al in 2015, 54 volunteer health advisors attended a 2-days Healthy Beginning Initiative (HBI) workshop in Ebola awareness training session. Pre-training questionnaire was disposed to participants before the start of training (39). Questions were

related to knowledge of Ebola such as: epidemiology, symptoms, transmission, preventive measures and treatment. Participants will complete the same questionnaire the day after the training. The average pre-test score was 7.3 and post-test score was 7.8 (p=0.01). 93% of participants can be identify that hand washing is the best way to prevent Ebola before training, and it rose to 100% after training. 83% of participants identified dead bodies could be infectious before training, and it rose to 93% after training. 88% of participants recognised that Ebola should go to the nearest hospital prior to training which it rose to 93% after training session. Study concluded that there's significant difference of Ebola knowledge prior to the training, however it was not significant after training.

Study conducted by Otu et al in 2016 in Nigeria involving 203 healthcare workers, pre- and post-education assessment were given to participants to assess their knowledge, attitude and practice in EVD (40). Ebola awareness tutorial (EAT) will be provided as the format of tablet computer tutorial, the course content includes the basic epidemiology, clinical features, management and prevention of the disease. The average knowledge of pre-EAT was 61.6% and post-EAT was 68.2%. There was an 11% improvement in the score ($p<0.05$), so there's a statistically significant improvement for the knowledge of EVD after the tutorial. The study also reported that more participants are willing to perform frequent hand washing, disinfection of surfaces and equipment (from 95% to 97%) and use of personal protective equipment to prevent transmission of Ebola (from 94% to 97%). The study concluded that the EAT can improve the knowledge and attitude changes toward EVD.

A study from Guinea by Soeters et al in 2018 involved 1625 healthcare workers, who were given training including didactic and hands-on training (41). The median pre- and post-

knowledge score in three groups were trainers (23 to 28), supervisors (23 to 28) and frontline health care workers (17-25), the percent increase in test score in IPC trainer, supervisors and frontline health care workers are 21%, 15% and 40% respectively. In the practical evaluation on donning or doffing personal protective equipment and preparation of chlorinated water, the majority of healthcare workers received a score of “acceptable” after the training.

In the study conducted by Cathcart et al in 2018, the Applied Learning and Development Team (ALDL) at the Centre for Disease Control and Prevention (CDC) created a 2-days just-in-time training for 120 new staff of the CDC State Coordinated Task Force (SCTF) (42). The pre-training, post-training and follow up evaluations were completed by the participants. The average training scores were 2.2, 4.0 and 4.3 respectively.

In the study done by African authors from countries affected by Ebola virus disease (EVD), Bemah et al in 2019 reviewed training programs, and multinational healthcare workers and non-clinicians participated in training programs and were evaluated on their knowledge and confidence on their knowledge of an Ebola Treatment Unit, safety and quality, rapid response team training and simulation (44). The mean changes of pre-post training scores was 28.2 and 22.7 for clinicians and non-clinicians respectively. It shows that knowledge was significantly better for clinicians than non-clinicians ($p=0.006$). The improvement in knowledge may have contributed to the real-world benefit of reduced infection of healthcare workers. The authors also suggested that the training programs may serve as an entry point for establishing epidemic preparedness and response frameworks. As suggested by the author, factors other than education may contribute to such benefits such as increase in PPE supplies. Strong

leadership, coordination and cooperation between health authorities and implementing partners would be equally important in management of EVD.

Discussion

Competence and training are closely interlinked as competence defined the skills set required for a certain standard. For this reason, defining the core competence would serve as the cornerstone for disaster healthcare training. Our findings however highlighted the various competencies in the current literature in a spectrum of studies. Due to the heterogeneity of study designs and definitions, it is challenging to classify the cited competencies into meaningful groups. The current study thus classified the identified competence into clinical and non-clinical to underscore the complexity of disasters which require concerted efforts which are multisectoral, multidisciplinary and collaborative.

Competencies are merely a set of skills as an individual but also requiring the understanding of the role and the awareness of an individual when working as a team. Although there are variations, the recurring theme of role identification showed its importance for the healthcare system to efficiently respond to disasters. From our findings, it appears that training can start as early as the undergraduate period. Incorporating concepts and knowledge of Health EDRM certainly would help build up local resilience when disasters arise. It would take time for undergraduates to receive adequate training before they can be deployed as manpower for disaster response to fully utilize their ability and knowledge as healthcare workers as professionals, the promising results from the identified studies showed the feasibility that even non-healthcare hospital workers can be trained in certain areas relevant to disaster risk management. This would potentially expand the source of manpower when disasters occur

that inevitably hinder certain proportion of usual expected manpower from working at its full capacity, such as the breakdown of transport system and other infrastructure during a natural disaster such as a typhoon.

Another finding identified in the current study is that nurses are the most representative cadre which is consistent with the findings of Gallardo et al. (13). The training involving different healthcare or healthcare-related workers would also provide a platform for healthcare workers that do not usually interact to allow engagement that is essential in creating bonding between different roles. It is of paramount importance to maintain such bonding and engagement as a high turnover and part-time role of staff in these sectors could contribute to the risk of a rapid dilution of skills and expertise. This could be achieved by providing on-the job training.

It is observed that in our study most of the training program evaluate the participants knowledge within a relatively short period of time with mostly evaluating before and after the program, and the longest follow up period was 2 years. It would be worthwhile to study the degree of knowledge degradation over time and to explore the optimum interval for refresher training. With the train-the-trainer approach, the dispersal of knowledge can be speed up in time of disasters to provide just-in-time training. It would be equally important to evaluate the response after settling each disaster to nurture to growing body of knowledge of disaster management.

In attempt to develop a generic approach for competence-based healthcare training, five out of the seven identified studies aimed to provide training for general disaster management.

Conceivably, the development of such generic approaches may imply the expense of loss of specific training to a particular type of hazard. Irrespective of the differences in approach, it is crucial to develop evidence-based training to set up internationally recognized standards in order to provide a scientific basis for accreditation, and in turn professionalization of disaster risk management. A recent example of a global mechanism to improve emergency preparedness, readiness and response was the establishment of WHO emergency medical teams (46).

The current studies identified, although heterogenous, serve as a pool of important empirical evidence for the future development of curricula. Another interesting observation from the current study is the use of information technology in the training emerged as an increasingly popular means for training delivery over time. Further study would be necessary to perform head-to-head comparisons between lectures and online learning in terms of the effectiveness of lectures with the increasingly pervasive nature of mobile internet technology and virtual or augmented reality.

Most of the English language literature included in the current study are conducted from the United States of America and Africa. The USA is constantly exposed to various form of terrorism and natural disasters, and since the 9/11 event huge resources have been devoted to scientific research on disaster preparedness and response. These factors may account for the observation that most of the English literature of the two areas of interest are from studies conducted in the USA. There has also been a surge in research projects published by African groups, and this could be related to the recent outbreak of Ebola virus disease. The

joint efforts of the local and global community played an essential role in ending this outbreak which was a public health emergency of international concern.

Limitations

The search was restricted to articles published in the English-language which may narrow the scope and spectrum of the search. To maximize the knowledge to be utilized, it would be ideal to include studies written in other languages including Chinese, Spanish and Arabic as speakers of these languages contribute a significant proportion of the world population. The Japanese literature, of note, would also be important as the country has faced various forms of disasters due to radiation disasters from historical encounters and geographical locations that exposed the country to natural disasters such as earthquakes and tsunamis. Future studies should aim to provide a multi-language review to overcome this issue.

Grey literature is not included in this scoping review. It is possible that there are a number of curriculums, competencies and training experience that has not been published in the medical literature, which could limit this review.

The carefully defined search terms and strategy aims to cover the most relevant and available articles as a scoping review. With the wide scope of Health EDRM and the multisectoral approach, it is possible that relevant non health focused literature might have been missed, even though we have included three databases in this study.

Conclusion

There was a scarcity of literature with the Health EDRM approach with all societal efforts to manage risk for all hazards. This review could not identify consensus in the curriculum or competencies required for the Health EDRM training. The development of competency-based education focusing on risks in disaster medicine and humanitarian assistance could represent a huge step forward for professionalization. This will allow better accountability and quality for future preparedness and response.

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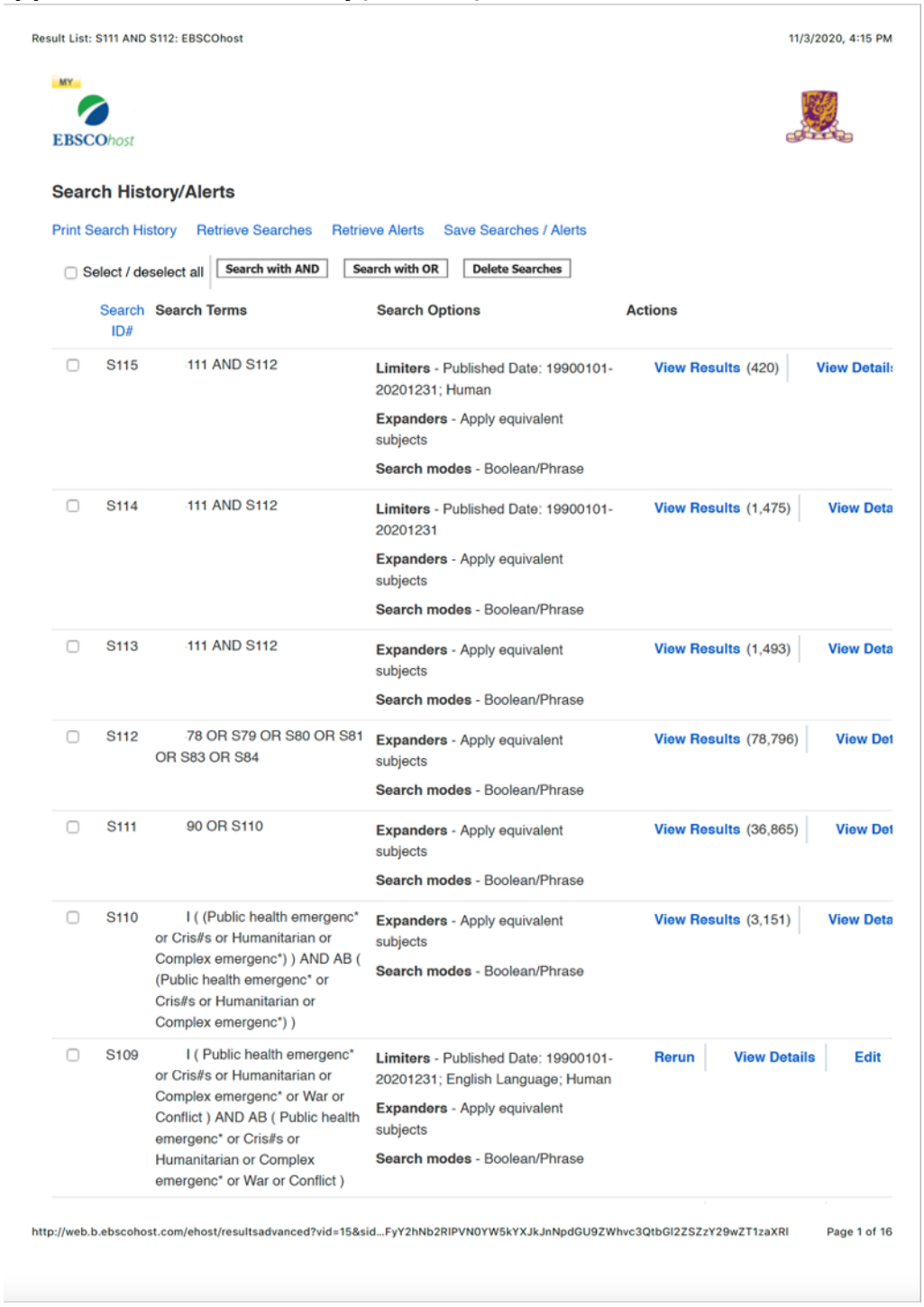
Appendix

Appendix 1 Search History(CINAHL)



Result List: S111 AND S112: EBSCOhost 11/3/2020, 4:15 PM

EBSCOhost

Search History/Alerts

Print Search History | Retrieve Searches | Retrieve Alerts | Save Searches / Alerts

Select / deselect all | Search with AND | Search with OR | Delete Searches

	Search ID#	Search Terms	Search Options	Actions
☐	S115	111 AND S112	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	View Results (420) | View Details
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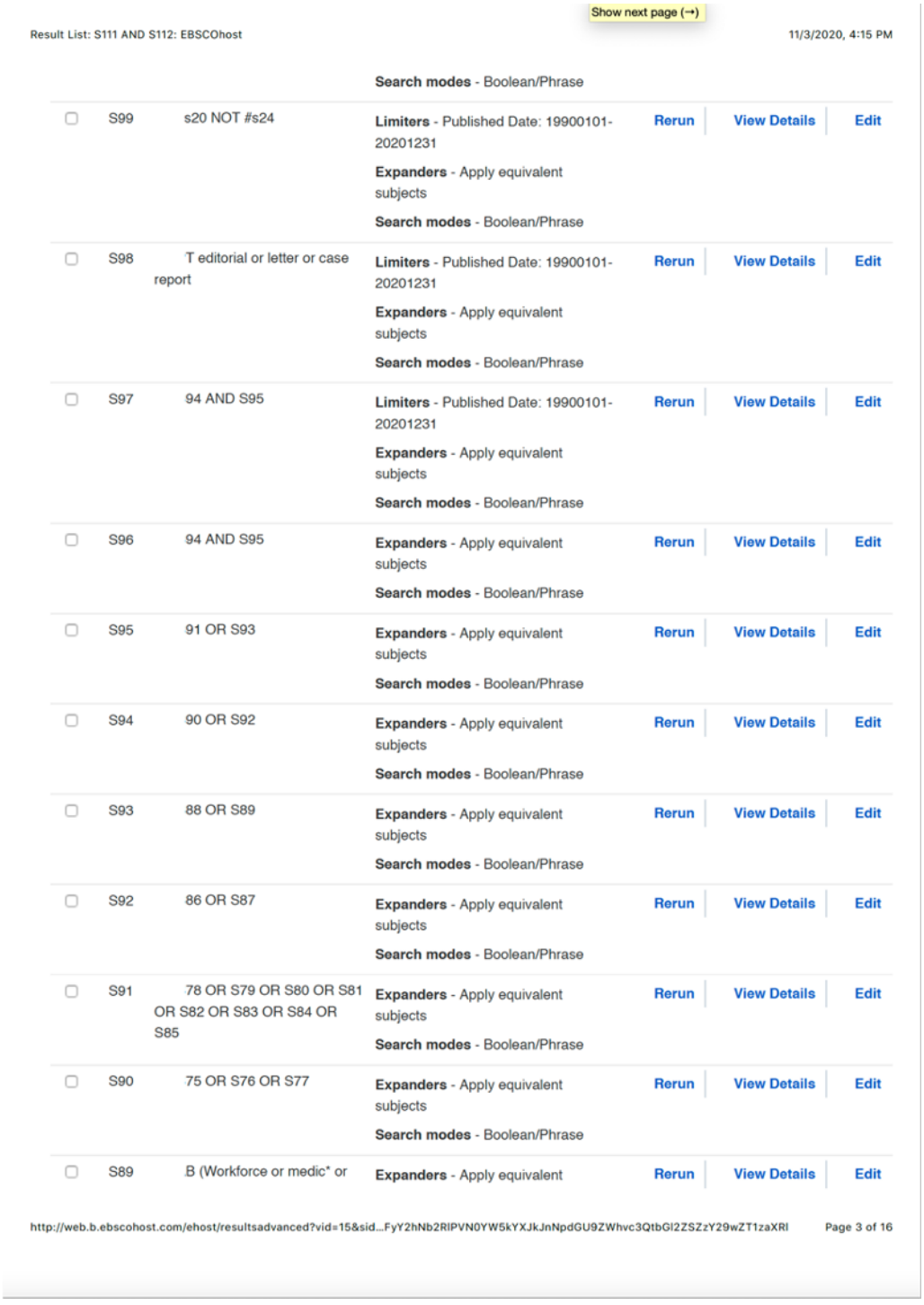
☐	S113	111 AND S112	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	View Results (1,493) | View Deta
☐	S112	78 OR S79 OR S80 OR S81 OR S83 OR S84	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	View Results (78,796) | View Det
☐	S111	90 OR S110	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	View Results (36,865) | View Det
☐	S110	I ((Public health emergenc* or Cris#s or Humanitarian or Complex emergenc*)) AND AB ((Public health emergenc* or Cris#s or Humanitarian or Complex emergenc*))	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	View Results (3,151) | View Deta
☐	S109	I (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or War or Conflict) AND AB (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or War or Conflict)	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun | View Details | Edit

http://web.b.ebscohost.com/ehost/resultsadvanced?vid=15&sid...FyY2hNb2RIPVN0YW5kYXJkJnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRI Page 1 of 16

☐	S108	90 AND S91	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S107	90 AND S91	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S106	94 AND S95	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S105	91 AND S94	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S104	91 AND S94	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S103	91 AND S94	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S102	91 AND S94	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S101	94 AND S95	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S100	94 AND S95	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects	Rerun	View Details	Edit



Show next page (→)

			Search modes - Boolean/Phrase			
☐	S99	s20 NOT #s24	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S98	T editorial or letter or case report	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S97	94 AND S95	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S96	94 AND S95	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S95	91 OR S93	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S94	90 OR S92	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S93	88 OR S89	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S92	86 OR S87	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S91	78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S90	75 OR S76 OR S77	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S89	B (Workforce or medic* or	**Expanders** - Apply equivalent	Rerun	View Details	Edit

		Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	subjects **Search modes** - Boolean/Phrase			
☐	S88	I (Workforce or medic* or Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S87	I (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S86	B (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S85	MH "Volunteer Workers")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S84	MH "Volunteer Workers")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S83	MH "Credentialing")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S82	MH "Quality of Health Care")	**Expanders** - Apply equivalent	Rerun	View Details	Edit

			subjects **Search modes** - Boolean/Phrase			
☐	S81	MH "Education")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S80	MH "Personnel Management")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S79	MH "Health Personnel")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S78	MH "Workforce")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S77	MH "Biological Warfare") OR (MH "Chemical Warfare") OR (MH "Nuclear Warfare")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S76	MH "Disasters")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S75	MH "Disease Outbreaks")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S74	72 AND S73	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S73	16 OR S71	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S72	39 OR S40 OR S41 OR S42 OR S44 OR S45	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S71	I (Public health emergenc* or Cris#s or Humanitarian or	**Limiters** - Published Date: 19900101-	Rerun	View Details	Edit

		Complex emergenc*) AND AB (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc*)	20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase			
☐	S70	I (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or War or Conflict) AND AB (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or War or Conflict)	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S69	51 AND S52	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S68	51 AND S52	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S67	55 AND S56	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S66	52 AND S55	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S65	52 AND S55	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S64	52 AND S55	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S63	52 AND S55	**Expanders** - Apply equivalent subjects	Rerun	View Details	Edit

			Search modes - Boolean/Phrase			
☐	S62	55 AND S56	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S61	55 AND S56	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S60	s20 NOT #s24	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S59	T editorial or letter or case report	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S58	55 AND S56	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S57	55 AND S56	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S56	52 OR S54	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S55	51 OR S53	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S54	49 OR S50	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S53	47 OR S48	**Expanders** - Apply equivalent	Rerun	View Details	Edit

			subjects **Search modes** - Boolean/Phrase			
☐	S52	39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S51	36 OR S37 OR S38	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S50	.B (Workforce or medic* or Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S49	I (Workforce or medic* or Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S48	I (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S47	.B (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S46	MH "Volunteer Workers")	**Expanders** - Apply equivalent	Rerun	View Details	Edit

			subjects **Search modes** - Boolean/Phrase			
☐	S45	ИН "Volunteer Workers")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S44	ИН "Credentialing")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S43	ИН "Quality of Health Care")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S42	ИН "Education")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S41	ИН "Personnel Management")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S40	ИН "Health Personnel")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S39	ИН "Workforce")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S38	ИН "Biological Warfare") OR (MH "Chemical Warfare") OR (MH "Nuclear Warfare")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S37	ИН "Disasters")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S36	ИН "Disease Outbreaks")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S35	I (Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or War or Conflict) AND AB (Public health emergenc* or Cris#s or Humanitarian or Complex	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit

emergenc* or War or Conflict)

☐	S34	16 AND S17	**Limiters** - Published Date: 19900101-20201231; English Language; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S33	16 AND S17	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S32	20 AND S21	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S31	17 AND S20	**Limiters** - Published Date: 19900101-20201231; Human; Language: English **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S30	17 AND S20	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S29	17 AND S20	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S28	17 AND S20	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S27	20 AND S21	**Limiters** - Published Date: 19900101-20201231; Human **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S26	20 AND S21	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent	Rerun	View Details	Edit

			subjects **Search modes** - Boolean/Phrase			
☐	S25	s20 NOT #s24	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S24	T editorial or letter or case report	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S23	20 AND S21	**Limiters** - Published Date: 19900101-20201231 **Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S22	20 AND S21	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S21	17 OR S19	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S20	16 OR S18	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S19	14 OR S15	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S18	12 OR S13	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S17	4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S16	1 OR S2 OR S3	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit

☐	S15	B (Workforce or medic* or Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S14	I (Workforce or medic* or Nurs* or volunteer* or Staff or Communit* or Human Resources for Heath or Retention or Brain drain or recruitment or remuneration or deployment or Training or Education or competenc* or abilit* or Knowledge or attitude* or skill* or Minimum standards or coordination or Professionali? ation.tw or learn* or course* or Undergraduate or Postgraduate or Accreditation or Surge)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S13	I (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict)	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S12	B (disaster* or Public health emergenc* or Cris#s or Humanitarian or Complex emergenc* or Outbreak* or War or Conflict	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S11	MH "Volunteer Workers")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S10	MH "Volunteer Workers")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S9	MH "Credentialing")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit

☐	S8	(MH "Quality of Health Care")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S7	(MH "Education")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S6	(MH "Personnel Management")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S5	(MH "Health Personnel")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S4	(MH "Workforce")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S3	(MH "Biological Warfare") OR (MH "Chemical Warfare") OR (MH "Nuclear Warfare")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S2	(MH "Disasters")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit
☐	S1	(MH "Disease Outbreaks")	**Expanders** - Apply equivalent subjects **Search modes** - Boolean/Phrase	Rerun	View Details	Edit

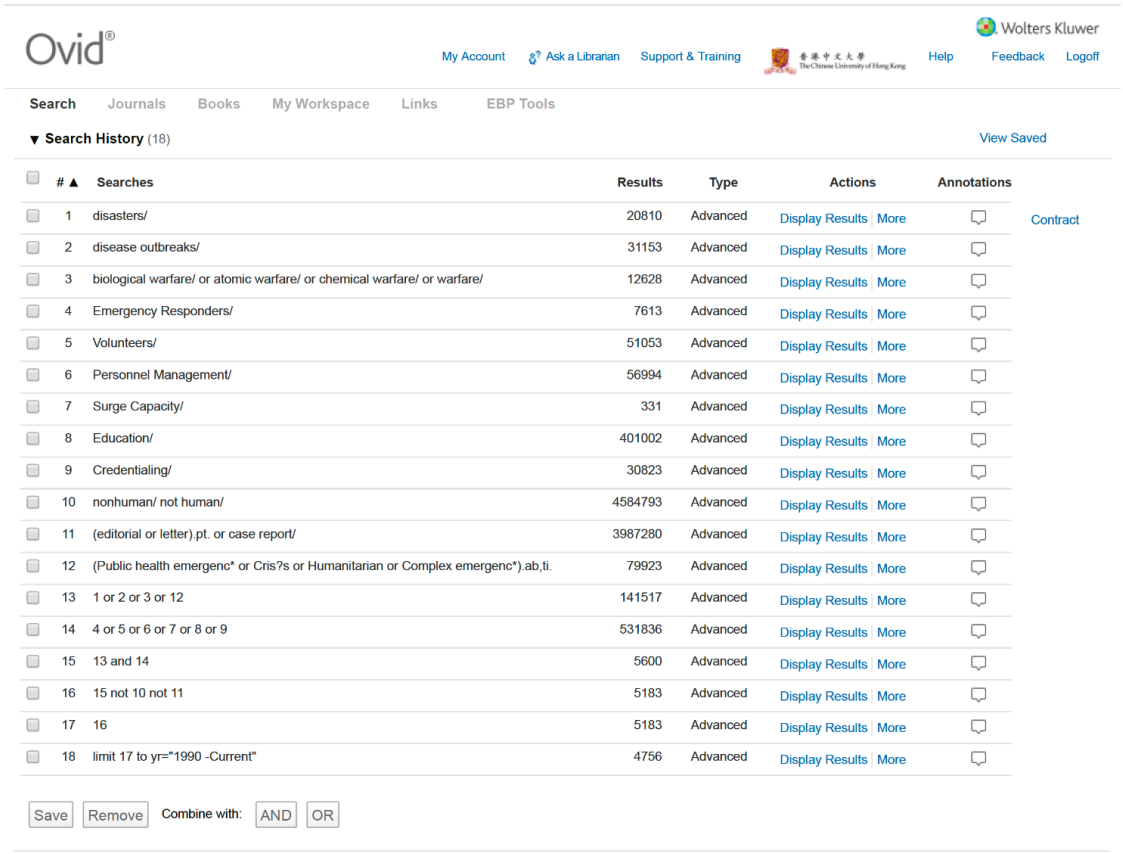
1. The Syrian **public health** and **humanitarian crisis**: A 'displacement' in global governance?

(includes abstract) Akbarzada, Sumaira; Mackey, Tim K.; Global **Public Health**, Jul2018; 13(7): 914-930. 17p. (Article - research, systematic review, tables/charts) ISSN: 1744-1692

Subjects: Public Health Syria; **Health** Care Delivery Syria; Refugees Syria; **Humanitarian** Aid

HTML Full Text PDF Full Text PlumX Metrics

Appendix 2 Search History(EMBASE)



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▼ Search History (18) View Saved

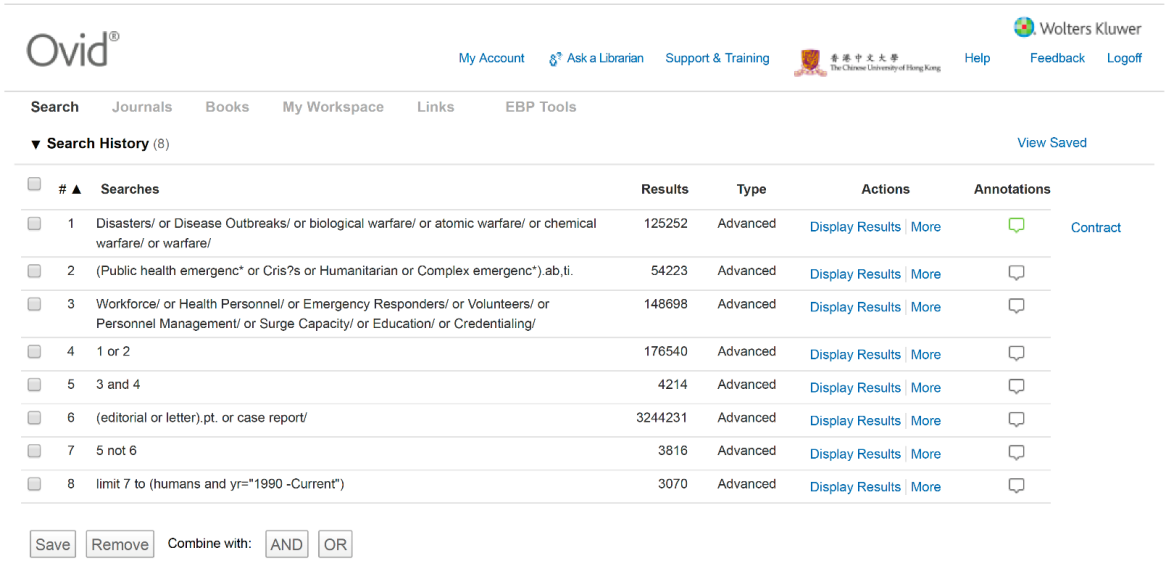
	# ▲	Searches	Results	Type	Actions	Annotations
☐	1	disasters/	20810	Advanced	Display Results | More	🗨
☐	2	disease outbreaks/	31153	Advanced	Display Results | More	🗨
☐	3	biological warfare/ or atomic warfare/ or chemical warfare/ or warfare/	12628	Advanced	Display Results | More	🗨
☐	4	Emergency Responders/	7613	Advanced	Display Results | More	🗨
☐	5	Volunteers/	51053	Advanced	Display Results | More	🗨
☐	6	Personnel Management/	56994	Advanced	Display Results | More	🗨
☐	7	Surge Capacity/	331	Advanced	Display Results | More	🗨
☐	8	Education/	401002	Advanced	Display Results | More	🗨
☐	9	Credentialing/	30823	Advanced	Display Results | More	🗨
☐	10	nonhuman/ not human/	4584793	Advanced	Display Results | More	🗨
☐	11	(editorial or letter).pt. or case report/	3987280	Advanced	Display Results | More	🗨
☐	12	(Public health emergenc* or Cris?s or Humanitarian or Complex emergenc*).ab,ti.	79923	Advanced	Display Results | More	🗨
☐	13	1 or 2 or 3 or 12	141517	Advanced	Display Results | More	🗨
☐	14	4 or 5 or 6 or 7 or 8 or 9	531836	Advanced	Display Results | More	🗨
☐	15	13 and 14	5600	Advanced	Display Results | More	🗨
☐	16	15 not 10 not 11	5183	Advanced	Display Results | More	🗨
☐	17	16	5183	Advanced	Display Results | More	🗨
☐	18	limit 17 to yr="1990 -Current"	4756	Advanced	Display Results | More	🗨

Contract

Save | Remove | Combine with: AND | OR

Appendix 3 Search History(MEDLINE)

3/11/2020 Ovid: Search Form



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▼ Search History (8) View Saved

	# ▲	Searches	Results	Type	Actions	Annotations
☐	1	Disasters/ or Disease Outbreaks/ or biological warfare/ or atomic warfare/ or chemical warfare/ or warfare/	125252	Advanced	Display Results | More	
☐	2	(Public health emergenc* or Cris?s or Humanitarian or Complex emergenc*).ab,ti.	54223	Advanced	Display Results | More	
☐	3	Workforce/ or Health Personnel/ or Emergency Responders/ or Volunteers/ or Personnel Management/ or Surge Capacity/ or Education/ or Credentialing/	148698	Advanced	Display Results | More	
☐	4	1 or 2	176540	Advanced	Display Results | More	
☐	5	3 and 4	4214	Advanced	Display Results | More	
☐	6	(editorial or letter).pt. or case report/	3244231	Advanced	Display Results | More	
☐	7	5 not 6	3816	Advanced	Display Results | More	
☐	8	limit 7 to (humans and yr="1990 -Current")	3070	Advanced	Display Results | More	

Contract

Save Remove Combine with: AND OR

Appendix 4 Data Extraction Form

General Information	
Paper No.	
Title	
Year	
Author	
Country of Study	
Type of Study	☐ Systematic Review ☐ Randomised Controlled Trial ☐ Non-randomised Interventional Study ☐ Cross-sectional Study ☐ Descriptive Study ☐ Others _____
Aim of Study	
Type of Disasters	☐ Geophysical (e.g. Earthquake) ☐ Hydrological (e.g. Floods) ☐ Climatological (e.g. Drought) ☐ Meteorological (e.g. Storms) ☐ Biological (e.g. Disease Outbreak) ☐ Man-made (e.g. CBRN)
Disaster Phase	☐ Mitigation ☐ Preparation ☐ Response ☐ Recovery
Study Location (Hospital/Department/Other Setting)	
Participants and sample size (n)	☐ Doctors (n=___) ☐ Nurses (n=___) ☐ Students (n=___) ☐ Pharmacists (n=___) ☐ Others (n=___)
Training Method (Intervention)	☐ Online Course ☐ Lecture ☐ Handouts ☐ Group Discussion ☐ Simulation Training ☐ Other _____
Pre-intervention Assessment Method	

Post-intervention Assessment Method	

Outcomes	
Primary outcomes	
Secondary outcomes	
Significant variables associated with outcomes	
Others	
Professional Category	
Pre-intervention Score (%) In different professional category	
Post-intervention Score (%) In different professional category	