

ORIGINAL  
ARTICLE**Evaluation of knowledge and preparedness of medical,  
dentistry, nursing and laboratory science technology students  
against a potential bioterrorism attack in Birjand University of  
Medical Sciences, 2017**

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Received: October 02, 2018

Revised: October 14, 2018

Accepted: October 17, 2018

**Abstract**

**Introduction:** During recent years, occurrence of terroristic attacks throughout the Middle East and occasionally in Iran have proposed that bioterrorists have the ability to disseminate biologic agents in the region and cause widespread social panic. Medical, health and laboratory personnel have a serious responsibility towards their public community in terms of the prevention, detection and treatment of potential bioterrorism attacks. To fulfill their responsibilities, they need to be trained by taking part in the relevant courses during their undergraduate education. In case of potential bioterrorism attacks, an appropriate level of knowledge and preparedness is essential for medical, health and laboratory personnel to ensure a proper medical response to such outbreaks. This study aimed to evaluate the level of knowledge, preparedness and attitude of medical, dentistry, nursing, and laboratory science technology students in Birjand University of medical sciences, Birjand, Iran on a potential bioterrorism attack.

**Methods:** This study is a cross-sectional analytical study. A total of 182 students of Birjand University of Medical Sciences in medicine (Med), nursing (Nurse), laboratory science technology (Lst) and dentistry (Dent) who had just passed their microbiology courses took part in this study, in 2017. Students who were not willing to complete the questionnaire were excluded from the study. A non-probabilistic sampling method was used. Data were collected using a licensed questionnaire. The data were extracted from the questionnaires, corrected and analyzed in SPSS software (version 24). All data were analyzed by the Kruskal-Wallis and Mann-Whitney Tests. P-value less than 0.05 was considered statistically significant.

**Results:** The result of the study showed that the mean scores (out of 100) of knowledge and preparedness of medicine, dental, laboratory science technology, and nursing students were obtained as 45.5±15.9 and 63.2±13.8, 41.3±6.5 and 66±12.5, 35.7±12.8 and 57.5±11.6 and 36.3±6.5 and 61.5±7.5, respectively. The knowledge score between Med and laboratory science technology students was significantly different (P=0.003). The same significant difference was also found between medicine and nursing students (P=0.007). Moreover, there was a statistically significant difference between dental and laboratory science technology students in terms of preparedness scores (P=0.002). However, no significant difference between dental and medicine students neither on their knowledge nor on their preparedness scores was observed (P=0.376, P=0.257).

**Conclusions:** It can be concluded that the level of knowledge and preparedness of medical, health and medical laboratory science students regarding bioterrorism is relatively low. Therefore, enclosing educational programs about bioterrorism in curriculum of all academic disciplines of medical sciences is suggested.

**Key Words:** Bioterrorism, Education, Knowledge, Preparedness, Students



## Introduction

The occurrence of terrorism attacks during recent years throughout the Middle East and occasionally in Iran have proposed that bioterrorists have the ability to disseminate biologic agents in the region and cause widespread social panic.

Medical, health and laboratory staff have a serious responsibility to their public community in terms of prevention, detection and treatment of potential bioterrorism attacks. To fulfill their responsibilities, they need to be trained by taking part in relevant courses during their undergraduate education. In case of potential bioterrorism attacks, appropriate level of knowledge and preparedness is essential for medical, health and laboratory personnel team to ensure a proper medical response to such outbreaks(1, 2).

The term bioterrorism generally means misuse of microorganisms, including viral, bacterial, parasitic, and fungal agents as well as microbial toxins for the purpose of causing fear or annihilation of humans and animals and destroying plants with the aim of killing, damaging, scaring and threatening to do so (3,4,5). Detection of bioterrorism attack occurrence is also very difficult and needs a close interaction between clinicians, healthcare practitioners and clinical microbiology scientists (6). This means that in a high risk region, all members of a health care team must be familiar and alert regarding the concept and different aspects of a bioterrorism attack. In general, the team has to know how to detect, be prepared, and deal with the situation after a possible attack.

Bioterrorism has a long history (7). The use of contaminated dead bodies to conquer enemy castles, infecting the wells and water resources to weaken the enemies in ancient times and more recently, posting letters contaminated with the spores of *Bacillus anthracis* to some journalists and politicians in the United States in 2001 are some examples of deliberate use of deadly microorganisms as a weapon or bioterrorism tool (3). During the recent years bioterrorism has been highly noticed from two aspects of medicine and healthcare (8–10).

The psychological aspect of bioterrorism attacks is very important. Even on a small scale, it causes fear and panic. Geopolitical position of Iran and expansion of wars, riots and terrorist attacks in the Middle East region, and vulnerability at the borders increase the possibility of bioterrorism attack against the country(3). Although the possibility of bioterrorism attacks is low, their

importance should not be neglected. The attack would cause irreparable damage in case of insufficient preparedness (5, 11-13). Emergencies, hospitals and healthcare practitioners, including doctors and nurses, are the first responders to patients who must have an acceptable level of knowledge, awareness and preparedness(5,12). Therefore, medical community should be familiar with the control measures, the epidemiology of these attacks, as well as secondary prevention, including early diagnosis and timely treatment, in order to be able to respond promptly, reasonably and in a peaceful manner (3).

So far, no sufficient information has been provided on level of knowledge of Iranian graduate students of medical and paramedical sciences in relation to bioterrorism. Therefore, the purpose of this study was to assess the knowledge, the preparedness and the attitude levels of students who study in the fields of medicine, dentistry, laboratory sciences technology and nursing just after passing their microbiology courses.

## Methods

This cross-sectional analytical study investigated the level of knowledge, preparedness and the attitude of students in Birjand University of Medical Sciences, Brijand, Iran regarding the basic concepts of bioterrorism and microbial attacks. In this study, a non-probabilistic sampling method was used, and the data were collected by questionnaires anonymously and voluntarily. Ethics were observed in accordance with the instructions of the Ethics Committee of the Birjand University of Medical Sciences, Brijand, Iran. Ethic code No: Ir.bums.rec.1396.2.4.

A total of 182 students of Birjand University of Medical Sciences, Brijand, Iran, in medicine (Med), nursing (Nurse), laboratory science technology (Lst), and dentistry (Dent) who had just passed their microbiology courses took part in this study, in 2017. Students who were not willing to complete the questionnaires were excluded from the study. According to Cochran formula, 181 students were selected by stratified random sampling method. Initially, the academic disciplines were chosen, and then the students were selected randomly according to the size of the population from each disciplines.

The data collection tool was a bioterrorism questionnaire of licensed professionals in Hawaii (13) that was translated into Farsi. The questionnaire consists of 10 multiple-choice questions to assess the knowledge of individuals about bioterrorism. Out of all questions, 4 items

evaluate the level of their preparedness on a 5-point Likert scale from strongly disagree, disagree, neutral, agree to strongly agree and 2 two-choice questions measure the attitude of the participants. Knowledge and preparedness questions are both graded on a 100-point scale and no answering is considered as an incorrect answer.

Background information including age, gender, field of study, and the current semester average score of the students were asked to be included in the last part of the questionnaire. The final question was an open-end question asking any additional training needs against probable terrorist attacks.

Reliability of the questionnaire was verified using a 40-case pilot study and reliability Statistics (Cronbach's Alpha = 0.722). Microbiology professors and experts of medical faculty of Birjand University of Medical Sciences confirmed face, criterion, and content validity of the questionnaire.

The extracted data from the questionnaires, were corrected and analyzed in SPSS software (version 24). Moreover, the analysis of data using One-Sample Kolmogorov-Smirnov Test revealed a non-normal distribution. In addition, Kruskal-Wallis and Mann-Whitney Tests were applied to

analyze the data and the results followed by Bonferroni correction using SPSS version 24. P-value of <0.05 was regarded statistically significant.

## Results

A total of 183 students of Birjand University of Medical Sciences (40.4% male) were participated in the study and asked to respond to the questions. The population included 74 (40.4%), 30 (16%), 38(20.8%), and 41 (22.2%) medicine, dental, laboratory science technology, and nursing students, respectively. There were 11 (6.1%) students whose Grade Point Average (GPA) was less than 14 (out of 20). The GPA for 129 (70.9%) students was between 14 and 17 and for 43 (22.9%) students was over 17 (Table 1).

The obtained scores of knowledge and preparedness are shown in Table 2. Figure 1 demonstrates a comparison of knowledge and preparedness among different fields. None of the scores of knowledge and preparedness in different major were normal using the Kolmogorov-Smirnov test.

**Table 1: Demographic information of the participants**

| Demographics    | Number        | Percent |
|-----------------|---------------|---------|
| Gender          |               |         |
| Male            | 71            | 39.4%   |
| Female          | 109           | 60.6%   |
| Field           |               |         |
| Med             | 74            | 40.4%   |
| Dent            | 30            | 16.4%   |
| Lst             | 38            | 20.8%   |
| Nurse           | 41            | 22.4%   |
| GPA             |               |         |
| Under 14        | 11            | 6.0%    |
| Between 14 , 17 | 127           | 70.5%   |
| Over 17         | 41            | 23.5%   |
| Age             |               |         |
| Range           | 20.56 ± 2.880 | -       |
| Mean score      | 18-25         | -       |

medicine (Med), nursing (Nurse), laboratory science technology(Lst), dentistry (Dent) and Grade Point Average(GPA)

Kruskal-Wallis Test showed a significant difference in knowledge and preparedness score of students among different majors. The results are shown in Table 2.

As figure 1 shows the knowledge score between medical and laboratory science technology students was significantly different ( $P=0.003$ ). The same significant difference was also found between medical and nursing students ( $P=0.007$ ). Moreover, preparedness scores between dental and laboratory science technology students were statistically

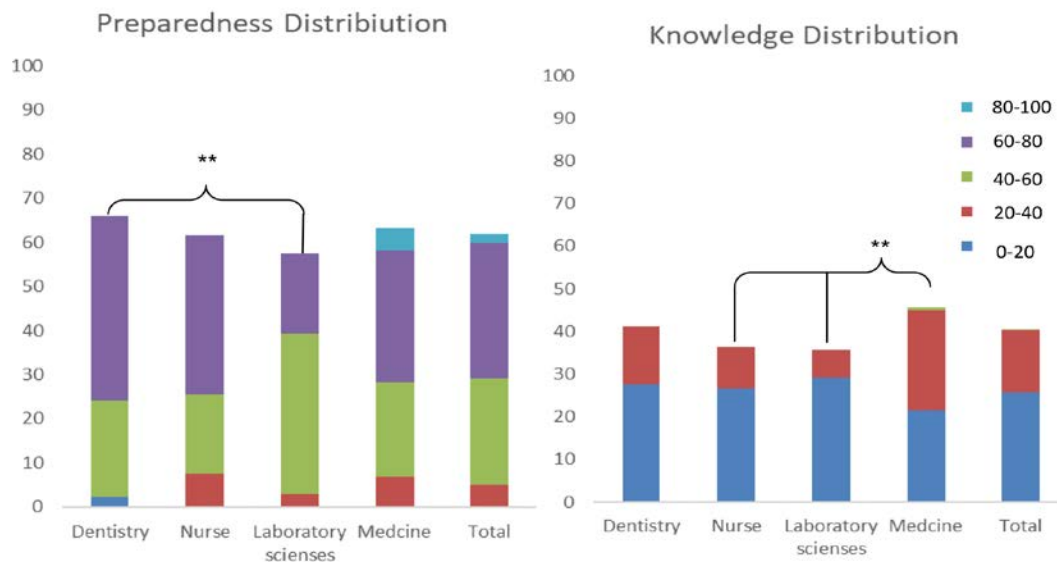
different ( $P=0.002$ ). However, no significant difference was found between dental and medical students neither on their knowledge, nor on their preparedness scores ( $P=0.376$ ,  $P=0.257$ ).

The average scores of knowledge and preparedness in males and females were  $39.05 \pm 16.5$ ,  $41.37 \pm 13.3$ ,  $62.15 \pm 12.5$ , and  $62.7 \pm 13.35$  respectively. There was no considerable correlation between gender and students' knowledge as well as gender and students' preparedness against bioterrorism attacks. (Table 3 and Figure 2).

**Table 2: Comparison of the average score of students' knowledge and preparedness by the field of study**

| Field | Knowledge                               |                                 | Preparedness                            |                                |
|-------|---|---------------------------------|---|--------------------------------|
|       | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis  | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis |
| Med   | 40(30-50)                               | $X^2=12.091$<br>df=3<br>P=0.007 | 65(55-70)                               | $X^2=9.508$<br>df=3<br>P=0.023 |
| Dent  | 40(30-60)                               |                                 | 70(60-75)                               |                                |
| Nurse | 30(30-50)                               |                                 | 65(60-70)                               |                                |
| Lst   | 40(30-40)                               |                                 | 60(45-65)                               |                                |

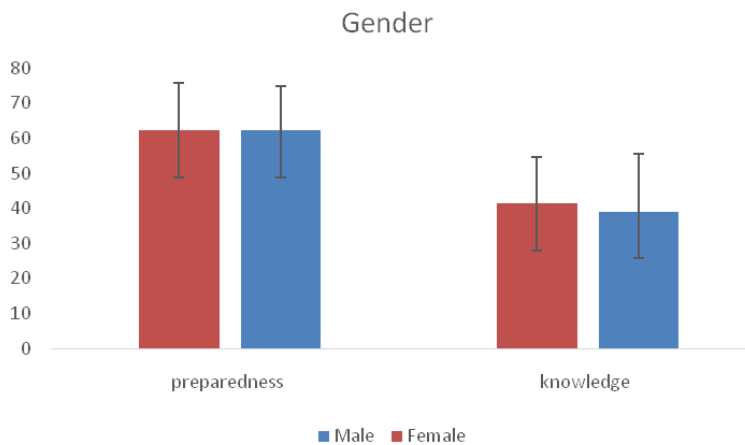
medicine (Med), nursing (Nurse), laboratory science technology(Lst) , dentistry (Dent)



\*\* significant difference  $P < 0.01$

**Figure 1: Comparison of preparedness and Knowledge within different fields of study.****Table 3: Comparison of the knowledge and preparedness scores of students by gender**

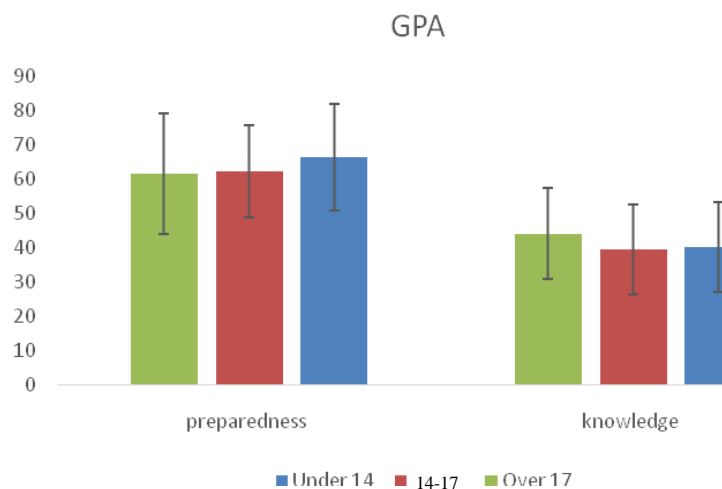
| Gender | knowledge                               |                                | Preparedness                            |                                |
|--------|---|--------------------------------|---|--------------------------------|
|        | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis |
| Male   | 40(30-50)                               | $Z=-1.387$<br>P=0.165          | 65(55-70)                               | $Z=-0.037$<br>P=0.970          |
| Female | 40(30-50)                               |                                | 65(55-70)                               |                                |

**Figure 2: Comparison of preparedness and Knowledge between genders**

**Table 4: Comparison of the average score of the students' knowledge and preparedness by GPA**

| GPA      | Knowledge                               |                                     | Preparedness                            |                                     |
|----------|---|-------------------------------------|---|-------------------------------------|
|          | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis      | Median(Q <sub>1</sub> -Q <sub>3</sub> ) | Result of statistical analysis      |
| Under 14 | 40 (30 -60)                             | Chi-square=3.015<br>df=2<br>P=0.221 | 60(55-75)                               | Chi-square=0.606<br>df=2<br>P=0.739 |
| 14-17    | 40(30-50)                               |                                     | 65(55-70)                               |                                     |
| Over 17  | 40(30-60)                               |                                     | 60(50-70)                               |                                     |

Grade Point Average(GPA)

**Figure 3: Comparison of preparedness and Knowledge between GPA**

As another part of the current study, the students were classified into three groups based on their GPA in each academic major. GPAs under 14, between 14 and 17, and over 17 were assigned to groups I, II, and III, respectively. The mean scores of knowledge and preparedness for groups I and II (11 and 129 students) were obtained as 40%, 66.36%, and 39.3%, 61.7%, respectively. However, 43.9% and 61.5% were the scores of knowledge and preparedness in group III (43 students). No significant difference was observed between the scores of students' knowledge or preparedness and their GPA using Kruskal-willastest (Tables 4 and Figure 3)

## Discussion

The findings of the present study showed that the mean score of participant's knowledge and preparedness against bioterrorist attack was low to moderate which was similar to the findings by Bahraini Moghadam. In the aforementioned study it was showed that 99.2% of the participants had low levels of knowledge on bioterrorism and 96.7% of the respondents believed their preparedness facing the bioterrorist attack was weak (5). Aghaei et al. by measuring knowledge and attitude of nurses revealed that 96% of

the participants had little knowledge about bioterrorism before the intervention. Before training, the majority of the participants in the study (96.9%) had an indifferent attitude (33 - 66 out of 100) about bioterrorism (1).

The present study showed that medical laboratory science students had lower knowledge and preparedness in comparison to the other academic majors. This expected low level is due to the different content of bacteriology and virology courses in laboratory science curriculum and the other academic majors. Medical microbiology course in laboratory science discipline mainly focuses on laboratory diagnosis; however, in the other academic majors, the course is mainly based on clinical aspects, prophylaxis and the treatment of microbial diseases.

A significant difference between the knowledge score of nursing and medical students was also observed. This can be explained by significantly less content delivered in nursing microbiology course compared to those offered in the field of medicine. Medical students pass 4 credits in microbiology, while nursing students pass only 0.75 of a credit.

The study conducted by Gorji et al. showed that 91.7% of nurses had low knowledge about bioterrorism and 93.3% of the students had no

attitude towards bioterrorism (12). A study by Inkaew et al. on third year nursing students at the Thai Red Cross Nursing Faculty showed that nurses were not ready to respond and manage the disasters due to the lack of knowledge or skills (14).

No significant difference was found between dental and medical students neither in knowledge nor in preparedness. The main reason for this could be the highly similar course contents of microbiology in these disciplines. In a survey conducted by Amit Chaudhari et al. in Sari, medical students showed more knowledge, attitude and performance than dental students. They also showed that the level of students' knowledge regarding the terrorism was low (15). This finding was in line with the current study results and could be explained by the similarities in the academic curriculum as well as lack of providing students with basic information on bioterrorism.

The results of the present study were also analyzed based on the gender of participants. There was no significant difference within the two genders in terms of knowledge and attitude. This finding was similar to the results of Hamzehpour et al. before their intervention with the students (5). Some significant differences based on gender were reported by a number of research, including a study conducted by Alshehri SA et al. on the population of Saudi Arabia (16). This study argued that females tend to report a higher level of perceived risk and be more concerned than males.

Finally, in our study no significant difference was observed between the scores of knowledge and preparedness and the students' GPA. It can be explained by the lack of specific contents or course on bioterrorism topic. It may also be due to the lack of regular training of this important issue in the curriculums of all academic majors in medical sciences. Both the knowledge and the preparedness against bioterrorism is related to learning the subject. In academic disciplines that the subject of bioterrorism is not included in their curriculum, no significant difference of knowledge and preparedness against bioterrorism within the learners of different disciplines is assumed.

## Conclusions

With regard to the moderate to low level of knowledge and preparedness of the students against possible bioterrorism attack, it is strongly necessary to promote the level of preparation and knowledge of students in this field by redesigning of curriculums in different academic medical

disciplines.

## Acknowledgments

We hereby would like to thank Clinical Research Unit of Vali-e-Asr Hospital in Birjand University of medical sciences, Birjand, Iran for statistical consultancy of the study. We would also like to especially thank Dr. Ali Rajabpour-Poursanati for his constructive comments. Finally, we need to appreciate all students who participated in the present study.

## Author's contribution

Zare-Bidaki M: Designed the study. Abdollahi-Karizno M, Pursalehi F, and Mirzaei M helped with data collecting. Data analysis was performed by Abdollahi-Karizno M and Salmani F. Manuscript was prepared by Abdollahi-Karizno M, Pursalehi F, and Mirzaei M. All authors read and approved the final manuscript.

## Funding

This study was funded by Birjand University of medical sciences, Birjand, Iran. Research project NO: 4606.

## Conflict of Interest

There is not Conflict of Interests.

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