

AWARENESS AND KNOWLEDGE ABOUT BIOTERRORISM AMONG MEDICAL STUDENTS AT A UNIVERSITY IN MALAYSIA

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ABSTRACT

The use of biological agents as weapons in warfare has been practiced since antiquity and is on the rise recently. In the event of an act of bioterrorism, health care professionals have to be prepared to identify and counter such incidents. They have to recognize and initiate rapid response to acts of bioterrorism underlining the importance of awareness and preparedness for bioterrorism. A closed questionnaire based survey, conducted among medical students, to assess their awareness and knowledge on bioterrorism included questions on biosafety, biosecurity, target population, biological agents, role of doctors and hospitals, response and scope. Results were analyzed by using simple statistical applications. Of 132 respondents, 64% were aware of the term bioterrorism. Students were aware of important etiological agents used in bioterrorism; *Bacillus anthracis* (52%), Ebola virus (58%), Small pox (51%), *Vibrio cholerae* (41%) and *Clostridium botulinum* (28%). Majority of students were aware about the importance of identifying illness, and reporting to concerned health officials and 95% respondents opined that, inclusion of bioterrorism in curriculum provides scope for expansion of preparedness. This study indicates a need to include bioterrorism as a topic in curriculum, thereby providing basic knowledge and preparedness to respond to bioterrorism.

Key words: Bioterrorism, Biological agents, Biosecurity, Biological weapons

INTRODUCTION

Acts of terrorism are increasingly being reported globally (Agnieszka *et al.*, 2015). Bioterrorism is of particular importance and relevance to the healthcare worker considering the nature of work and work-environment pertinent to healthcare. Several agencies have defined bioterrorism and one among them is by The Model State Emergency Health Powers Act [Centers for Disease Control and Prevention (US)]; ‘Bioterrorism is the intentional use of any microorganism, virus, infectious substance, or biological product that may be engineered as a result of biotechnology – or any naturally occurring or bioengineered component of any such microorganism, virus, infectious substance, or biological product – to cause death, disease, or other biological malfunction in a human, animal,

plant, or other living organism to influence the conduct of government or to intimidate or coerce a civilian population’ (Ryan *et al.*, 2008). As defined, it is the relative ease of use and inexpensive methods of production of biological agents that are key to selection of this mode of attack. Moreover, these agents are easily aerosolized enabling widespread distribution resulting in significant disease or even death. Commonly used agents of biological warfare include causative pathogens of anthrax, tularemia, brucellosis, melioidosis, several foodborne pathogens, cryptosporidiosis, cryptococcus, smallpox and viral hemorrhagic fevers (Agnieszka *et al.*, 2015; Ryan *et al.*, 2008). Documented evidences of biological terrorism demonstrate use of a wide biological arsenal in varied settings such as *Bacillus anthracis* in a mail processing center and *Salmonella enterica* var Typhimurium in an attempt to sabotage an election (Noah *et al.*, 2002; Treadwell *et al.*, 2013; Morbidity

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Mortality Weekly Report, 2000). Risk mitigation strategies and rapid response plans directed towards bioterrorism preparedness are of significance amongst the healthcare worker community. An assessment of current medical curriculum is warranted to evaluate the educational status of bioterrorism among medical students (Torok *et al.*, 1997). Medical educationalists are also of the opinion that there is sufficient evidence to highlight the lack of teaching in this area at the undergraduate level (Lee *et al.*, 2001). The objective of our survey was to evaluate the level of awareness and knowledge on bioterrorism among medical students in the pre-clinical and clinical years.

MATERIALS AND METHODS

A closed questionnaire based survey was conducted among medical students at a medical college in Malaysia to assess their awareness and knowledge on bioterrorism. The students underwent a 5 year integrated MBBS program. Curriculum in first and second years focused on basic science and pre-clinical subjects whereas the third, fourth and fifth years' curriculum encompasses clinical subjects including forensic medicine and community medicine. This questionnaire survey was conducted online using 'Survey Monkey[®]', an online survey application. It was conducted over a period of six days including two days of the weekend. Student email addresses were solicited after informing students about the survey and were assured, confidentiality and anonymity of opinions shared. Of the invitations sent out to participate in the survey (n=188), a total of 132 students responded. One student communicated to opt out of the survey. Pre-clinical year two group respondents (n=62) were

yet to have formal discourses on forensic medicine in contrast to the year four (n=46) and year five (n=24) respondents who were exposed to concepts in forensic medicine. The questionnaire included questions on biosafety, biosecurity, target population, biological agents, role of doctors and hospitals, response and scope. Results were analysed using simple statistical applications.

RESULTS

Student responses were monitored on a real time basis to assess the quality of time spent in taking the survey. Response turn around time is summarized in Figure 1. Of the 132 respondents, 64% were aware of the term bioterrorism. Among 129 respondents, 32% alone were aware of the term biosafety. Awareness of these two terms among the survey respondents is summarised in Table 1. Majority of students were aware about the importance of identifying illness and the doctors played a key role in reporting to concerned health officials for immediate health intervention measures. A basic analysis of student perceptions is summarized in Figure 2 and Table 2. Student attitudes and opinions towards incorporating topics on bioterrorism in medical curriculum are represented in Figures 3, 4 and 5.

DISCUSSION

Electronic survey proves to be useful in disseminating and collecting data considering that not all participants could be physically briefed on the study protocol. Group representatives were given detailed instructions which was

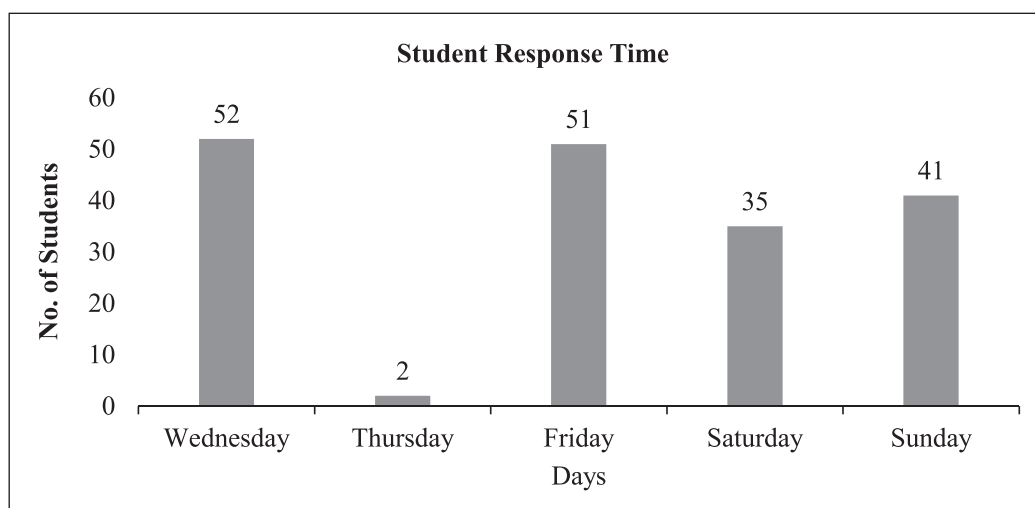


Fig. 1. Students' response distribution over time.

Table 1. Student awareness about bioterrorism and biosecurity

	Answer	Year 2	Year 4	Year 5
Do you know what is bioterrorism?	Yes	77.42%	54.35%	50.00%
	No	22.58%	45.65%	50.00%
Do you know what is biosecurity?	Yes	40.68%	23.91%	27.27%
	No	59.32%	76.09%	72.73%

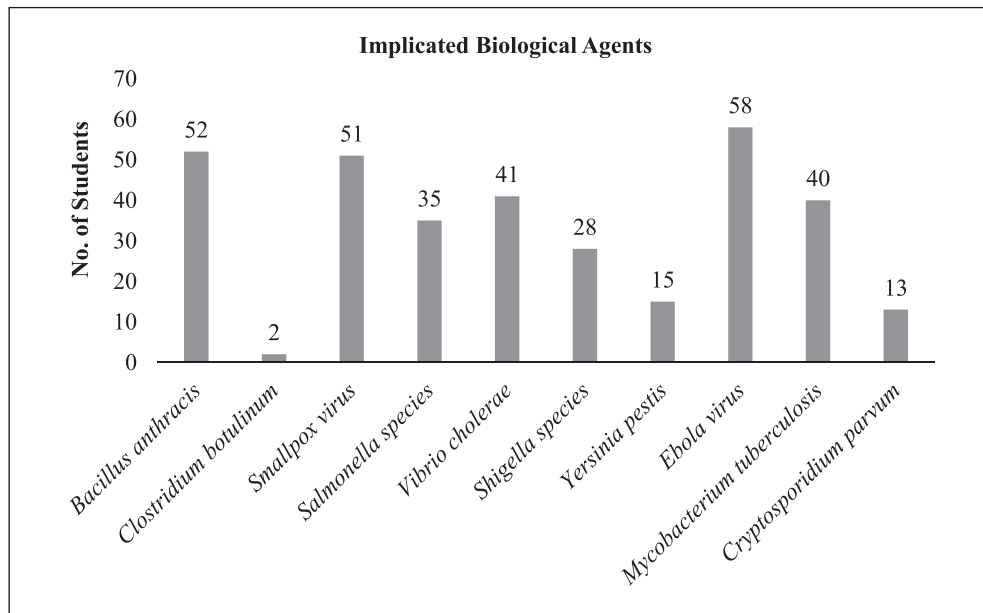


Fig. 2. Student perceptions on implicated biological agents.

Table 2. Student awareness on key role of doctors in reporting bioterrorism

Question: What in your opinion is the role of doctors and hospitals in bioterrorism? Rank the most significant first.					
Answered: 130	Skipped: 2			Total	Score
	1	2	3		
Awareness of primary signs and symptoms of illness related to bioterrorism	65.05% 67	17.48% 18	17.48% 18	103	2.48
Report such illness immediately to public authority	19.42% 20	58.25% 60	22.33% 23	103	1.97
Report clusters of illness that are related to bioterrorism agents	11.90% 15	27.78% 35	60.32% 76	128	1.52
Basic statistics					
	Minimum	Maximum	Median	Mean	Standard deviation
Awareness of primary signs and symptoms of illness related to bioterrorism	1	3	1	1.52	0.77
Report such illness immediately to public authority	1	3	2	2.03	0.65
Report clusters of illness that are related to bioterrorism agents	1	3	3	2.48	0.7

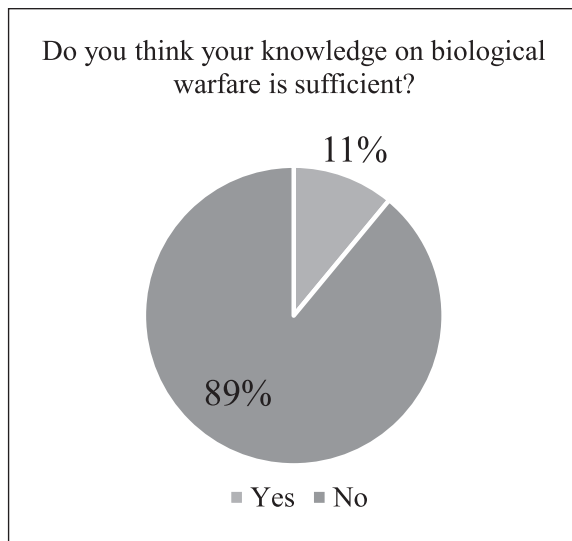


Fig. 3. Student knowledge on bioterrorism.

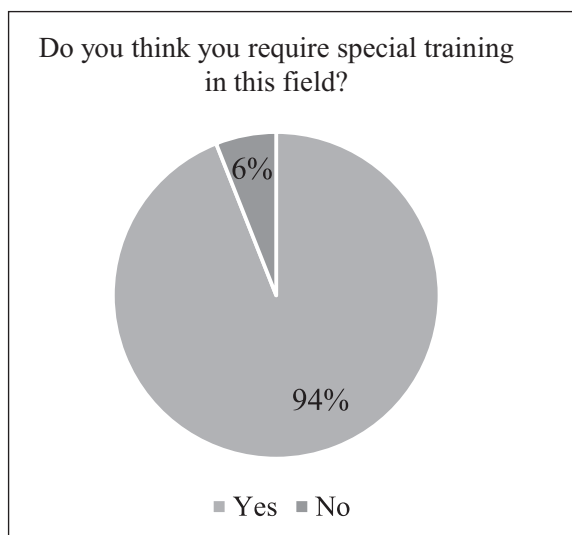


Fig. 4. Student willingness for training.

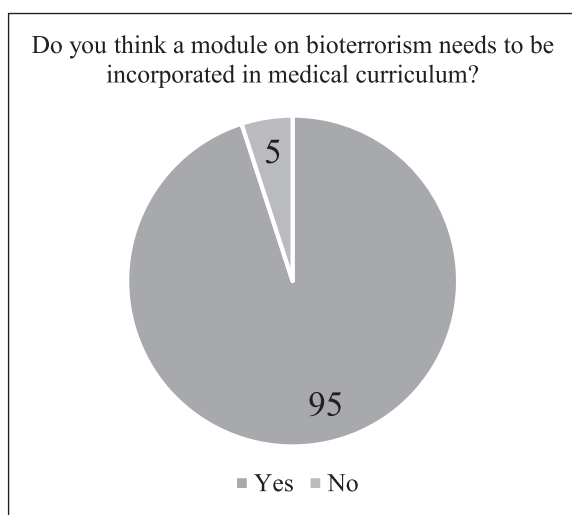


Fig. 5. Student opinion on curriculum modification.

later disseminated to participants using mass communications systems. This method has been validated by other studies proving to be a more efficient method when applied for large group surveys involving hundreds of participants (Green *et al.*, 2013). Response turn around time was observed to be within the first 36 hours in most participants. Responses over the weekend was minimal (n=17) which may give an insight into the spontaneity of information collected.

Student awareness on bioterrorism is higher than that on biosafety. Several other studies conducted globally, involving diversely skilled populations ranging from medical students to physicians, including other health care workers demonstrate similar trends (Uhlig *et al.*, 2014; Canyon, 2009). Interestingly, students belonging to the year 2 cohort opined greater comprehension of the topic than the year 4 and 5 cohorts respectively.

Our data reveal that commonly implicated organisms are the Ebola virus (58%), *Bacillus anthracis* (52%), small pox (51%) and less commonly Salmonella (35%) and Shigella (28%). This is in concurrence to one other survey conducted among nursing staff at a hospital in Poland (Chaudhari *et al.*, 2011). An act of bioterrorism using spores of *Bacillus anthracis* 'posted' in an envelope to a United States senator's office causing inhalational anthrax resulted in significant morbidity and mortality at the Brentwood Mail Processing Distribution Centre, Columbia (Treadwell *et al.*, 2013). One other reported incident involved intentional dissemination of *Salmonella enterica* var Typhimurium in a salad bar by a group to cause crippling impact on the voter turnover in an upcoming election (Morbidity Mortality Weekly Report, 2000). These incidents demonstrate the spectrum of both magnitude as well as intentions of bioterrorists. Therefore, it is imperative that healthcare personnel be aware and trained on bioterrorism. Medical students need to be abreast with current global issues and should be adequately prepared to recognize and initiate a mitigation plan in case of sudden disease outbreaks as a result of bioterrorism (Lee *et al.*, 2001).

CONCLUSION

Our survey demonstrates that students perceive that the need for 'Awareness of primary signs and symptoms of illness related to bioterrorism is very essential. This emphasizes the importance of addressing lacunae in the current medical curriculum pertinent to bioterrorism. Students clearly recognize their knowledge gap and are of the opinion that bioterrorism needs to be incorporated in medical curriculum. Therefore, basic knowledge concepts

on bioterrorism may be incorporated in the pre-clinical year and basic training in management of bioterrorism attacks in advanced years' curricula.

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