

Comparison of Disaster Medicine Education in Emergency Medicine Residency and Emergency Medical Services Fellowship in the United States

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Conflicts of interest: The authors Sara P. Sandifer, Bryan J. Wexler, and Avram Flamm declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Keywords: disaster medicine; emergency medicine; Emergency Medical Services; medical education

Abbreviations:

ABEM: American Board of Emergency Medicine
ABMS: American Board of Medical Specialties
ACEP: American College of Emergency Physicians
ACGME: Accreditation Council for Graduate Medical Education
CBRNE: Chemical, Biological, Radiation, Nuclear and Explosives
DM: Disaster Medicine
EM: Emergency Medicine
EMS: Emergency Medical Services
SAEM: Society of Academic Emergency Medicine

Abstract

Introduction: Disaster Medicine (DM) is defined by Koenig and Shultz as the “disciplines and organizations involved with governmental public health, public and private medical delivery including Emergency Medical Services (EMS), and governmental emergency management.” The Accreditation Council for Graduate Medical Education (ACGME) sets curriculum requirements and standards for Emergency Medicine (EM) residencies and EMS fellowships, which include a limited portion of the DM curriculum topics recommended by the Society of Academic Emergency Medicine (SAEM). The ACGME does not currently approve DM fellowships, as DM is not recognized as a subspecialty by the American Board of Medical Specialties (ABMS). This lack of nationally standardized guidelines for DM training leads to variability in disaster-related knowledge and skills, even among physicians trained by ACGME-accredited programs.

Study Objective: The objective of this study is to analyze the DM components covered in EM residency and EMS fellowship in the United States and compare those to SAEM DM fellowship curriculum guidelines.

Methods: The DM curriculum components of EM residencies and EMS fellowships were evaluated, using the SAEM DM curriculum as a control. Overlapping topics, as well as gaps between the programs, were analyzed using descriptive statistics.

Results: Of the DM curriculum components developed by SAEM, EMS fellowship covered 15 of 19 (79%) major curriculum components and 38 of 99 (38%) subtopics, while EM residency covered seven of 19 major curriculum components (37%) and 16 of 99 (16%) subtopics. Together, EM residency and EMS fellowship cover 16 of 19 (84%) major curriculum components and 40 of 99 (40%) subtopics.

Conclusion: While EMS fellowship covers a large portion of the DM major curriculum components recommended by SAEM, there are several important DM subtopics that are not covered either in EM residency or EMS fellowship. Furthermore, there is no standardization for the depth and manner that DM topics are addressed in either curriculum. Time constraints in EM residency and EMS fellowship may also prevent extensive review of important DM topics. Disaster Medicine covers a distinct body of knowledge, represented in the curriculum subtopics, that are not covered in either EM residency or EMS fellowship. The development of an ACGME-accredited DM fellowship and recognition of DM as a distinct subspecialty could allow for more effective DM graduate medical education.

Sandifer SP, Wexler BJ, Flamm A. Comparison of disaster medicine education in emergency medicine residency and Emergency Medical Services fellowship in the United States. *Prehosp Disaster Med.* 2023;38(3):378–383.

Received: January 15, 2023

Revised: February 22, 2023

Accepted: March 1, 2023

doi:[10.1017/S1049023X23000407](https://doi.org/10.1017/S1049023X23000407)

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Introduction

History of Disaster Medicine

Disaster Medicine (DM) is defined by Koenig and Shultz as the “disciplines and organizations involved with governmental public health, public and private medical delivery including Emergency Medical Services (EMS), and governmental emergency management.”¹ While the history of DM is complex, it is well-recognized that the first modern iteration of the field was coined by Heinrich Zanger in the early 20th century with the publication of medical protocols to follow in the case of a disaster.² His emphasis on the disproportionate number of potentially injured patients in relation to emergency providers and materials available provided an argument for the related, but distinct, fields of Emergency Medicine (EM) and DM.³

As the 20th century progressed, the field of DM continued to grow and take shape under the pressure of new threats to human health and safety. In the intervening years, the University Association of Emergency Medicine, today known as the Society of Academic and Emergency Medicine (SAEM; Des Plaines, Illinois USA), called for the establishment of DM fellowships. This development led to the first DM board certification in 2005, the American Board of Disaster Medicine (ABODM; American Board of Physician Specialties, Tampa, Florida USA), which is not under the governance of the American Board of Medical Specialties (ABMS; Chicago, Illinois USA).^{4,5} Disaster Medicine education is supported by two comprehensive texts: *Koenig and Shultz’s Disaster Medicine: Comprehensive Principles and Practice* and *Ciottoni’s Disaster Medicine*.^{1,6}

Disaster Medicine Training

Several paths exist for training physicians to pursue further education in DM. As of 2023, the SAEM fellowship directory web site lists seven SAEM-approved DM fellowships, with an additional 11 fellowships that are not approved by SAEM.⁷ There are both one-year and two-year training options with a common standard curriculum and the opportunity to pursue additional electives or an advanced degree, such as a master’s in public health, in the second year. Training physicians may also choose to pursue a combined fellowship, with one year of EMS training followed by one year of DM training.⁴

The SAEM has also developed a standard DM curriculum which DM fellowships must follow to receive SAEM approval. This curriculum is composed of major curriculum components, as well as related subtopics. Major DM curriculum components include: Introduction to Disaster Medicine, Public Health and Disaster Medicine, Hospital Disaster Preparedness, Disaster Preparedness, Mitigation, Response and Resiliency, Incident Command Systems, Operations and Logistics, Psychological Aspects of Disaster Medicine, Ethical Issues in Disaster Medicine, EMS and Disaster Medicine, Safety and Security, Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE), Disaster Medicine in the Field, Environmental Disasters, Technological Disasters, International Disaster Response, Mass-Gathering Medicine, Communications, Technology and Disaster Medicine, and Disaster Medicine Research.⁸ These major curriculum components, as well as their relative subtopics, can be viewed in Table 1. Additionally, the American College of Emergency Physicians (ACEP; Irving, Texas USA) has published a list of suggested DM competencies to be met by any DM fellowship curriculum, shown in Table 1.⁹

Physician Residency and Fellowship Training

The Accreditation of Graduate Medical Education (ACGME; Chicago, Illinois USA) is an organization that accredits graduate medical education, including residencies and fellowships, based on the standards of the specialty for which that program is training physicians. The ACGME provides accreditation for 12,740 residency and fellowship programs, providing assurance to trainees, as well as to the public, as to the quality of education provided by these programs.¹⁰

While the ABMS recognizes EMS as a subspecialty of EM, it does not recognize DM as a unique subspecialty.⁵ Therefore, there are no ACGME-approved DM fellowships.¹¹ However, some components of DM training are taught in EM residency and EMS fellowships, providing a route for physicians to obtain DM skills and knowledge.^{12,13} This study seeks to analyze the DM components covered in EM residency and EMS fellowships in the United States and compare those to SAEM DM fellowship curriculum guidelines. The hypothesis is that while some components of DM are covered in EM residency and/or EMS fellowship, there is a distinct DM body of knowledge not covered in either curriculum.

Methods

Control Curriculum

The DM curriculum topics were derived from the SAEM recommendations for DM fellowship programs.⁸ This curriculum was chosen as it is the most comprehensive in terms of DM curriculum topics and as SAEM is the only organization providing an approval process for DM fellowships as of 2023. These major curriculum components are accompanied by related subtopics, which may be viewed in Table 1.

EM and EMS Training Curricula

The EM residency training curriculum was obtained from *The 2019 Model of the Clinical Practice of Emergency Medicine*. This was chosen as the national EM residency curriculum because it was approved and is continuously revised by several of the leading EM organizations, including the American Board of Emergency Medicine (ABEM; East Lansing, Michigan USA), the Council of Emergency Medicine Residency Directors (CORD; Irving, Texas USA), ACEP, the Emergency Medicine Resident’s Association (EMRA; Irving, Texas USA), the Residency Review Committee for Emergency Medicine (RRC-EM; Chicago, Illinois USA), SAEM, and the American Academy of Emergency Medicine (AAEM; Milwaukee, Wisconsin USA). This curriculum has also been cross-referenced with the ACGME six core competencies for the practice of medicine.¹²

The EMS fellowship training curriculum was obtained from *The 2019 Core Content of Emergency Medical Services Medicine*. Similarly, this curriculum was chosen because it was developed and is revised by leaders in both EMS medicine as well as EM, including the National Association of EMS Physicians (NAEMSP; Atlanta, Georgia USA) and ABEM. Additionally, this curriculum has been cross-referenced with the ACGME six core competencies for the practice of medicine.¹³

Study Design

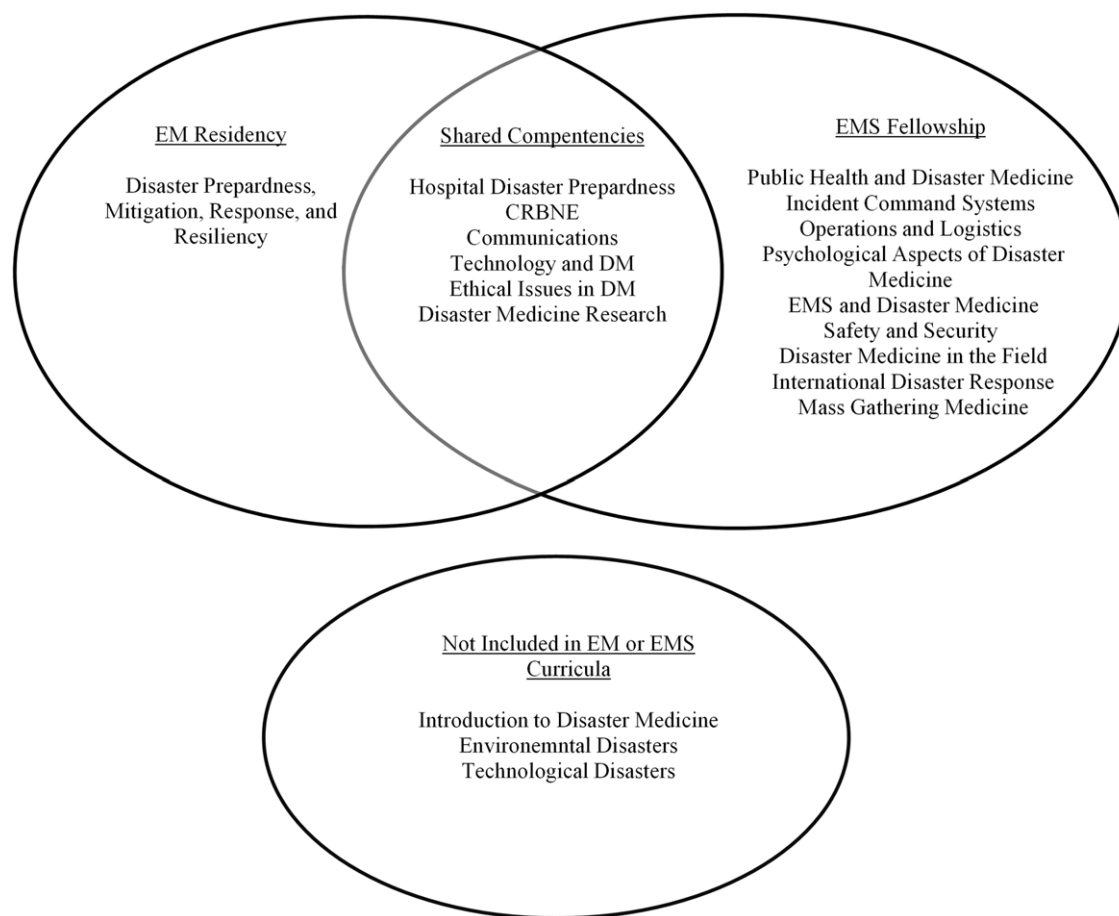
The EM residency and EMS fellowship curricula were analyzed for inclusion of DM major curriculum components and subtopics, using the SAEM-published DM curriculum as a control. A SAEM DM major curriculum component was considered to be covered if at least one of the relevant subtopics were described in

SAEM Major Curriculum Component	SAEM Subtopics Included	ACEP DM Competencies
Introduction to Disaster Medicine	<i>The disaster cycle, evolution of emergency management, local disaster response, national disaster response</i>	Risk and Crisis Communications
Public Health and Disaster Medicine	<i>Role of public health agencies in DM, National Response Framework, public health surveillance, needs assessments, sphere standards/water, sanitation and hygiene (WASH), climate change and DM, vaccine and pharmaceutical distribution</i>	Preparedness and Response Strategies and Interventions
Hospital Disaster Preparedness	<i>Hazard vulnerability analysis, hospital incident command systems, emergency operations plans, command center operations, community integration, information management/communications, surge capacity, planning for MCIs, drill design, scarce resource allocation protocols</i>	Incident Management System
Disaster Preparedness, Mitigation, Response, Resiliency	<i>Personal preparedness, organization preparedness, hospital preparedness, community preparedness, national preparedness, rehabilitation and reconstruction, organization-based disaster resiliency, community-based disaster resiliency</i>	Surveillance and Detection
Incident Command Systems (ICS)	<i>ICS basics, command and control, international systems</i>	Preparedness and Response Strategies and Intervention
Operations and Logistics	<i>Field operations and logistics, disaster operations, volunteer management, operational continuity, care of animals, nursing and disaster</i>	Investigation and Analysis
Psychological Aspects of Disaster Medicine	<i>Psychological effects of DM, psychological first aid</i>	Safety and Protection
Ethical Issues in Disaster Medicine	<i>Liability in disaster response, ethics of DM, disaster finance, vulnerable populations</i>	Psychological Aspects
EMS and Disaster Medicine	<i>EMS disaster operations, search and rescue, tactical EMS, active shooter, fireground safety, vehicle extrication</i>	Situational Awareness
Safety and Security	<i>Scene safety, security in the field</i>	Collaboration, Connectivity, and Community Relations
Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE)	<i>Chemical agents, biological agents, radiation/nuclear events, pandemics/emerging infectious diseases, hazardous materials (HAZMAT), personal protective equipment (PPE), blast/crush injuries, burns, quarantine, decontamination</i>	Decision Making and Prioritizing
Disaster Medicine in the Field	<i>Disaster triage, disaster medical assistance teams (DMAT), basics in the field, alternate care sites, mass fatalities and mortuary care</i>	Public Health Legal Authority
Environmental Disasters	<i>Hurricane/typhoon, earthquakes, volcanoes, tornadoes, tsunami, flooding, famine, drought, winter storms, wildfires</i>	Responsible and Ethical Conduct
Technological Disasters	<i>Structural collapse, transportation disasters</i>	Hazard, Vulnerability, and Risk Assessment
International Disaster Response	<i>UN cluster system, displaced populations, complex public health emergencies, emergency medical teams and the World Health Organization (WHO), International Search and Rescue Advisory Group (INSARAG), non-governmental organizations</i>	Personal Preparedness
Mass-Gathering Medicine	<i>Mass gatherings, civil unrest</i>	Organizational and Community Response Plans
Communications	<i>Crisis and emergency risk communication, communication systems and informatics, social media and disasters</i>	Personal Safety Measures
Technology and Disaster Medicine	<i>Crisis mapping, telemedicine, disaster modeling and simulation, patient tracking, ultrasound, informatics</i>	Surge Capacity Assets
Disaster Medicine Research	<i>Journal club, research basics</i>	Clinical Management of All Ages and Populations of Practice
		Legal Principles to Protect the Health and Safety of All Ages, Populations, and Communities
		Short- and Long-Term Considerations for Recovery
		International Response (NATO)
		International Response
		Recovery
		Interfacing

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Table 1. SAEM Major Curriculum Topics and Subtopics

Abbreviations: ACEP, American College of Emergency Physicians; SAEM, Society of Academic Emergency Medicine; DM, Disaster Medicine; EMS, Emergency Medical Services; HAZMAT, Hazardous Materials; WASH, Water, Sanitation, and Hygiene; MCI, Mass-Casualty Incident; ICS, Incident Command System; PPE, Personal Protective Equipment; DMAT, Disaster Medical Assistance Team; WHO, World Health Organization; INSARAG, International Search and Rescue Advisory Group; NATO, North Atlantic Treaty Organization.



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Figure 1. DM Major Curriculum Components Found in EM Residency and EMS Fellowship Training Curricula. Abbreviations: DM, Disaster Medicine; EM, Emergency Medicine; EMS, Emergency Medical Services; CBRNE, Chemical, Biological, Radiation, Nuclear, and Explosives.

the curriculum. Overlapping topics, as well as gaps for the DM components of each training curricula, were analyzed using descriptive statistics.

Results

The SAEM categorizes the DM curriculum into major curriculum components with related subtopics (Table 1). Figure 1 compares the DM major curriculum components found in EM residency and EMS fellowship training curricula. Major curriculum components shared between EM residency and EMS fellowship include Hospital Disaster Preparedness, CBRNE, Communications, Technology and Disaster Medicine, Ethical Issues in Disaster Medicine, and Disaster Medicine Research. However, the major curriculum components Introduction to Disaster Medicine, Environmental Disasters, and Technological Disasters are not included in either curriculum, as seen in Figure 1.

Table 2 shows a comparison of the different DM major curriculum components included in the EM residency, EMS fellowship, and DM fellowship curricula. The EMS fellowships cover more of the DM major curriculum components (15/19 [79%]) than the EM residency (7/19 [37%]). Together, EM residency and EMS fellowship cover 16/19 (84%) DM major curriculum components.

A comparison of the portion of DM curriculum subtopics covered by EM residency and EMS fellowship is shown in

Table 3. Of note, EMS fellowship covers 38 out of the 99 (38%) total SAEM DM curriculum subtopics, while EM residency covers 16 out of 99 (16%) total SAEM DM curriculum subtopics. The EM residency, combined with an EMS fellowship, covers 40 out of 99 (40%) of the SAEM DM curriculum subtopics.

Discussion

This study found that while there are several SAEM DM curriculum components covered by EM residency or EMS fellowship, there is a body of knowledge not covered by either curriculum (Figure 1). A physician, after training in EM residency followed by an EMS fellowship, will have covered 16 out of the 19 major curriculum components (84%), as shown in Table 2, and only 40 out of the 99 curriculum subtopics (40%), as shown in Table 3. This gap represents a significant body of knowledge of DM topics that will not have been covered by a physician that has completed an EM residency followed by an EMS fellowship.

Additionally, the DM major curriculum components that are covered by EM residency and/or EMS fellowship may be covered in different depths, depending upon the nature and setting of the training curriculum. For example, while a graduate of either an EM residency or an EMS fellowship will have covered the DM major curriculum component Hospital Disaster Preparedness, only two out of ten of the curriculum subtopics are covered by EM residency,

DM Fellowship Major Curriculum Topic	EMS Fellowship	EM Residency	EM + EMS
Introduction to Disaster Medicine	No	No	No
Public Health and Disaster Medicine	Yes	No	Yes
Hospital Disaster Preparedness	Yes	Yes	Yes
Disaster Preparedness, Mitigation, Response, Resiliency	No	Yes	Yes
Incident Command Systems	Yes	No	Yes
Operations and Logistics	Yes	No	Yes
Psychological Aspects of Disaster Medicine	Yes	No	Yes
Ethical Issues in Disaster Medicine	Yes	Yes	Yes
EMS and Disaster Medicine	Yes	No	Yes
Safety & Security	Yes	No	Yes
Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE)	Yes	Yes	Yes
Disaster Medicine in the Field	Yes	No	Yes
Environmental Disasters	No	No	No
Technological Disasters	No	No	No
International Disaster Response	Yes	No	Yes
Mass-Gathering Medicine	Yes	No	Yes
Communications	Yes	Yes	Yes
Technology and Disaster Medicine	Yes	Yes	Yes
Disaster Medicine Research	Yes	Yes	Yes
Total	15/19 (79%)	7/19 (37%)	16/19 (84%)

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Table 2. Coverage of SAEM DM Major Curriculum Components by GME Programs
Abbreviations: DM, Disaster Medicine; EM, Emergency Medicine; EMS, Emergency Medical Services; GME, Graduate Medical Education; SAEM, Society of Academic Emergency Medicine; CBRNE, Chemical, Biological, Radiation, Nuclear, and Explosives.

while six out of the ten subtopics are covered by EMS fellowship, as shown in Table 2 and Table 3. Furthermore, the manner in which a DM topic is covered likely differs between EM residency and EMS fellowship due to differing focuses between the two fields. For example, while both EM residency and EMS fellowship cover topics of CBRNE, in the EMS setting, the focus may be on pre-hospital operations, management, and decontamination, while in the EM setting, the focus will be on definitive management and hospital protocols.

A study in 2017 by Sarin, et al showed that while many EM residency programs report covering some aspects of DM, there is no consistency amongst EM programs regarding what DM topics are covered and to what degree.^{14,15} While the ACGME does recommend that graduating EM residents have “experience

DM Fellowship Major Curriculum Topic	EMS Fellowship	EM Residency	EM + EMS
Introduction to Disaster Medicine	0/4	0/4	0/4
Public Health and Disaster Medicine	2/7	0/7	2/7
Hospital Disaster Preparedness	6/10	2/10	7/10
Disaster Preparedness, Mitigation, Response, Resiliency	0/8	1/8	1/8
Incident Command Systems	2/3	0/3	2/3
Operations and Logistics	2/6	0/6	2/6
Psychological Aspects of Disaster Medicine	2/2	0/2	2/2
Ethical Issues in Disaster Medicine	1/4	1/4	1/4
EMS and Disaster Medicine	3/6	0/6	3/6
Safety and Security	1/2	0/2	1/2
Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE)	10/10	9/10	10/10
Disaster Medicine in the Field	2/5	0/5	2/5
Environmental Disasters	0/10	0/10	0/10
Technological Disasters	0/2	0/2	0/2
International Disaster Response	1/6	0/6	1/6
Mass-Gathering Medicine	1/2	0/2	1/2
Communications	2/3	1/3	2/3
Technology and Disaster Medicine	2/6	1/6	2/6
Disaster Medicine Research	1/3	1/3	1/3
Total	38/99 (38%)	16/99 (16%)	40/99 (40%)

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Table 3. Coverage of SAEM DM Curriculum Subtopics Covered by GME Programs
Abbreviations: DM, Disaster Medicine; EM, Emergency Medicine; EMS, Emergency Medical Services; GME, Graduate Medical Education; SAEM, Society of Academic Emergency Medicine; CBRNE, Chemical, Biological, Radiation, Nuclear, and Explosives.

in Emergency Medical Services, emergency preparedness, and disaster management,” they do not have a standardized requirements for the manner or depth in which this topic is covered.¹⁶ Additionally, disaster preparedness has been identified as a commonly under-taught component by EM residency program directors.¹⁷

In 2020, the Centre for Research on the Epidemiology of Disasters (CRED; Brussels, Belgium) reported an increase in the number of disasters over the previous 20 years, resulting in the loss of 1.23 million human lives and \$2.97 trillion world-wide.¹⁸ In response to the ever-growing frequency of disasters, and the impact

on human health and prosperity, there has been increased attention to educational growth and development in the field of DM. As of 2019, there were 24 DM and emergency preparedness journals indexed in PubMed/MEDLINE (National Center for Biotechnology Information, National Institutes of Health; Bethesda, Maryland USA), representing the relevance of the field as an academic pursuit.¹⁹

Disaster Medicine is a constantly evolving field with many skill sets that are unique from concepts currently taught in EM residency and EMS fellowship. There are several DM topics recommended by SAEM that are not being addressed in either EM residency or EMS fellowship curricula. Furthermore, over one-half of all the DM curriculum subtopics will not be covered by a physician during EM residency followed by EMS fellowship (Table 3). This gap in knowledge creates a workforce of EM physicians, even those with additional EMS fellowship training, that are not optimally trained to respond to disasters, nor to provide appropriate medical direction and subject matter expertise. The development of a distinct, ACGME-accredited DM fellowship could provide a more standardized and effective DM training model for physicians preparing to respond to disasters.

Limitations

One limitation of this study is the use of a standard national curriculum for EM residency and EMS fellowship. Although these guidelines represent the minimum level of competence defined by the ACGME and the ABEM, individual programs may differ in the quantity and quality in which these topics are covered. The degree to which individual programs teach DM topics was not assessed in this study and will require further research. Comparing individual programs' inclusion of SAEM DM curriculum components will allow for a more complete understanding of the current status of DM education currently being covered in EM residency and EMS fellowship. This could allow for further understanding of the need for an ACGME-approved DM fellowship.

Additionally, when comparing the SAEM DM curriculum topics between EM residency and EMS fellowship, a component was only considered as being covered if the wording was a close or identical match to the SAEM DM curriculum component. However, two or more separate SAEM DM topics may be covered together under a single topic in EM residency or EMS fellowship. This is especially true for DM topics that are particularly relevant to either hospital or prehospital EM. For example, although the SAEM DM curriculum subtopic "active shooter" is not listed as being covered by EMS fellowship, these scenarios may instead be covered under "Disaster Management." This may result in falsely low reporting of SAEM DM curriculum topics being taught in EM residency or EMS fellowship. The focus of this study is United States-based EM residency and EMS fellowship programs, and therefore findings are not externally valid for programs located outside of the United States.

Conclusion

Emergency Medicine residency programs cover 37% of the DM major curriculum components and 16% of subtopics, while EMS fellowship programs cover 79% of DM major curriculum components and 38% of subtopics. A physician who completed EM residency and EMS fellowship will cover 84% of DM major curriculum components and only 40% of curriculum subtopics. Although EMS fellowship covers more DM topics than EM residency, several DM topics are not addressed by either curriculum, including Environmental Disasters and Technological Disasters. Furthermore, there is no standardization for the depth and manner in which DM topics are currently addressed in EM residency and EMS fellowship programs. There are many DM topics that are not covered by EM residency and/or EMS fellowship training in the United States. Recognizing the distinctive body of knowledge that DM covers suggests there is a need for ACGME-accredited training programs and ABMS recognition of DM as a subspecialty.

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