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The Level of Information and Awareness of Healthcare Workers on Bioterrorism Agents

Sağlık Çalışanlarının Biyoterörist Ajanlarla İlgili Bilgi ve Farkındalık Düzeyi

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ABSTRACT Objective: The masses can be affected both mentally and physically even though biological agents are used in the narrow context for the purpose of bioterrorist attack. It is important to have trained and experienced health workers whose mission and responsibility is to identify biological agents rapidly and control them before they turn into epidemic. This research aims to investigate the personnel's knowledge and awareness about bioterrorist activities working in the public health laboratories and increase awareness by stressing the importance of topic. **Material and Methods:** This research was performed between October and December 2017 on 162 volunteers who have bachelor's and undergraduate degree and work in various occupations in public health laboratories by a 21-item questionnaire. Questionnaires applied by using face-to-face interview method, and the data were evaluated with descriptive statistics and Chi-square analysis. **Results:** When asked the level of knowledge about bioterrorism, 25.9% of participants stated that they have information about bioterrorism agents, while 18.5% don't have information and 55.6% have partial information. Only 6.8% of the respondents considered the trainings, which they received about bioterrorism, are adequate. While 91.4% of the respondents thought that the bioterrorist agents were important risk factors for Turkey, and 58% of them stated that the most dangerous biological agent is *Bacillus anthracis*. **Conclusion:** Evaluation results show that health personnel who work in the public health laboratories had lack of knowledge on some certain topics and unawareness in the field of bioterrorism. It is believed that inside training programs about bioterrorism will be useful to resolve the lack of information and to create awareness for health personnel. Besides bio-security information should be disseminated.

Keywords: Bioterrorism; biological agents; public health

ÖZET Amaç: Biyoterörist saldırı amacıyla kullanılan biyolojik ajanlar dar kapsamda kullanılsalar da kitleler, hem ruhsal hem de fiziksel olarak etkilenebilirler. Biyolojik ajanın çok hızlı tanınmasında ve salgın haline dönüşmeden kontrolünde görev ve sorumlulukları bulunan sağlık çalışanlarının eğitimli ve donanımlı olması büyük önem taşımaktadır. Bu çalışmada halk sağlığı laboratuvarlarında çalışanların biyoterörist ajanlarla ilgili bilgi ve farkındalık düzeylerinin araştırılması ve konunun önemine vurgu yapılarak farkındalığın arttırılması amaçlanmaktadır. **Gereç ve Yöntemler:** Bu araştırma, Ekim ve Aralık 2017 arasında, halk sağlığı laboratuvarlarında çeşitli mesleklerde çalışan ön lisans ve lisans derecesine sahip 162 gönüllüye uygulanan 21 maddelik bir anket formu ile gerçekleştirilmiştir. Anketler yüz yüze görüşme yöntemi kullanılarak uygulandı ve elde edilen veriler tanımlayıcı istatistik ve ki-kare analizi ile değerlendirildi. **Bulgular:** Katılımcılara biyoterörizm hakkındaki bilgi düzeyleri ile ilgili soru yöneltildiğinde, %25.9'u biyoterörizm ajanları ile ilgili bilgi sahibi olduğunu; %18.5'i bilgi sahibi olmadığını bildirirken, %55.6'sı ise konuyla ilgili kısmen bilgiye sahip olduğunu belirtmiştir. Biyoterörizm konusunda aldıkları eğitimleri katılımcıların sadece %6,8'i yeterli görmektedir. Katılımcıların %91,4'ü biyoterörist ajanların Türkiye için önemli bir risk unsuru olduğunu düşünürken en tehlikeli biyolojik ajanın %58 oranında *Bacillus anthracis* olduğunu ifade etmişlerdir. **Sonuç:** Çalışma sonuçları değerlendirildiğinde halk sağlığı laboratuvarlarında çalışan sağlık personelinin biyoterörizm konusunda bazı bilgi ve tutum eksikliklerinin olduğu görülmüştür. Biyoterörizm ile ilgili olarak sağlık personelinin bilgi eksiklerinin giderilmesi ve bu konuda farkındalık oluşturmak için planlanacak hizmet içi eğitim programlarının faydalı olacağı düşünülmüştür. Ayrıca biyogüvenlik bilgisi de yaygınlaştırılmalıdır.

Anahtar Kelimeler: Biyoterörizm; biyolojik ajanlar; halk sağlığı

Terrorism is becoming a global phenomenon because of increasing cultural, religious, political differences and conflicts in the world crossed the country's borders. Terrorism is considered to be a big problem for all countries that affect the masses.[1] Frequency of terrorist attacks escalate bio-terrorist attempts a serious threat for Turkey because of Turkey from time to time, is one of the countries where the terrorist attacks occurred, possible bioterrorist activities is a big threat to our country. Microorganisms or biological toxins, which are the source of bioterrorism agents, are being used to produce disease or death for people, animals and plants.[2-4] These biological agents are extremely fatal and resistant to many adverse physical conditions. They also have high propagation speed as an aerosol and some types are highly contagious.[5] It is known that more than 180 pathogens are used as bio-terrorism agent.[6] Bioterrorist agents have been classified into 3 categories by Centers for Disease Control and Prevention (CDC) to consider the potential of their ability to create death or disease in plants, animals and humans.[7] In category A (anthrax, botulism, tularemia and viral hemorrhagic fever) agents are consist of that can be transmitted from human to human, high risk of death, easily spread to the environment, lead to panic and chaos in the community, and their mortality rates are high.[6] These agents are seen as the most dangerous group of threat to countries. According to intelligence sources agents in this class are the ones who are the most likely to be used in a future attack. Also these organisms are studied from a biological standpoint armament and research development.[8] Category B (brusellosis, epsilon toxin of *Clostridium perfringens*) can lead to moderate disease, spreads relatively easy, contaminates food and water, and has lower mortality and morbidity rates.[6] And category C is the group, that can be described as a highly potential (Nipah, Hanta virus etc.), to become a threat in the future with easy spread and produced features.

It is known that envelopes that had been infected with anthrax posted to news agencies in the United States of America (USA) and the US Senate Office in 2001. Even this kind of narrowly and simple bioterrorist attack caused 22 people to become infected, death of 5 people and more than 10.000 people to have prophylactic treatment. And the most importantly these events have created fear of bioterrorist attack in all over the world.[9,10] Ebola is thought to be a threat to bioterrorism.[11] It is considered for this epidemic that the patient-zero was a 2-year-old child who died because of Ebola virus in December 2013. Then it spread to other countries and it still exists. And it's reported that in west African countries, since the first report of Ebola virus disease (EVD) in March 2014, the number of cases has increased rapidly, EVD case fatality rate was rate of >50%.[12]

In case of a bioterrorist attack, it is really important to reside in a good coordination of all units from the receipt of the sample suspect to phase detection in the laboratory and determination of the threat level. It is easier to detect biological agents that affect numerous people than identifying agents that affect fewer people. In this context it has a great importance to detect it and take precautions for quickly spreading bioterrorist agents before they turn into epidemic cases and to reveal the more narrowly bioterrorist activities. Following bioterrorist activity, detection of biological agents is carried out in units of the Ministry of Health. The Public Health Laboratory staffs, who work with the Ministry of Health, are actively involved for the first-response and the determination of the factors in case of bioterrorist attack. For this reason, it is important to investigate the level of knowledge and awareness of the Public Health Laboratory staff about biological agents to avoid unexpected circumstances.

In this study it is aimed to research the Public Health Laboratory personnel's awareness and knowledge level about bio-terrorist activities, by emphasizing the vital of the subject.

MATERIAL AND METHODS

In this research, due to their involvement to the first intervention team of a bio terrorist attack or being a part of laboratory analysis team afterwards, public health laboratory staffs who work with Min-

istry of Health have been chosen. From Istanbul, Ankara, Izmir, Adana and Samsun where the possibility of a bio terrorist attack and the city population are relatively higher Public Health Laboratory Personnel have been chosen to work with. Volunteers were selected from health workers (biologist, chemical engineer, health technician) who do laboratory analysis and commissioned in the UMKE (National Medical Rescue Team). This questionnaire was conducted with 200 health workers from Public Health Laboratory and 162 of them (turnout: 81%) accepted to join on this research as a volunteer. This questionnaire-based, descriptive research performed with 162 educated at the undergraduate and graduate level of volunteers who are working in different occupational groups in Public Health Laboratories in Turkey. It is offered that to participate in this research and to make a survey by the researchers with face-to-face meeting. The purpose of the research was explained to volunteers. It is explained clearly that the given information can and will be used only for this research purposes and personal data will remain confidential. Volunteers' approvals in which they declared their acceptance of participation to the study have been collected before they start the survey. Questionnaire that is prepared in accordance with that purpose has been presented to local participants as hard copies. Volunteers who agreed to participate to the survey and signed the survey form were included. Survey forms without signature have not been evaluated. Research data covers a period of 3 months that October to December 2017. Despite the fact that the time was scheduled for 6 months, this phase has been completed after 3 months because the volunteers' number with the planned research method was fixed to a number.

The 21-questions survey, which is prepared as a data collection tool, contains 4 questions about volunteer's socio-demographic characteristics such as age, gender, profession and professional experience. Next inquiries consisted of multi-choice questions to Public Health Laboratories employees' bioterrorism-related knowledge and their awareness level.

Participants' professional experiences classified into 7 categories for express clearly. However, in terms of this category it was seen that numerical statistical evaluation was not proficiency for comparison between groups. For this reason gathered data has been categorized into 2 groups by the working years of experience such as 10 years or less, and 10 years and more, and this taken into account for interpretations.

The information in the questionnaire form have been collected by the researchers and transferred to the computer. The obtained data was assessed by descriptive statistic by using a statistical program SPSS 21.0. Chi-square analysis was used for comparison between groups. Accepted significance level of difference between two groups: $P<0.05$.

ETHICS

In all the studies in this research, the research team accepts that they are working in accordance with the Helsinki Declaration Principles. For this work, permission was obtained from the Ethics Committee of Altınbaş University (Date of the Ethics Committee meeting will take place 09.10.2017 and the number of board approvals will take place 2018/08). "Informed consent" was obtained from people who participated in the study.

RESULTS

Volunteers agreed to participate in the survey 56.2% of female, 43.8% of male, average age was 41.4 ±9.9 (min. 24, max. 61) years and the average professional experience was 13.0±11.2 (min. 1, max. 36) years. Participants were divided into 7 groups at intervals of five years according to their level of knowledge in the manner of professional work experience. As result, 42.0% of participants has concluded 1-5, 13.6% of them as 6-10, 4.9% of them 11-15, 6.2% of them 16-20, 12.4% of them 21-25, 16.0% of them 26-30 and 4.9% of them 31-35 years of experience.

As 162 of volunteers were questioned about their knowledge and awareness level of bioterrorism (Table 1), 25.9% of them responded as they were familiar, 18.5% of them reported that they did not have information on that area, and 55.6% of

them claimed that they partially got informed on the subject. When the volunteers, who have had studied in the field of bioterrorism, were asked if the training was satisfying; only 6.8% of them responded positively. When they were asked whether they believe that they have adequately informed about the sprawl methods of bioterrorist agents and protective measures against them; 85.8% of them said "no". Eventually, as the last question under this section, they were asked if they believe that bioterrorism dangerous for Turkey. 91.4% of the participants responded that question as "yes, I do" (Table 1).

Knowledge and awareness level of volunteers were examined in the next section of the survey (Table 2). When they were asked which bioterrorist agents was the most dangerous 58.0% of them answered as *Bacillus anthracis*. When the question was phrased as "human to human contagious", the highest rate returned 81.5% as Ebola virus. The question that way of transmitting of *Clostridium botulinum* 70.4% answered 'oral'. When asked that the disease agent which higher mortality rate compared to the others and first found in Congo, 70.4% answered 'Ebola virus'.

When asked to volunteers, which was the most effective agent, in terms of the impact range and cost, 66.7% answered 'biological weapons'. When asked the institution/organization that comes first to mind, 38.3% of volunteers answered Public Health Agency of Turkey, and only 7.4% choose the Search & Rescue Association (AKUT: Arama Kurtarma Derneği).

In the last section, volunteers' knowledge and awareness levels about prevention from bioterror and sprawling of it was examined (Table 3). When they were asked which the ways to spread biological agents were, 87.7% of the participants answered all (air, water, soil), however the option "soil" was not selected by any of them. It has been asked which of the listed items not personal equipment was. 79.6% of volunteers selected oxygen tube. When examined the responses with other question, 48.8% of participants stated that they would leave the building if they would have faced with a bioterrorist agent. When we asked which option would have less importance in a comparison to consider biological disease effects as biological agents, 61.7% of them selected "low cost production" as their answer.

When asked which institution/organization comes first to mind, 38.3% of volunteers answered Public Health Agency of Turkey.

When the volunteers were classified into two groups considering the duration of the professional experience as in a breakdown of 10 years and under, and more than 10 years, there were no statistically significant difference between the groups in terms of survey responses ($p>0.05$).

48 of volunteers had undergraduate degree and 114 of volunteers had graduated degree. Considering the response to the survey questions statistically significant difference was observed between following two groups: "Which one is the most effective bioterrorist agent?" "Which one is

TABLE 1: Participant's thoughts about bioterrorism.

Questions	Frequent Percent	Yes	No	Partly/ No idea	Total
Are you familiar with bioterrorism agents?	N	42	30	90	162
	%	25.9	18.5	55.6	100
If you had trained about bioterrorism, do you think that was enough?	N	11	104	47	162
	%	6.8	64.2	29.0	100
Do you think that you have informed about transmission routes and prevention of bioterrorist agents?	N	22	139	1	162
	%	13.6	85.8	0.6	100
Do you think that bioterrorism is a threat to Turkey?	N	148	12	2	162
	%	91.4	7.4	1.2	100

TABLE 2: Participant's level of knowledge and awareness about bioterrorism agents.

Questions	Answers	N	%
In your opinion, some bioterrorist agents, ranked as follows in terms of danger which one is the most dangerous?	*Clostridium perfringens*	12	7.4
	Bacillus anthracis	94	58.0
	E.coli O157: H7	29	17.9
	Bacillus cereus	12	7.4
	No idea	15	9.3
	Total	162	100
Which one is the biological agent of the following that is transmitted from human to human?	*Clostridium botulinum*	9	5.6
	Clostridium perfringens	4	2.5
	Ebola virus	132	81.5
	S. aureus enterotoxin	10	6.1
	No idea	7	4.3
	Total	162	100
What is the most deadly route for anthrax?	Intravenous injection	34	21.0
	Oral route	39	24.1
	Inhalation	60	37.0
	Subcutaneous injection	16	9.9
	No idea	13	8.0
	Total	162	100
What is the way of transmitting for *Clostridium botulinum?*	Inhalation	18	11.1
	Oral route	114	70.4
	Subcutaneous injection	10	6.2
	Intravenous injection	4	2.5
	No idea	16	9.9
	Total	162	100
Which one could be caused the disease that to detected in 1970, in the first time, in Congo and the rate of mortality higher than others?	*Clostridium botulinum*	10	6.2
	Bacillus anthracis	22	13.6
	Ebola virus	114	70.4
	Smallpox	5	3.1
	No idea	11	6.8
	Total	162	100
Which one of the following disease does not take place in the group of disease with high rates of mortality and morbidity?	Tularemia	44	27.2
	Botulism	21	13.0
	Ebola virus disease	20	12.3
	Polio	62	38.2
	No idea	15	9.3
	Total	162	100
Which of the following is in the category A (most deadly) in terms of classification made by CDC considering the mortality and morbidity rates?	*Cryptosporidium parvum*	15	9.3
	E.coli O157:H7	29	17.9
	Lassa virus	68	42.0
	Clostridium perfringens toxin	24	14.8
	No idea	26	16.0
	Total	162	100

CDC: Centers for Disease Control and Prevention.

the biological agent of the following that is transmitted from human to human?" questions ($p<0.05$). 71.1% of graduated and 56.3% of undergraduate degree has replied the question of the most effective bioterrorist agent as "biological agents". 86.8% of graduated and 68.8% of undergraduate degree

TABLE 3: Participant's knowledge and awareness about ways of transmission and prevention of biological agents.

Questions	Answers	N	%
What is the path used for the dissemination of biological agents?	Air	7	4.3
	Water	13	8.0
	Soil	-	-
	All	142	87.7
	Total	162	100
Which is not personal protective equipment?	Completely covered dress	22	13.6
	Oxygen tube	129	79.6
	Glove	7	4.3
	Filter mask	-	-
	No idea	4	2.5
	Total	162	100
Which is not one of the first measures to be taken when faced with a bioterrorist agent?	Washing hands	43	26.5
	Leave the building	79	48.8
	Inform to safety/first aid unit	29	17.9
	Wearing a mask	8	4.9
	No idea	3	1.9
	Total	162	100
Which one is less important compared to the others to accept a biological disease factor as a bioterrorist agent?	Producing easily	30	18.5
	Have a high rate of mortality	17	10.5
	Spreading fast	8	4.9
	To effect in humans	5	3.1
	Low cost producing	100	61.7
	No idea	2	1.2
	Total	162	100

has replied the question of the most effective agent, which transmitted from person to person as "Ebola virus".

DISCUSSION

During the detection of a bioterrorist attack public health laboratory workers take an important place within the healthcare workers who were the most likely to encounter bioterrorist agent. In this study, Public Health Laboratory workers targeted research group illustrates a wide distribution throughout the country including the big cities at first. We could not reached the very high numbers of sample because of the target group showing dispersed settlements in a restricted area and for the effective data collection we choose face to face data collection (congress-symposium and in service training areas). For this reason, including statistical comparisons between sub-groups, advanced statistical analysis methods could not be applied. The study was performed mostly on descriptive statistical data. Because of that this research which has some limitations, would be useful if supported by more extensive research which has more number of sampling in the sub-groups.

Special teams with trained personnel are established to make the first response for any event that occurs within the scope of bioterrorism in Turkey. Employees of UMKE (National Medical Rescue Team), which are one of those special teams mentioned above, have received trainings on specific topics and are in charge to detect bioterrorism activities, take protective measures, prevent it to spread and provide adequate and qualified health services to the victims of bioterrorism attacks, as swiftly as possible. UMKE selects its team members among the health personnel from various units and proficiencies who have actual daily jobs, on volun-

tary basis. Public Health Laboratory employees can encounter to bioterrorism agents as well. Even in UMKE, in some cases. Furthermore, Public Health Laboratory employees have an important task and responsibility to detect infectious diseases and prevent them to spread. Therefore, Public Health Laboratories have an important vision in Turkey in case of potential bioterrorist threat. Thus in this study, when asked the institution/organization that comes first to mind, 38.3% of volunteers answered Public Health Agency of Turkey.

In order to create an effective defense to bioterrorist agents, trained and experienced new units, soldiers, health organizations, scientists, and health-illness statistics are must-haves.[13] In this study, we evaluated the Public Health Laboratory employees' knowledge and awareness levels about bioterrorism, who are the ones should have trained and experienced the most. Only 25.9% of participants responded they had knowledge about bioterrorism agents; 55.6% responded as they had partly idea about the subject. Likewise only 6.8% of the participants who were Public Health Laboratory employees joined this survey, found their training enough so far. According to a recent survey focused on family physicians in the US, 24.0% of participants responded that they could define the event when they faced with an attack; 19.0% might responded in an effective way to bioterrorist event in their community.[14] In a study, applied on health care workers, whose 40% of nurses, found same reasons and only 23.0% of participants responded that they had indicated confidence for treatment in case of a hypothetical cumulative loss terrorist attack.[15] Another study on this subject shows that the most of the participants (87.0%) specified that their knowledge about biological attack and care of the patient with an infectious disease is not enough. In the same study, 92.0% of nurses said that they need training on bioterrorism and its methods in case of an attack where biological agents were used.[16] In this study, both during the literature search when considering the studies it seems that especially health professionals do not have enough information in the field of bioterrorism. Global events in recent years show that bioterrorism is not a myth but a reality.[17] Whereas it is important to employ health personnel who have received special training on the subject and giving a training program to all Public Health Laboratory in the field of bioterrorism as the bioterrorism threat is increasing.[18,19] Biological weapons can be more effective rather than mass destruction to the masses by causing mass panic. Biological weapons also cost low, and because of latent period for the people in terrorist activities can get away from the scene before they could be detected.[4,20,21] In this study, when asked which one was the most effective agent in terms of cost and impact area 66.7% - the highest rate-of participants answered "biological weapons"; 7.4% answered "chemical weapons". A study on nurses about this subject 78.0% of thought that bioterrorism creates a significant threat for the world, and according to 61.0% the target of bioterrorist attacks seem as human.[16] The most important reason why is seen as a factor of high risk biological agents in terms of community health, it is easy to distribution and difficult to define.[5] Whereas many microorganisms, can be used as a biological material, can be produced in low-budget laboratories.[22]

Bioterrorism agents are more easily spread by inhalation, and are also likely to spread via water and food.[23] In this study, when asked the way of used for the spread of biological agents, 87.7% of Public Health Laboratory employees answered "all (air, water, soil)". Renn-Zurek et al. asked a similar question in a study on nurses 57.0% of participants referred to pathogens enters the human body through the respiratory tract. The difference between the groups could be that the option "all" was not in the options in this question on Renn-Zurek et al.'s research.[16]

The CDC in the US splits biological agents in terms of potentiality of causing death or creating disease into 3 categories as plants, animals and humans.[7] Considering this classification questions were asked to Public Health Laboratory employees to determine their level of knowledge and awareness about bioterrorist agents. Accordingly when bioterrorist agents sorted in terms of dangerousness the most dangerous agent was *Bacillus*

anthracis with rate of 58.0%; when asked biological agent that transmitted from person to person 81.5% chose Ebola virus. That factors which in category A that according to CDC classification is the most dangerous group, agents spreading easily to the environment, transmitted from person to person and carries a high mortality rate.[6,7] We think that the participants need to increase their knowledge and awareness levels on this subject although they marked the biological agents that at the highest rates in the highest risk group.

In this study, data that gathered from responses of health workers to questionairre which aimed to examine their knowledge and awareness level about bioterrorist agencies, has been categorized by sections and shown in 3 separate tables (Table 1, Table 2, Table 3). The ideas of the participants about bioterrorism presented in Table 1, levels of knowledge and awareness about bioterrorist agents presented in Table 2, and levels of knowledge and awareness about ways of transmission and prevention of bioterrorist agents presented in Table 3. Participants thought that their level of knowledge and training was not sufficient about the subject in the data belongs to the first three questions presented in Table 1. However, in the 4th question, almost all of the participants (91.4%) have seen the bioterrorism is an important risk factor for Turkey and they demonstrated their awareness about the importance of the issue (Table 1). The data in the Table 2 were evaluated in terms of impact of the study, it was seen that more than half of the participants had quite incomplete information about bioterrorist agents considering to their responses to 3, 6 and 7th questions. On the other hand, it can be seen that considering the answers to 1, 2, 4 and 5th questions, less than half of the participants have lack of information (Table 2). The data presented in Table 3 shows that participants had partial knowledge in regard of their responses to 1, 2 and 4th questions. On the contrary, result of 3rd question was considered as a big shortcoming that asks, "What would you do when you are faced with a biological agent", almost half of the participants' (48.8%) answer was "I would leave my current locate" (Table 3). Because the most important precaution that need to be taken in a bioterrorist attack, is to close the area soon as possible to prevent bioterrorist agents from spreading.[24,25] Consequently, considering all of the answers to the survey questions, reached to the conclusion that a significant portion of participants has less level of knowledge and awareness about bioterrorism, and again, a significant portion of them also have partial or incomplete information and awareness.

CONCLUSION

It is not too hard to keep the biological weapons away from national and international controls because of their production can be in any laboratories or vaccine production institute. Therefore, it could be confused that humans and animals can result in illness and death of biological weapons with the case of natural death and disease. For this reason, it is important to identify biological agents, get them under control before they turn into epidemic, and also Public Health Laboratory employees who worked in the first stages of treatment need to be informed and trained. An overall evaluation, according to this research's data, although the knowledge and awareness level in some certain subject has been found sufficient, on some issues there is still a need to increase the level of education and awareness. Identifying the attack not as quick as it should have been, most of the time can cause bioterrorism agent to spread on wider areas quicker. Hence, in case of bioterrorism attacks, it is very important to make the first response with team members who have high level of knowledge and experience, under a highly skilled management to reduce the effect of the danger. It is also advised to provide training programs to people in order to increase the level of their knowledge and skill sets on that subject, to fight more effective against bioterrorism.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea / Concept: *Şükriye Karaday, Nurdan Sezgin, Beytullah Karadayı;* ***Design:*** *Şükriye Karaday, Beytullah Karadayı;* ***Supervision / Consultancy:*** *Şükriye Karaday;* ***Data Collection and / or Processing:*** *Şükriye Karada, Beytullah Karadayı;* ***Analysis and / or Interpretation:*** *Şükriye Karadayı, Nurdan Sezgin, Beytullah Karadayı;* ***Source Browsing:*** *Beytullah Karadayı, Nurdan Sezgin;* ***Writing of the Makalen:*** *Şükriye Karadayı, Beytullah Karadayı, Nurdan Sezgin;* ***Critical Review:*** *Beytullah Karadayı, Nurdan Sezgin;* ***Sources and Funding:*** *Şükriye Karaday, Beytullah Karadayı.*

REFERENCES

1. Yılmaz A, Akdeniz B. [Management of terror based crises as a public management question: a comparison of Turkey and the USA]. Cumhuriyet University Journal of Economics and Administrative Sciences. 2016;17(1):343-68.
2. Beeching NJ, Dance DA, Miller AR, Spencer RC. Biological warfare and bioterrorism. BMJ. 2002;324(7333):336-9. [Crossref] [PubMed] [PMC]
3. Ashford DA, Kaiser RM, Bales ME, Shutt K, Patrawalla A, McShan A, et al. Planning against biological terrorism: lessons from outbreak investigations. Emerg Infect Dis. 2003;9(5):515-9. [Crossref] [PMC]
4. Yüksel O, Erdem R. [Bioterrorism and health]. Hacettepe Sağlık İdaresi Dergisi. 2016;19(2): 203-22.
5. Agarwal R, Shukla SK, Dharmani S, Gandhi A. Biological warfare--an emerging threat]. J Assoc Physicians India. 2004;52:733-8. [PubMed]
6. Bossi P, Garin D, Guihot A, Gay F, Crance JM, Debord T, et al. Bioterrorism: management of major biological agents. Cell Mol Life Sci. 2006;63(19-20):2196-212. [Crossref] [PubMed]
7. Cenciarelli O, Rea S, Carestia M, D'Amico F, Malizia A, Bellecci C, et al. Bioweapons and bioterrorism: a review of history and biological agents. Defence S&T Tech Bull. 2013;6(2): 111-29.
8. Katz R. Biological weapons: a national security problem that requires a public health response. No: 310. Working Papers, Princeton University, Woodrow Wilson School of Public and International Affairs, Office of Population Research. 2004.
9. Yenen OŞ, Doğanay M. [Bioterrorism]. J Society of Antimicrobial Chemotherapy. 2008; 22(2):95-116.
10. Gerberding JL, Hughes JM, Koplan JP. Bioterrorism preparedness and response: clinicians and public health agencies as essential partners. JAMA. 2002;287(7):898-900. [Crossref] [PubMed]
11. Strauss S. Ebola research fueled by bioterrorism threat. CMAJ. 2014;186(16):1206. [Crossref] [PubMed] [PMC]
12. Liu WB, Li ZX, Du Y, Cao GW. Ebola virus disease: from epidemiology to prophylaxis. Mil Med Res. 2015;(2):1-8.
13. Baysallar M, Kenar L. [Bioterrorism and decontamination management]. Turk Bulletin of Hygiene and Experimental Biology. 2006;63(1-3):115-28.
14. Chen FM, Hickner J, Fink KS, Galliher JM, Burstin H. On the front lines: family physicians' preparedness for bioterrorism. J Fam Pract. 2002;51(9):745-50. [PubMed]
15. Rose MA, Larrimore KL. Knowledge and awareness concerning chemical and biological terrorism: continuing education implications. J Contin Educ Nurs. 2002;33(6):253-8. [Crossref]
16. Renn-Żurek A, Łopacińska I, Tokarski Z, Denys A. Assessment of bioterrorism awareness in a group of nurses. Micro Medicine. 2015;3(1):20-5.
17. Pinto VN. Bioterrorism: health sector alertness. J Nat Sci Biol Med. 2013;4(1):24-8. [Crossref] [PubMed] [PMC]
18. Yeşilbağ K. [Biological weapons: I. the threat]. J Veterinary Microbiology. 2002;2(2):58-66.
19. Sarıtaş SÇ, Kızıl AB, Sarıtaş S. [Emergency service nurses' knowledge and opinions about bioterrorism]. Bozok Med J. 2013;3(2): 29-36.
20. Aksoy U. [Bioterrorism, parasites as potential bioterrorism agents and biosecurity studies]. Mikrobiyol Bul. 2006;40(1-2):129-39. [PubMed]
21. Kiremitçi İ. [The threat of biological terrorism on a global scale]. The Journal of Defense Sciences. 2014;13(2):27-58.
22. Serinken M, Kutlu SS. [Bioterrorism and anthrax]. Turk J Emerg Med. 2009;9(4):185-90.
23. Rotz LD, Khan AS, Lillibridge SR, Ostroff SM, Hughes JM. Public health assessment of potential biological terrorism agents. Emerg Infect Dis. 2002;8(2):225-30. [Crossref] [PubMed] [PMC]
24. Anderson PD, Bokor G. Bioterrorism: pathogens as weapons. J Pharm Pract. 2012;25(5):521-9. [Crossref] [PubMed]
25. Ludovici GM, Gabbarini V, Cenciarelli O, Malizia A, Tamburrini A, Pietropaoli S, et al. A review of techniques for the detection of biological warfare agents. Def S&T Tech Bull. 2015;8(1):17-26.