

# Disaster medicine education in Canadian medical schools before and after September 11, 2001

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## ABSTRACT

**Objective:** To describe disaster medicine (DM) education in 16 Canadian medical schools before and after September 11, 2001 (9/11).

**Methods:** Email invitations and reminders to complete an Internet-based survey were sent to 48 undergraduate and fellowship representatives.

**Results:** A total of 24 responses were received from 15 of the 16 Canadian medical schools in operation at the time of the study, representing 10 undergraduate and 14 fellowship programs. Prior to 9/11, 22 programs at 9 schools taught DM compared with 14 programs post 9/11, a reduction of 37%. Six schools reported no DM teaching before 9/11; 7 reported no DM instruction after that date. Respondents from 12 schools felt that DM should be taught at the undergraduate level, and 9 of the 12 felt it should be included as core content. Respondents from all 15 responding schools felt that DM should be included as core content at the fellowship level. Twenty-two respondents (92%) indicated a belief that the public expects physicians to be prepared to deal with the consequences of disasters. The most frequently taught topics were emergency medical services and disasters, disaster management, hospital disaster planning, and bioterrorism.

**Conclusion:** Despite support for DM instruction and increases in terrorism and global disasters, 46% of the responding medical schools do not teach this topic and there has been a downward trend in this regard since 9/11.

**Key words:** disaster medicine education; Canadian medical schools

## RÉSUMÉ

**Objectif :** Décrire l'enseignement de la médecine de catastrophe dans 16 écoles de médecine avant et après le 11 septembre 2001.

**Méthodes :** Des invitations par courriel à remplir un sondage par Internet ainsi que des rappels furent envoyés à 48 représentants du premier cycle et des études supérieures.

**Résultats :** Un total de 24 réponses fut reçu de 15 des 16 écoles de médecine en opération au moment de l'étude, représentant 10 programmes du premier cycle et 14 programmes d'études supérieures. Avant le 11 septembre, 22 programmes dans neuf écoles enseignaient la médecine de catastrophe comparativement à 14 programmes après le 11 septembre, une diminution de 37%. Six écoles n'enseignaient pas la médecine de catastrophe avant le 11 septembre; sept écoles ne l'enseignaient pas après cette date. Les répondants de 12 écoles jugeaient que la médecine de catastrophe devrait être enseignée au niveau du premier cycle et neuf de ces 12 écoles jugeaient que

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cet enseignement devrait être inclus dans le contenu obligatoire du programme. Les répondants de toutes les 15 écoles ayant répondu estimaient que la médecine de catastrophe devrait être incluse comme matière obligatoire au niveau des études supérieures. Vingt-deux répondants (92 %) croyaient que le public s'attend à ce que les médecins soient préparés à gérer les conséquences des catastrophes. Les sujets enseignés le plus souvent étaient les services médicaux d'urgence et les catastrophes, la gestion des catastrophes, la planification hospitalière en cas de catastrophe et le bioterrorisme.

**Conclusion :** Malgré l'appui de l'enseignement de la médecine de catastrophe et l'augmentation des actes de terrorisme et des catastrophes naturelles, 46 % des écoles de médecine ayant répondu au sondage n'enseignent pas ce sujet et on a noté une tendance à la baisse à cet égard depuis le 11 septembre.

## Introduction

The events of September 11, 2001 (9/11) provided graphic evidence of the vulnerability of North America to terrorism. Since 9/11, global natural disasters, such as the tsunami in Southeast Asia in December 2004 and hurricane Katrina in the southern United States in August 2005, have demonstrated the importance of early warning systems and preparedness. In each of these cases community and medical responses were required and the ability of physicians to respond appropriately was dependent on prior training and experience. A systematic review of the world literature on disaster medicine education revealed that little has been published on this topic.<sup>1</sup>

## Objectives

The primary objective of this descriptive study was to survey Canadian medical schools to determine the degree of disaster medicine (DM) education at the undergraduate and fellowship levels. A secondary objective was to comparatively evaluate the disaster education offered at the schools before and after 9/11. Specifically we sought to determine:

- the degree to which disaster medicine/preparedness was taught at undergraduate and fellowship levels;
- which programs offered courses in DM;
- whether DM courses were part of the core or elective curriculum;
- which specific topics were taught within the DM context;
- respondents' perspectives on the responsibility of Canadian medical schools to teaching DM.
- respondents' perspectives on public expectations related to physician preparedness to deal with disaster situations and consequences.

## Methods

Ethics approval was obtained through the University of

Eastern Piedmont, Italy, site of the European Master in Disaster Medicine. Following pilot testing, VS Survey (VS Communications Inc., Edmonton, Alta.) was used to assist in developing the survey, which was then deployed on the Internet using Java Server Pages (JSP) technology and the Apache Tomcat Web server. The data collected by the software were securely stored in a MySQL™ relational database management system (MySQL™ Inc., Seattle, Wash.). The Web server and database were both protected by firewalls, and the servers were kept up to date with the latest operating system updates and antivirus software.

A request to complete the survey was then distributed to undergraduate Associate Deans and fellowship program Medical Directors at all 16 Canadian medical schools accredited by the Association of American Medical Colleges (AAMC) at the time of the study\* (Appendix 1).<sup>2</sup> A unique identifier was assigned to protect the identity of respondents, schools and programs. Each contact received up to 4 emails (the first 2 anonymous, and the next 2 personalized) inviting them to participate in the study. An automated system of survey distribution and reminders was used when required.

The survey asked respondents to identify core and elective topics taught by their medical school from a list of DM topics developed from 3 sources: the contents of Disaster Medicine,<sup>3</sup> the module outline of the European Master in Disaster Medicine,<sup>4</sup> and the 2001 course outline of Disaster Medicine Online<sup>5</sup> (offered to all Canadian Emergency Medicine residents through the Division of Emergency Medicine at the University of Alberta).

For analysis, data were imported from the electronic database into Microsoft Excel (Microsoft, Redmond, Wash.). The contact information and survey results were stored in 2 separate tables to prevent inadvertent matching of results to respondents.

\*At the time of this study, Canada's newest medical school, the Northern Ontario School of Medicine, a twin-site medical school, had not yet opened its doors.

**Results**

A total of 24 responses were received from 48 potential respondents (50%) representing 15 of the 16 Canadian medical schools (94%). Figure 1 illustrates the results from each step of the surveying system and the resulting final study population. The 24 respondents represented 10 undergraduate and 14 fellowship programs. Table 1 shows the distribution of DM education across the surveyed schools before and after 9/11. Before 9/11, 9 of the 15

schools taught DM in the Department of Emergency Medicine. Other programs that included DM were Public Health, Pediatrics and Community Medicine. Six schools did not offer DM before 9/11. In the schools that taught DM before 9/11, 4 indicated that it was core content.

A change of emphasis in DM curriculum before and after 9/11 is noted in Table 1. Before 9/11, 22 programs in 9 of the schools taught some topics in DM. After 9/11, the total number of programs that included topics in DM decreased by 37%, to 14. There was no change in the number

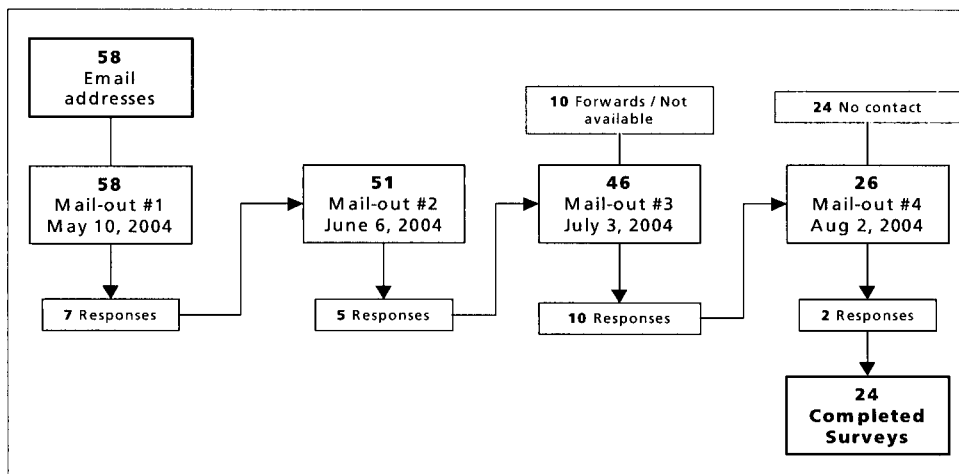


Fig. 1. Disaster medicine survey flowchart.

Table 1. Disaster medicine programs (\*) in 15 Canadian medical schools before (Pre) and after (Post) September 11, 2001

School, no. of students enrolled	Faculty of Medicine divisions and departments													
	Emerg Med		Publ Health		Pediatrics		CM		Infect Dis		Surgery		Other	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<b>&gt;20 000</b>														
1	*	*	*	*	*	*	*		*	*	*	*	*	*
2	*	*	*	*	*	*	*				*			
3	*	*	*											
4	*				*		*							
5	*			*										
6														
7	*			*	*									
8														
<b>10 000–20 000</b>														
9	*													
10	*						*							
11														
12														
13										*				
14														
<b>5 000–10 000</b>														
15	*													

Emerg Med = Emergency Medicine; Publ Health = Public Health; CM = Community Medicine; Infect Dis = Infectious Diseases

of schools (4) that reported core content DM education. The number of Emergency Medicine programs teaching DM dropped from 9 to 3 after 9/11. Two schools (#1, #2) accounted for 12 of the 22 programs that taught DM before 9/11, and 8 of the 14 programs that taught DM after 9/11. Finally, the number of schools that reported no instruction in DM increased by 1 (from 6 to 7) after 9/11.

Table 2 shows the DM topics currently taught in various programs in 9 of the 15 responding schools. Large schools tend to offer more topics than small schools. The topics taught, in order of frequency were: EMS & Disasters (8 schools); Disaster Management (8); Hospital Disaster Planning (8); Bioterrorism (6); Radiation Disasters (6); Pandemics (6); Natural Disasters (5); HazMat (5); Mass Gatherings Disasters (5); Chemical Disasters (5); Aviation Disasters (3); Myths & Facts About Disasters (3); Terrorism (2); Mass Shootings (2); and Risk Assessment and Communication Issues in Disasters (1).

Respondents were asked whether they felt that DM should be taught at the undergraduate or fellowship levels and whether it should be core or elective content. Respondents representing 12 schools (80%) felt that DM should be taught at the undergraduate level and 11 of the 12 (73%) felt that it should be core content. Respondents from all 15 schools (100%) felt that DM should be taught at the fellowship level as core content.

Thirteen of the 15 responding Canadian medical schools and 22 of the 24 respondents (92%) indicated they believed that the public expects physicians to have knowledge in DM. Respondents were also asked to choose whether undergraduate programs, fellowship programs, hospitals or communities were responsible for teaching DM to physicians. The respondents were not limited to one answer, and results were as follows. Respondents from 10 schools suggested that the responsibility should lie with the undergraduate program, 13 suggested it should lie with

**Table 2. Current disaster medicine topics taught (\*) in Canadian medical schools**

School, no. of students enrolled	Disaster medicine topic														
	EMS & Disasters	Disaster Management	Hospital Disaster Planning	Bioterrorism	Radiation	Pandemics	Natural	HazMat	Mass Gatherings	Chemical	Aviation	Myths & Facts	Terrorism	Mass Shootings	Other <sup>†</sup>
<b>&gt;20 000</b>															
1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3		*				*									
4	*	*	*		*		*	*		*	*				
5	*		*	*	*	*	*					*			
6															
7	*	*	*	*		*		*		*					
8															
<b>10 000–20 000</b>															
9	*	*	*	*	*	*	*	*	*						
10	*	*	*	*	*				*	*					
11															
12															
13	*	*	*						*						
14															
<b>5 000–10 000</b>															
15															

HazMat = Hazardous Materials  
 \* Topic is taught in that particular school.  
 †Risk Assessment and Communication Issues in Disasters.

the fellowship programs, 6 felt it should lie with the hospital, and 3 suggested that it should lie with the community. Two respondents reported that no one had the responsibility to teach DM, and 1 school suggested it was the responsibility of the federal government through Health Canada.

## Discussion

Disaster medicine has traditionally fallen under the domains of Emergency Medicine and Public Health. This is reflected in the number of Canadian medical schools that offered DM through their departments/divisions of Emergency Medicine. Because the surgical curriculum in Canada has not traditionally included DM topics as part of the core program, the fact that DM was taught by Surgery divisions in 2 schools was unexpected. Our results also indicate an unexpected diversity of programs in which DM was taught, both before 9/11 and currently. Another surprising finding was the concentration of topics taught in 2 of the schools. This apparent concentration of DM teaching in a small number of schools is a concern; a wider distribution of medical schools teaching DM across Canada would ensure that Emergency Medicine residents receive DM instruction. The importance of this is underscored by the fellowship exams in Emergency Medicine, which routinely contain questions pertaining to DM. Although the *Objectives of Training and Specialty Training Requirements in Emergency Medicine* from the Royal College of Physicians and Surgeons of Canada does not list specific requirements for training or competency in DM,<sup>6</sup> if DM training is not available in all medical schools and residencies, it may be difficult for residents to meet the knowledge standard implicitly expected at the fellowship level.

In some schools, DM was taught in many different programs. It was not clear from the data whether the responsibility for the DM program was based in one department but taught horizontally across departments, or if each department taught a component of DM relevant to their specialty.

The total number of programs teaching DM decreased after 9/11. Additionally, the number of Emergency Medicine programs teaching DM decreased from 9 to 3. Two significant factors may be responsible for this. First, the Online Disaster Medicine Course based at the University of Alberta, accessed by many Emergency Medicine residents in programs across the country, ceased to be offered in late 2002. Second, the reduction and shift away from Emergency Medicine as the major provider of Disaster Medical Education may, in large part, have been a result of Canada's experience with SARS (severe acute respiratory syndrome), providing a renewed focus for disaster teach-

ing. The SARS outbreak in Toronto and Asia demonstrated the necessity of strong linkages between global and national surveillance and DM education. This disease led all health care professionals to refocus their attention on pandemics and may have led to Public Health and Infectious Disease specialists assuming a greater role in the teaching of physicians and other health care personnel in this area.

The events of September 11, 2001, did not result in the development and implementation of courses in Bioterrorism and Chemical Terrorism in Canadian medical schools. In contrast, the US significantly increased the number of "Bioterrorism" courses offered after 9/11. The Association of American Medical Colleges (AAMC) Web Site<sup>7</sup> provides information concerning the number of US medical schools that taught "Biological and Chemical Terrorism" before and after September 11, 2001. Prior to 9/11, the AAMC Web site indicated 1 required course, 2 elective courses and 26 courses where DM was part of a required course in Biological and Chemical Terrorism in the listed US medical schools.<sup>8</sup> In contrast, after 9/11, the same source indicated that the total number of courses in Biological and Chemical Terrorism had risen to 63 required courses and 9 elective courses. This response was the result of work initiated by AAMC in conjunction with the US Centers for Disease Control and Prevention (CDC) and the Partnership for Community Safety.<sup>9</sup> In Canada, the military teaches Bioterrorism and Chemical Terrorism, a course that is offered to emergency physicians and EMS personnel on an invitation basis.

Our results showed significant support among respondents for including DM as part of the core curriculum at both the undergraduate and fellowship levels. The rank order indicated that topics such as "Myths & Facts About Disasters" were ranked low, even in schools that offered many topics in DM. Optimal curriculum design is based on delivery of content topics in a sequence that helps learners achieve their objectives.<sup>10</sup> We believe it is fundamental to provide education about myths and facts about disasters early in DM education because such a course has the potential to dispel many of the misconceptions related to the definition of, response to, and outcomes of disasters.

### Public expectations

Finally, 13 of the 15 responding Canadian medical schools and 22 of the 24 respondents reported that they believe that the public expects physicians to be prepared and able to deal with the consequences of disasters. The responsibility for educating physicians was also felt to lie with medical schools in the undergraduate and fellowship programs. This indicates an endorsement for the design and imple-

mentation of a curriculum in DM for undergraduate and fellowship medical programs. The challenge will be in how to design and implement DM in a curriculum that is already very large and diverse. The implementation and evaluation of such a curriculum is fertile ground for future research.

### **Limitations**

A limitation of this study was the variation in the number of respondents from different programs in each school. Of the 24 respondents surveyed, 10 were from undergraduate programs (Associate Deans) and 14 were from subspecialty fellowship programs. The 24 respondents represented 15 of the (then) 16 AAMC accredited Canadian medical schools. At least 2 respondents from each school were targeted to participate in the survey. In the end, the distribution of respondents by school was as follows: 3 schools with 3 respondents, 3 with 2 respondents, 9 with 1 respondent and 1 school with no response. This may be a reflection of the complexity of Canadian medical schools and the perceived content of DM curriculum. The schools with 1 respondent may have delegated 1 person to respond who may have been viewed by the others as the most appropriate respondent to the original email. Our response rate may also have been influenced by our use of an email and Internet-based surveying methodology. Finally, given the limitations of our design, it is impossible to differentiate between association and causation with regard to any differences in DM education pre and post 9/11. In fact, as discussed previously, we suspect the reduction in DM education that we found post 9/11 was predominately attributable to other factors.

### **Survey response rates**

Sheehan examined factors affecting response rates to both email and postal mail surveys,<sup>11</sup> and 3 were relevant to this survey. The first factor was survey length. Although the evidence was mixed, Steele, Schwendig and Kilpatrick concluded that the length of the survey was important: the longer the survey, the lower the response rate.<sup>12</sup> In Sheehan's analysis of 31 surveys, the number of questions ranged from a low of 5 to a high of 94 questions.<sup>11</sup> Therefore, this Canadian medical schools survey was developed with a total of 20 questions.

The second factor was respondent prenotification. Many researchers found that prenotification had a positive influence on response rate.<sup>11</sup> The final factor was follow-up contacts. Sheehan and Hoy found that a reminder message for the survey increased response rates by 25%.<sup>8</sup> Sheehan also reported an average response rate of 36.83% for 31

surveys analyzed.<sup>11</sup> In our survey, there were 3 follow-up reminders (mail-out 2, 3, 4) with a personalized letter. As a result the response rate doubled from mail-out 2 to mail-out 3 (Fig. 1). The final response rate was 50%, well above that reported by Sheehan.<sup>11</sup>

In the end, we were satisfied that the responses from 15 of the 16 medical schools represented a comprehensive representation of undergraduate and fellowship medical school leaders in Canada.

### **Conclusions**

This survey of Canadian medical schools showed strong support among respondents for mandatory education in DM at undergraduate and fellowship levels. Despite support for DM instruction and increases in terrorism and global disasters, 46% of the responding schools do not teach this topic and there has been a drop in this regard since 9/11. We believe a societal obligation and responsibility exists for medical education administrators to design and implement a DM program in current medical curricula. The content and sequencing of a proposed Canadian DM curriculum is available for implementation and evaluation.<sup>13</sup>

### **Recommendations**

Based on the results from this survey and our own experience, we offer the following observations and recommendations.

- Access to Disaster Medicine teaching across Canada is not equitable. All medical schools do not require an exhaustive curriculum. However, a minimum level of DM should be taught at all medical schools in a sequence to assist the learner in achieving the objectives.
- This minimum level of DM curriculum is essential to support fellowship programs in Canada where residents are expected to have competency in DM.
- Disaster Medicine should be taught at undergraduate and fellowship levels in Canadian medical schools.
- Canadian medical school educators and fellowship directors believe that Canadian medical schools are responsible for the education of physicians in DM. This recognition of social conscience is essential.
- The curricula in undergraduate and fellowship programs need to be examined for apparent shortfalls in DM education. Program leaders must adjust existing medical curricula such that DM can be offered at both levels of training.
- For a more coordinated and planned educational experience

rience, DM should be based in a single department/division, though the educational content could be delivered by many programs.

**Competing interests:** None declared.

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### Appendix 1. List of Canadian medical schools accredited by the Association of American Medical Colleges, as of September 2005\*

#### **Alberta**

University of Alberta Faculty of Medicine and Dentistry  
University of Calgary Faculty of Medicine

#### **British Columbia**

University of British Columbia Faculty of Medicine

#### **Manitoba**

University of Manitoba Faculty of Medicine

#### **Newfoundland**

Memorial University of Newfoundland Faculty of Medicine

#### **Nova Scotia**

Dalhousie University Faculty of Medicine

#### **Ontario**

McMaster University School of Medicine  
Northern Ontario School of Medicine\*  
Queen's University Faculty of Health Sciences  
University of Western Ontario Faculty of Medicine & Dentistry  
University of Ottawa Faculty of Medicine  
University of Toronto Faculty of Medicine

#### **Quebec**

Laval University Faculty of Medicine  
McGill University Faculty of Medicine  
Université de Montréal Faculty of Medicine  
Université de Sherbrooke Faculty of Medicine

#### **Saskatchewan**

University of Saskatchewan College of Medicine

\*At the time of the study in 2004, Canada's newest medical school, the Northern Ontario School of Medicine, a twin-site medical school, had not yet opened its doors.

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