


From Didactics to Disasters: Unveiling CBRNe and Counter-Terrorism Medicine Training in US Medical Schools

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Abbreviations:

AAMC: Association of American Medical Colleges
CBRNe: chemical, biologic, radiologic, nuclear, and explosive
COVID-19: coronavirus disease 2019
CPR: cardiopulmonary resuscitation
CTM: counter-terrorism medicine
LCME: Liaison Committee on Medical Education

Abstract

Introduction: The threat of chemical, biological, radiologic, nuclear, and explosive (CBRNe) terrorist attacks has increased over time. The need for rapid and effective responses to such attacks is paramount. Effective medical counter-measures to CBRNe events are critical and training for such may effectively occur early in physician training. While some medical specialties are more involved than others, counter-terrorism medicine (CTM) spans all medical specialties.

Methods: All United States allopathic medical schools were examined via online curriculums and queries for academic content related to CBRNe and terrorist medical counter-measures.

Results: Analysis of 153 United States allopathic medical schools demonstrated that 15 (9.8%) medical schools offered educational content related to CBRNe and terrorist counter-measures. This is in contrast to legislation following the September 11, 2001 attacks that called for high priority for such education.

Conclusion: Effective CBRNe medical counter-measures are currently in place; however, there is room for improvement in education that may begin during medical school. While certain medical specialties such as emergency medicine, primary care, and dermatology may have specific niches in such events, physicians of all medical specialties have something to offer, and even a basic education in medical school can help best prepare the nation for future attacks.

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Introduction

The use of chemical, biological, radiologic, nuclear, and explosive (CBRNe) weapons remains a threat of concern due to their large impact in mass-casualty attacks.¹ There currently exist effective, tiered, and scalable CBRNe counter-terrorism personnel and teams throughout civilian, law enforcement, and military units within the United States (and other countries). These specialized personnel and units collaborate to provide optimal response and protection. Such specialized education and training are typically designed and offered exclusively to designated personnel serving on these specialized units.

Physicians of all medical specialties who practice in geographic locales where terrorism is common report both experience and the need for proper education and training in counter-terrorism and CBRNe scenarios.^{2,3} This is overall lacking at the medical school educational level in the United States, except within a minority of institutions where specific training exists. Aside from designated CBRNe personnel and/or units, such training only occurs in some disaster-oriented emergency medicine residency programs. Training in basic CBRNe

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content and recognition is uncommon within the medical school education, with only a small number of medical schools offering any form of this education.⁴⁻⁶ In fairness, CBRNe events are fortunately not common and medical school education demands a wealth of core information to be taught within a finite timespan. However, some familiarity with CBRNe/counter-terrorism medicine (CTM) could provide medical students a basic template for disaster awareness and serve as a springboard for future education among interested students. It would also offer at least a basic level of preparedness for more physicians who may be able to participate in terrorist and/or CBRNe attacks.

The specialty of CTM is relatively new and stems from its parent specialty disaster medicine and previous iterations of terror medicine.⁷ Court, et al⁷ outlined the creation of CTM as a consolidation of discrete medical sub-specialties and based on a triad of violence, intent, and health care impact. Increased terrorist threats to include the September 11, 2001 attack spurred an increased interest and literature publications on terrorism and health care impacts.⁷ The advent and formal creation of the CTM specialty paves the road for future training and response for all health care providers.

The purpose of this study is to examine the current education of counter-terrorism and CBRNe medicine within United States allopathic medical schools. Analysis and recommendations for practical educational programs will be reviewed.

Methods

Data collection pertaining to CTM and CBRNe education in United States medical schools was performed by a systematic analysis (in accordance with the Preferred Reporting Items for Systematic Reviews [PRISMA] guidelines) of current United States allopathic medical school curriculums and content/course offerings.⁸ Determinations were made on whether medical schools offered CTM and/or CBRNe content by specific inclusion criteria. This analysis was performed in online curriculum searches to determine which of United States allopathic medical schools had published articles discussing any CBRNe/CTM topics within their curriculums. A secondary PubMed (National Center for Biotechnology Information, National Institutes of Health; Bethesda, Maryland USA) search was performed to ensure that no curriculum content was missed. A total of 153 United States allopathic medical schools were evaluated by using the search terms *counterterrorism medicine*, *counter-terror medicine*, *CBRN*, *CBRNe*, and the name of each individual medical school. Additional citations were identified by related article links from these initial searches. A further online review of the medical school curriculum was searched on each institutional website (153 United States allopathic medical schools; open-source curriculum). This strived to ensure that no content and/or results were missed with either search. Pertinent content and/or programs were considered present with at least one lecture specifically focused on any aspect of CTM and/or CBRNe events. This may be as simple as a single course and/or lecture or as much as a dedicated block of time for such education. Counter-terrorism medicine and CBRNe content contain a wide array of potential course content. Inclusion criteria for a medical school to be deemed as containing such content was the presence of any component (ie, not necessarily a comprehensive course). Thus, a school having some content or that related to chemical attacks was considered present, even if the curriculum lacked other components. Additionally, educational programs may be elective or mandatory. Analysis of educational content was

determined by two authors (JEL, AA) and any disparity was re-evaluated and a collaborative determination was made. Uncertain findings were also confirmed by contact with the specific medical school contact. Results were imported into Microsoft Excel (Microsoft Corporation; Redmond, Washington USA) for analysis.

Results

All (100%) of the 153 United States allopathic medical schools were examined. Of these, only 15 (9.8%) offered educational material, lectures, courses, and/or experiences associated with CTM and/or CBRNe medicine. Results were tabulated as per the methodology by searching both PubMed and each individual institutional site for online curriculum content. Results were not necessarily mutually confirmatory. All United States allopathic medical schools did have curricula information online, although the detail of which varied greatly. There existed high variability in content, as a single lecture may be offered at one institution, whereas a more formal course or series exists at other another institution. Comprehensive offerings were offered at several medical schools, some lasting up to two-to-four weeks, with one institution offering educational content throughout all four years of medical school.^{9,10} The majority of content was elective. At least one school offered a designated CBRN defense certificate program that was available to medical students.⁸ Other schools offered detailed courses on terror medicine with multiple subsequent publications detailing the importance of this content for medical student education.^{6,10-12}

Discussion

The evolution of warfare demonstrates consistency in the nature of warfare but distinct changes in its character. The advent of perpetual advances in technology and cybertechnology, the use of drones, artificial intelligence, and the internet offer additional advances that were not present in the past. However, age-old tactics of warfare such as the utilization of CBRNe weaponry maintain destructive capabilities for mass-casualty incidents and induces the highest level of fear and panic. The potential integration of CBRNe modalities with modern technology (such as the use of drones for delivery mechanisms) furthers the potential for terrorist attacks.^{13,14}

Counter-measures for terrorist and CBRNe attacks are unique in that specific training is necessary to identify and respond. Medical counter-measures are critical in response to a CBRNe attack. However, identification of many CBRNe agents can be difficult and is often delayed due to their inconspicuous and inherent properties, delivery, and/or onset. This highlights the importance of medical education for counter-terrorism and CBRNe weapons and events. A baseline education is critical for all medical specialties to be able participate in a terrorist attack. This is analogous to the wide-spread teaching of Basic Life Support and cardiopulmonary resuscitation (CPR), thus offering victims a greater chance of survival based on a higher probability that someone may be able to provide some level of medical assistance. Greater attention may certainly be given to medical specialties that may deliver a higher impact on CBRNe identification and response, such as emergency medicine, critical care, and dermatology for example.

Cole emphasized the importance of at least a basic education for United States physicians on the topic of terror medicine.^{6,7,10,15} He examined the education and experience of physicians in countries

that were embedded in CTM, such as Israel, emphasizing the importance of learning from their experiences.¹⁵

The likelihood of terrorist and CBRNe attacks remains low and thus one must justify the time and cost of CBRNe medical education. However, a basic introductory lecture (as minimum content) carries little to no cost but offers a useful framework for medical students. It also serves to stimulate interest in those who may express further interest in CTM, whether formally or informally at future points in their career. There exists a need for both CTM and CBRNe response specialists. However, there is also a benefit for community physicians to be able to recognize signs and symptoms of a CBRNe attack and be able to provide medical assistance in a terrorist attack. Certainly, this need justifies action just as in geographic locales where medical counter-terrorism measures are mandatory. However, there is no substitute for preparedness as the world saw amidst the coronavirus disease 2019 (COVID-19) pandemic.

The field of CTM continues to evolve as a subspecialty of emergency and disaster medicine.^{1,15–20} Counter-terrorism medicine includes a full spectrum of medical responses, starting at the tactical level in the field, moving to immediate response and care, to the hospital, and includes a multitude of post-event components to include both acute and chronic psychological impact. Thus, there exists a wide range of medical specialties who can and should be involved in the care of those victims of terror and CBRNe events.²⁰

Counter-terrorism medicine education is primarily taught in medical residency, fellowship, and military (and law enforcement) levels. There are some medical schools that do incorporate counter-terrorism and CBRNe medical education at the undergraduate medical school level; however, the vast majority have minimal to no such curriculum in place.^{21–25} In general, the presence or absence of content offering appeared most linked to the association of faculty with high level of interest in CTM and/or CBRNe content. The Association of American Medical Colleges (AAMC; Washington, DC USA) and Liaison Committee on Medical Education (LCME; Washington, DC USA) called for the incorporation of disaster training within United States medical education following the September 11, 2001 attacks, although only a minority of schools include any form of robust disaster training.^{23,25} Similarly, the Centers for Medicare and Medicaid Services (CMS; Baltimore, Maryland USA) published a rule in 2016 that required all participating physicians to coordinate with local, state, and federal emergency preparedness systems.²⁶ However, aside from hospitals and ambulatory surgery centers that are routinely inspected for such policies, this is an uncommon policy and/or prepared contingency in the vast majority of medical offices.

A multitude of studies demonstrate both the interest and proposed benefit of implementing CTM within the medical school curricula.^{21–25} There have been previous reports analyzing both United States allopathic and osteopathic medical schools.^{7,10,11} Similar studies in countries other than the United States yielded similar findings.^{27–29} Cole published the success of a two-week elective course in a United States medical school.^{4,5} Cole also emphasized the importance of learning from countries that have greater experience with CTM, such as Israel.^{4,5,30} Specifically, Cole emphasized specific lessons that the United States can learn from Israel's experience: crisis management, national standards, coordination, and communication. He noted differences in Israel and United States organization, in that Israeli medical responses

are centered around a national disaster management system, whereas local and regional systems predominate in the United States.³⁰ This national-based centralized system in Israel offers tiered protocols, while the more decentralized system in the United States may yield communication challenges. Additionally, the United States tends to train organizations while Israel trains individuals.³⁰ A clear example is the use of various code colors that often mean different circumstances in various United States hospitals.

Germany incorporated disaster medicine as part of its medical education in 2006; however, its implementation was not consistent and there is currently no standardized training.^{29,31} There are elective courses available in many countries including Italy and Belgium, while the Netherlands and China had no curricula for disaster medicine in medical schools.³¹

The movement to implement CTM into medical school curriculums gained maximum momentum after the September 11, 2001 terrorist attack on the World Trade Tower (New York USA).^{4–6,15–20} Cole developed a two-week course on terror medicine for medical students, encompassing four key areas: preparedness, incident management, mechanisms of injuries, and psychological consequences.^{4,5} Each medical school will determine both content and time allotted for any such education. Other institutions may offer single lectures, grand round presentations, or simulations, all of which offer at least exposure of the topic to medical students. Goals in introducing CTM and CBRNe education to medical students include the following: (1) introduction to the topic, (2) familiarity with the topic, (3) association with each student's chosen medical specialty, and (4) increased preparedness (starting with individual preparedness).

A number of studies have evaluated the need to implement counter-terrorism and disaster medicine into medical school curricula.^{7,10,11} Smith examined allopathic medical schools, finding that approximately one-third included disaster medicine in the core curriculum.^{7,10,11} While this is a minority, the number of United States medical schools that offer such content seems much less based on the current study. Kaiser, et al conducted a survey to United States allopathic and osteopathic medical schools and found that the majority of medical students (60%) were willing to participate in a natural disaster, a pandemic influenza response, or a radiological attack scenario.³² However, more important than an exact statistical number is the overall trend of the need for more education on this topic.

The AAMC, the LCME, and the Centers for Disease Control and Prevention (CDC; Atlanta, Georgia USA) previously deemed CTM to be a necessary topic to include in medical school despite the subsequent failure of implementation.^{23,25} The threat of terrorism both on the domestic front and overseas continues to increase.⁴ While the incidence of CBRNe attacks or the COVID-19 pandemic are infrequent, their impact is wide-reaching and substantial, thus justifying the call for increased education and preparedness. Just as civilians are trained in basic first aid, CPR, and bleeding control programs (Stop the Bleed), medical students and physicians should be proficient at higher level medical care capabilities.³³ Additionally, there are methods to incorporate CTM and CBRNe content within medical school curricula via numerous modalities that maximize both this content and traditional content. Medical students learn standard educational content but rarely in the context of CTM. Perhaps standardization

is not practical; however, there is both a need and a way for medical schools to incorporate at least an introduction to this critical topic.

Limitations

This study and methodology are not without limitations. First, online curriculums are helpful to establish an overall direction but may not be as detailed to include smaller lectures, electives, or mini courses. Additionally, there exist differences in the detail of curriculums published online by various medical institutions. While medical school curriculums were available online, the potential lack of updated content and/or non-inclusion of smaller content components may be difficult to account for. Second, there exists some degree of interpretation required by the authors to determine what content is representative of the search terms indicated. For example, gunshot injury is certainly an educational topic in all medical schools; however, this does not imply teaching in the context of a terrorist attack. Third, this study examined United States allopathic medical schools only.

Conclusion

There is both a need and interest in the promotion of counter-terrorism (to include CBRNe) medicine. The challenge of injecting this coursework within existing packed curricula is understandable; however, this ultimately demands the interest of each institution and experienced faculty. A total of 15 among the 153 United States allopathic medical schools (9.8%) offered some type of CTM and/or CBRNe medical education. The application to and inclusion of all medical specialties offers United States medical school graduates the great opportunity to be prepared and able to help in the unfortunate event of a terrorist attack. Such action might require an emergency needle decompression, but it also may simply require that authorities are activated and direct hemorrhage control is performed. Just as individuals are trained in CPR and programs to stop life-threatening bleeding (Stop the Bleed), the more physicians who are aware and prepared, the more people can be helped after a terrorist attack.!

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