

ORIGINAL RESEARCH

Disaster Medicine and Public Health Preparedness of Health Professions Students: A Multidisciplinary Assessment of Knowledge, Confidence, and Attitudes

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ABSTRACT

Objective: This study assessed disaster medicine knowledge and competence and perceived self-efficacy and motivation for disaster response among medical, nursing, and dental students.

Methods: Survey methodology was used to evaluate knowledge, comfort, perceived competency, and motivation. Also, a nonresponder survey was used to control for responder bias.

Results: A total of 136 responses were received across all 3 schools. A nonresponder survey showed no statistical differences with regard to age, gender, previous presence at a disaster, and previous emergency response training. In spite of good performance on many knowledge items, respondent confidence was low in knowledge and in comfort to perform in disaster situations. Knowledge was strong in areas of infection control, decontamination, and biological and chemical terrorism but weak in areas of general emergency management, role of government agencies, and radiologic events. Variations in knowledge among the different health professions were slight, but overall the students believed that they required additional education. Finally, students were motivated not only to acquire more knowledge but to respond to disaster situations.

Conclusions: Health care students must be adequately educated to assume roles in disasters that are a required part of their professions. This education also is necessary for further disaster medicine education in either postgraduate or occupational education. As students' performance on knowledge items was better than their perceived knowledge, it appears that a majority of this education can be achieved with the use of existing curricula, with minor modification, and the addition of a few focused subjects, which may be delivered through novel educational approaches. (*Disaster Med Public Health Preparedness*. 2013;7:499-506)

Key Words: health profession student, education, healthcare education, student assessment, disaster education

The US government has recognized the importance of a health care workforce that is competent to respond to bioterrorism and other public health emergencies. A number of congressional acts, most notably the 2003 Homeland Security Bill and the Nunn-Lugar-Domenici Amendment of 1997, call for a national level of readiness that specifically addresses the need for well-trained and prepared health care professionals.^{1,2} Because of the important role health professionals play with respect to early and local efforts in response to disasters, terrorism, and other public health emergencies, it is essential that health care students be appropriately and adequately prepared to handle these respective situations.

Data support the findings that health professionals have low levels of knowledge and self-perceived competence with regard to bioterrorism and disaster

preparedness, but they have overwhelmingly high interest in this type of training.³⁻⁹ Sparse data exist on the self-perceived competence, self-perceived confidence, and objective level of knowledge of health care students in the medical, nursing, dental, and public health fields in relation to bioterrorism and disaster preparedness. The small amount of evidence available shows trends similar to those seen in health care professionals.¹⁰⁻¹⁴

No data could be found that compare the perceived competence and actual knowledge bases of students within each health care discipline. Also, no studies could be found that compare perceived competence and actual knowledge bases, as well as comfort with disaster preparedness, across the various professional health care disciplines cited. Such data would be valuable to identify common gaps in knowledge and

help with the development of a systematic curriculum and competencies that could be adapted across each of these health care disciplines. To assure preparedness of the national health care workforce, these professionals need to be prepared to participate on an interdisciplinary level at the time of graduation, as they enter the health care workforce.

Educational efforts have been advanced by federal and state agencies, public health departments, as well as medical, dental, nursing, and public health schools. Many curricula are incorporating the competencies on bioterrorism published by the Centers for Disease Control and Prevention^{7,15} and our previously published health professional students' emergency management educational competencies.¹⁶ While a number of curricula and strategies from across the different health care fields are available to address this issue, systematic and formal evaluations of these have rarely been published. Consequently, the effectiveness of these various programs in meeting the programmatic goals has not been ascertained.¹⁶⁻²⁰ Also, these programs have largely targeted the population of health care professionals already in the practice setting. Further, to our knowledge, a systematic approach to the preparation of a large cadre of health professionals to respond to a disaster, terrorism, or other public health emergency in a multidisciplinary and interdisciplinary collaborative effort has not been undertaken.

The increased threats of terrorism today, coupled with our findings, clearly support the need to incorporate emergency preparedness and disaster medicine material into curricula for every health professional school in the nation. A coordinated and multidisciplinary response is needed to mitigate morbidity and mortality and maintain the fundamental elements of a health care system as well as public order.

This report presents data from a survey of health care students in the medical, nursing, and dental fields. The data provide the opportunity for intradisciplinary and interdisciplinary comparisons to identify common knowledge gaps and areas of improvement among emerging health care professionals. These data may help to strengthen and streamline the disaster, terrorism, and public health emergency preparedness curriculum at health professional schools across the nation.

METHODS

The institutional review board at Columbia University approved this study and the use of a web-administered survey to health care students in medical, dental, and nursing programs. All students received the request for participation at the same point, and the solicitation and completion methods employed the same methodology used by these schools for end-of-semester course evaluations. Invitations that explained the purpose, use of data, and importance of the study were sent by a dean from each school.

Individuals were asked basic information including age, gender, program, and expected graduation date. They also were asked questions regarding personal presence at disasters; past emergency response training such as being an emergency medical technician; and any disaster medicine or emergency management education received in a current program. Students were then asked whether they had received sufficient education in emergency management and disaster medicine, and about competency and comfort in these areas. Additional questions assessed the perceived risk and feeling of reward of participating in different types of events. Last, the students were presented questions regarding knowledge of emergency management and disaster medicine.

To address potential nonresponder bias, a nonresponder survey was sent to all nonresponders. This brief survey included age, gender, school, and program, previous presence at a disaster, emergency response training, and a knowledge question.

All statistical analyses were conducted using SAS, SPSS version 13.0. Basic illustrative tables and figures were created using Microsoft Excel 2002.

RESULTS

A total of 418 surveys were sent, and 136 respondents replied, for a response rate of 33%. Respondents were split relatively equally across the 3 schools surveyed. Medical and nursing school respondents made up 36% of the total respondents each; the dental school respondents made up 28% of the total respondents. Also, 65% of respondents were women; the highest percentage (73%) of female respondents was in the nursing school, as compared to the medical and dental schools (Table 1). The majority of respondents were aged 24 to 28 years old, but ranged between ages 23 and 57 years. The median age was 26 years. A comparison with the nonresponder survey respondents showed no statistical difference between the groups for age, gender, previous presence at a disaster, and previous emergency response training.

The majority of respondents (85%) across all schools had rarely or never been present at a man-made or natural disaster as either a professional or a volunteer. Another 14 respondents (10%) had rarely been present at a man-made or natural disaster as either a professional or a volunteer. The nursing school had the highest percentage (20%) of respondents that had at least 1 experience at a man-made or natural disaster as either a professional or a volunteer.

Cardiopulmonary resuscitation was the highest level of emergency medical response training for the majority of respondents across all schools. The dental school had the highest percentage (24%) of responders with a more advanced level of emergency medical response training (ie, certified first responder, emergency medical technician,

TABLE 1

Respondents (*N* = 136) in the Bioterrorism Curriculum Enhancement Project Pilot Student Survey

Respondent Characteristics	School Attended			Total
	Nursing	Medical	Dental	
No. of respondents (% total)	49 (36)	49 (36)	38 (28)	136 (100)
Female gender (% of each school)	36 (73)	28 (57)	24 (63)	88
Disaster presence as a responder (%)				
Never	39 (80)	42 (86)	34 (89)	115 (85)
Rarely	6 (12)	7 (14)	1 (2)	14 (10)
Occasionally	2 (4)	0 (0)	2 (5)	4 (3)
Often	2 (4)	0 (0)	1 (3)	3 (2)
Regularly	0 (0)	0 (0)	0 (0)	0 (0)
Highest level of emergency response training (%)				
Cardiopulmonary resuscitation	41 (84)	45 (92)	29 (76)	115 (85)
Certified first responder	0 (0)	1 (2)	2 (5)	3 (2)
Emergency medical technician	3 (6)	2 (4)	5 (13)	10 (7)
Paramedic	0 (0)	0 (0)	0 (0)	0 (0)
Licensed provider (MD, NP)	5 (10)	1 (2)	2 (5)	8 (6)

Abbreviations: MD, doctor of medicine; NP, nurse practitioner.

or physician or other licensed independent provider), and the medical school had the lowest percentage (8%).

Respondents were asked questions regarding receiving didactic (classroom) education about various aspects of disaster preparedness (Table 2). Respondents were only asked about didactic, classroom learning and not about any simulation or tabletop exercises. The topics included education about the incident command system (ICS), all-hazard emergency planning, biologic terrorism, chemical terrorism, and nuclear terrorism. The majority of respondents across all schools either strongly disagreed or disagreed about receiving didactic (classroom) education about the ICS, all-hazard emergency planning, and nuclear terrorism as part of their required coursework. A substantial percentage of medical and dental students (55% and 34%, respectively) either agreed or strongly agreed regarding receiving didactic education about biologic terrorism, whereas 59% of nursing students either strongly disagreed or disagreed regarding receiving didactic education about biologic terrorism. A higher percentage of medical students agreed or strongly agreed (33%) about receiving education about chemical terrorism as part of their required coursework than did nursing or dental students (18% and 21%, respectively).

Overall, respondents from across all schools believed that disaster preparedness was not integrated into multiple courses in the academic curriculum (Table 3). However, a majority of respondents across all schools believed that learning about disaster preparedness was an important part of their professional training. Compared to medical and nursing students (88% each), a smaller percentage of dental students (71%)

thought that learning about disaster preparedness was important to professional training.

Respondents generally believed that the academic training about disaster preparedness was not adequate or sufficient enough to allow them to function in the professional role that they may have to assume during a disaster. In addition, a minority of respondents across each school believed that they were competent to treat and manage patients exposed to biologic, chemical, and nuclear agents of terrorism (Table 4). A similar and substantial percentage of nursing, medical, and dental students (41%, 39%, and 45%, respectively) believed that they were comfortable working with other health care providers to coordinate patient care for victims of terrorism.

Students from each school were also asked about the risk and reward in participating in disaster response situations. In general, students across each school thought that participating in biological, chemical, radiation, and nuclear/explosive terrorism responses were extremely or slightly risky. The risks involved in these activities may include physical harm to oneself and the possible associated negative neurological impact of mass destruction and traumatic injury to fellow humans. However, the majority of students across schools thought that participation in these events is extremely or slightly rewarding, meaning that the benefit outweighed the risk of participation in these events. Therefore, the majority of students responding to the survey were willing to respond to disaster events. The rewards of participation in these events include the satisfaction of helping other humans in need of medical care and making the world a safer place.

TABLE 2

Didactic Education Topic	School Attended			Total
	Nursing	Medical	Dental	
Incident command system (%)				
Strongly disagree	19 (39)	22 (45)	16 (42)	57 (42)
Disagree	15 (31)	20 (41)	11 (29)	46 (34)
Mixed feelings	10 (20)	4 (8)	5 (13)	19 (14)
Agree	4 (8)	2 (4)	6 (16)	12 (9)
Strongly agree	1 (2)	1 (2)	0 (0)	2 (1)
All-hazard emergency planning (%)				
Strongly disagree	17 (35)	20 (41)	16 (42)	53 (39)
Disagree	18 (37)	16 (33)	10 (26)	44 (32)
Mixed feelings	5 (10)	4 (8)	5 (13)	14 (10)
Agree	8 (16)	8 (16)	7 (18)	23 (17)
Strongly agree	1 (2)	1 (2)	0 (0)	2 (1)
Biologic terrorism (%)				
Strongly disagree	12 (24)	8 (16)	8 (21)	28 (21)
Disagree	17 (35)	9 (18)	15 (39)	41 (30)
Mixed feelings	9 (18)	5 (10)	2 (5)	16 (12)
Agree	7 (14)	21 (43)	13 (34)	41 (30)
Strongly agree	4 (8)	6 (12)	0 (0)	10 (7)
Chemical terrorism (%)				
Strongly disagree	13 (27)	11 (22)	10 (26)	34 (25)
Disagree	19 (39)	18 (37)	18 (47)	55 (40)
Mixed feelings	8 (16)	4 (8)	2 (5)	14 (10)
Agree	7 (14)	14 (29)	8 (21)	29 (21)
Strongly agree	2 (4)	2 (4)	0 (0)	4 (3)
Nuclear terrorism (%)				
Strongly disagree	16 (33)	16 (33)	17 (45)	49 (36)
Disagree	24 (49)	23 (47)	18 (47)	65 (48)
Mixed feelings	7 (14)	6 (12)	2 (5)	15 (11)
Agree	2 (4)	4 (8)	1 (3)	7 (5)
Strongly agree	0 (0)	0 (0)	0 (0)	0 (0)

As previously discussed, students across each school believed that they were lacking in competence, confidence, and education in disaster preparedness. To assess the correlation between students' personal opinions and their actual knowledge, the survey contained questions assessing the students' actual knowledge of disaster preparedness, radiation, biologic, and chemical terrorism (Table 5).

With regard to disaster preparedness questions, similar trends were seen across schools. The majority of respondents knew where to find hazmat policies (79%) and knew how to perform gross decontamination (64%). Respondents performed less successfully on questions regarding identifying basic ICS and on interactions with public health and law enforcement. Only 29% of the respondents could identify the definition of comprehensive emergency management, and just 15% could define a functional type of exercise. Only 4% of respondents successfully identified the Federal Bureau of Investigation as the lead agency in a bioterrorist-related incident, while most (55%) incorrectly chose the Centers for Disease Control and Prevention. The majority of respondents also incorrectly chose the state public health laboratories as

the most appropriate place to send terrorist-related biologic specimens (74%); only 13% correctly chose the local public health laboratory.

Respondents from each school performed generally well on questions regarding radiation, biologic, and chemical terrorism: 65% of respondents correctly identified blast or shock as the initial destructive action of nuclear explosions; 49% of respondents (only 37% of nursing students) identified anthrax as not routinely transmissible via person-to-person contact; and 59% of respondents identified that a previous vaccination for smallpox is not a contraindication for smallpox immunization (Table 5). Medical students had a higher percentage of correct answers than students from the other schools.

Limitations

A few potential limitations were noted in our study. Although our sample size was robust at 418 surveys, a response rate of 33% could possibly lead to nonresponse bias. In light of this potential limitation, a nonresponder survey (98 surveys returned) revealed no statistical difference

TABLE 3

Question	School Attended			Total
	Nursing	Medical	Dental	
Was disaster preparedness integrated into multiple courses? (%)				
Strongly disagree	18 (37)	17 (35)	16 (42)	51 (38)
Disagree	21 (43)	19 (39)	18 (47)	58 (43)
Mixed feelings	7 (14)	7 (14)	1 (3)	15 (11)
Agree	2 (4)	5 (10)	3 (8)	10 (7)
Strongly agree	1 (2)	1 (2)	0 (0)	2 (1)
Is disaster preparedness an important part of training? (%)				
Strongly disagree	2 (4)	2 (4)	2 (5)	6 (4)
Disagree	2 (4)	0 (0)	2 (5)	4 (3)
Mixed feelings	2 (4)	4 (8)	7 (18)	13 (10)
Agree	26 (53)	26 (53)	25 (66)	77 (57)
Strongly agree	17 (35)	17 (35)	2 (5)	36 (26)
Was academic training about disaster preparedness to function in professional role I may assume? (%)				
Strongly disagree	15 (31)	9 (18)	9 (24)	33 (24)
Disagree	26 (53)	25 (51)	19 (50)	70 (51)
Mixed feelings	5 (10)	10 (20)	9 (24)	24 (18)
Agree	3 (6)	4 (8)	1 (3)	8 (6)
Strongly agree	0 (0)	1 (2)	0 (0)	1 (1)

TABLE 4

Agent	School Attended			Total
	Nursing	Medical	Dental	
Biologic (%)				
Strongly disagree	15 (31)	12 (24)	9 (24)	36 (26)
Disagree	19 (39)	24 (49)	16 (42)	59 (43)
Mixed feelings	10 (20)	8 (16)	9 (24)	27 (20)
Agree	4 (8)	5 (10)	3 (8)	12 (9)
Strongly agree	1 (2)	0 (0)	1 (3)	2 (1)
Chemical (%)				
Strongly disagree	15 (31)	15 (31)	12 (32)	42 (31)
Disagree	19 (39)	27 (55)	17 (45)	63 (46)
Mixed feelings	11 (22)	5 (10)	6 (16)	22 (16)
Agree	3 (6)	2 (4)	2 (5)	7 (5)
Strongly agree	1 (2)	0 (0)	1 (3)	2 (1)
Nuclear (%)				
Strongly disagree	16 (33)	17 (35)	12 (32)	45 (33)
Disagree	18 (37)	26 (53)	16 (42)	60 (44)
Mixed feelings	10 (20)	4 (8)	7 (18)	21 (15)
Agree	4 (8)	2 (4)	2 (5)	8 (6)
Strongly agree	1 (2)	0 (0)	1 (3)	2 (1)

between the groups for age, gender, previous presence at a disaster, and previous emergency response training. Nevertheless, in future study design, it may be beneficial to enhance the response rate by methods such as mandating the return of surveys before grades are released, as is done with course evaluations.

DISCUSSION

This survey demonstrated interesting trends among students from across various schools of health care. With the ever present threat of foreign and domestic disasters, terrorism, and public health emergencies, the need for appropriately trained health care workers is extremely important. Our findings

TABLE 5

Type of Question	School Attended			Total
	Nursing	Medical	Dental	
Disaster preparedness (% correct)				
Comprehensive emergency management	18 (37)	11 (22)	10 (26)	39 (29)
Functional exercise	6 (12)	6 (12)	9 (24)	21 (15)
Hazmat policies location	41 (84)	41 (84)	26 (68)	108 (79)
Use of personal protective equipment	13 (27)	14 (29)	8 (21)	35 (26)
Gross decontamination	33 (67)	30 (61)	24 (63)	87 (64)
Government agency roles	1 (2)	3 (6)	2 (5)	6 (4)
Laboratory roles	12 (6)	4 (8)	7 (18)	17 (13)
Biologic terrorism (% correct)				
Anthrax transmission	18 (37)	29 (59)	19 (50)	66 (49)
Smallpox postexposure vaccination	21 (43)	27 (55)	16 (42)	64 (47)
Smallpox vaccine contraindications	27 (55)	30 (61)	23 (61)	80 (59)
Chemical terrorism (% correct)				
Category A biologic agent criteria	17 (35)	25 (51)	13 (34)	55 (40)
Most effective treatment of exposure	21 (43)	24 (49)	11 (29)	56 (41)
Radiation terrorism (% correct)				
Use of potassium iodide after exposure	11 (22)	10 (20)	11 (30)	32 (24)
Destructive action of nuclear explosion	31 (63)	36 (73)	21 (55)	88 (65)

demonstrated that students are motivated to learn about and participate in these types of situations. Students from different health care fields thought that disaster preparedness and emergency response training was an important part of their education. These students also believed that while participating in disaster response may be risky, the experience would be very rewarding.

The majority of students thought disaster preparedness and emergency response training were important and essential to their education, but believed that this education was lacking in the curriculum of their respective schools. While most students perceived that they had low competence and confidence in disaster preparedness and emergency response knowledge, performance on objective questions was strong in some areas.

Students' performance on the knowledge-based questions combined with the subjective feeling of insufficient education on the material may have indicated that some of the subject matter is being taught in school, but they may not have realized that the information is relevant to bioterrorism or disaster preparedness. This observation indicated that some type of education in this field exists within the current curriculum. The fact that some of the material may be introduced sporadically in school under different topics such as microbiology or public health may have further disguised the subject matter.

Having faculty highlight how core topics are important for disaster and public health emergency preparedness is one way to accomplish the adjustment of the curriculum.

Examples might include current inclusion of agents that affect the autonomic nervous system but may also be employed in chemical nerve agents. Small pox, which is often presented as an eradicated disease, can still be considered a possible biological terrorism agent. The curriculum adjustment can also occur in the clerkship years. For instance, incorporating patient prioritization in emergency medicine is the foundation for teaching triage in mass casualty situations. The important concept for curricular design is that a significant percentage of disaster medicine and public health preparedness education can occur not by requiring additions to the curriculum but rather through alterations in organization and categorization.

Students assessed did not feel prepared to treat or manage patients in a disaster setting. This perception was found in students across all health care disciplines and across all years of training, and was due to their low confidence and perception of weak competence about disaster preparedness and emergency response. In addition, students thought that the education about these situations in school was incomplete. The knowledge-based questions identified knowledge gaps common among all students. These areas included the roles of government and public health agencies, general emergency management principles, and some radiation exposure knowledge. This finding was not surprising, as these areas have less overlap with the traditional health professional schools' curriculum.

The categorization of this information into a disaster-related topic may help students correctly answer related knowledge questions, as this information is typically not present in many

health curricula. The questions, however, also identified areas in which knowledge was strong, such as biologic and chemical terrorism, hazardous materials, and gross decontamination. As stated, this finding was not surprising because many of these topics are either fully or mostly covered in the current curriculum. These students will face disaster situations, whether natural or man-made, in their professional roles in practice or in health care institutions, which makes all of the areas of knowledge assessed with this survey important.

Based on the analysis of actual knowledge versus perceived knowledge, it is clear that, across multiple health care disciplines, students underestimated their knowledge regarding disaster and emergency preparedness and bioterrorism. In spite of this general trend, differences were found among the health professions students. Medical students performed better on the subjects of chemical and biologic terrorism than nursing or dental students; this trend may be explained by greater curricular overlaps for medical students. Another question that arose from this survey is whether a first-year student can accurately judge the school's disaster training. Our survey questioned all classes, but the majority of responses were from students in their graduation year or the year before graduation (119 of 136 respondents or 88%). Therefore, the majority of respondents had enough experience to accurately judge their school's disaster training.

Another interesting finding from the survey was the significant percentage of students who were comfortable working with other types of health care providers to coordinate patient care for victims of terrorism. This finding should not be overlooked given the importance of interdisciplinary teams and the multitude of people from different services involved in a successful disaster response. Although a significant number of students were comfortable working with other health care providers, many respondents were not comfortable. Adjustments in curricula may be needed to require these students to participate in some sort of disaster preparedness class or simulation together. This type of education would allow hands-on practice working together and establish definitive roles for each health care provider that can be used in the future.

The results of this survey identify areas of improvement for health professions student education as well as areas that are fairly strong. Medical, nursing, and dental students desire and require a more well-rounded disaster, terrorism, and public health emergency curriculum. Curricula may need revision to better organize and prioritize disaster education so that students can relate the information correctly. This curricular update would mostly require recategorization and slight additions to allow an understanding of how topics apply or slightly differ in disaster medicine. Slight additions would be needed to cover roles of governmental agencies and general emergency management.

Moreover, approaches such as distance learning could be employed to address the issues of limited ability to add

material to existing health professions curricula. In a society in which the disaster and emergency response system is frequently used and the threat of bioterrorism is ever present, health care students must be adequately trained to provide a prepared and efficient health care workforce for the public in the future. This education will also give students the core education needed for further disaster medicine education in either postgraduate or occupational education.

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