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Research Article

Knowledge, Attitudes, and Practices of Medical Science Students Regarding Emerging and Re-Emerging Infectious Diseases: A Cross-Sectional Study

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Abstract

Background: Emerging infectious diseases are contagious illnesses made of a newfound lineage of a microorganism.

Objectives: This survey aimed to evaluate the knowledge, attitudes, and practices (KAP) of health science students regarding emerging and re-emerging infectious diseases.

Methods: This cross-sectional survey was conducted on 462 randomly selected students from several constituent colleges of Birjand University of Medical Sciences, including nursing, medicine, dentistry, and paramedical colleges (from October to March 2019) who had just passed their microbiology courses. A simple random sampling method was used to avoid bias that could influence the validity of the results. Moreover, participation was entirely voluntary. For data collection, a structured knowledge, attitude, and practice questionnaire was used, whose validity was checked by experts. In the end, the collected data were analyzed by SPSS V.19 using the independent t-test and one-way analysis of variance (ANOVA).

Results: Totally, 462 medical science students (mean age = 20.27 ± 3.69 years) participated in this survey. According to the collected data, the mean scores for KAP were at a medium level, which was not ideal, and showed that there were several weaknesses in the curriculum. The mean knowledge scores for medicine, dentistry, laboratory science, and nursing students were 42.53 ± 15.78, 46.24 ± 20.99, 39.63 ± 15.35, and 40 ± 19.43, respectively. The mean attitude scores were 60.25 ± 6.13, 59.68 ± 5.86, 58.60 ± 5.06, and 57.77 ± 6.59, and the practice mean scores were 58.99 ± 25.11, 67.80 ± 25.72, 62.46 ± 24.48, and 62.29 ± 21.08, respectively.

Conclusions: According to the collected data, paying more attention to the microbiology courses is recommended in all medical and paramedical disciplines. Moreover, it is necessary to provide further education for the students to prepare them to take appropriate measures to prevent the spread of infection.

Keywords: Knowledge; Attitude; Practice; Emerging Infectious Diseases; Re-Emerging Infectious Diseases; Medical Education

1. Background

During the second half of the 20th century, there was overcoming positive attitudes toward the preparedness of humanity against infectious diseases (1). The belief appeared to be justified given the improvement of antibiotics and vaccines as well as successes against poliomyelitis and smallpox. However, during the past twenty years, we have been affected by a range of infectious diseases such as Crimean-Congo hemorrhagic fever (CCHF), Ebola, Marburg virus, Lassa fever, the Middle East respiratory syndrome (MERS) coronavirus, severe acute respiratory syndrome (SARS) coronavirus, Nipah, henipavirus disease, Rift Valley fever, Zika virus disease, and more recently the 2019 novel coronavirus disease (COVID-19) (2, 3). Among infectious diseases, emerging and re-emerging infectious diseases have been increasing during recent years. Also, more than 30 new kinds of infectious diseases have been found during the last two decades (4).

In 2015, the World Health Organization (WHO) explained an emerging infectious disease as "one that has appeared in the population for the first time, or that may have existed previously, but is rapidly increasing in incidence or geographic range" (5). The Centers for Disease Control and Prevention divided emerging infectious diseases into several types as follows (6):

New infections resulting from the variations or development of existing organisms;

The recognized infections propagating to new regions or populations;

Formerly unknown infections emerging in regions undergoing ecological transformation.

The emerging/re-emerging infectious diseases cause particular concerns to public health systems of developing and developed countries (the United States, the United Kingdom, Australia, Japan, and Germany) (7, 8).

It was shown that emerging infectious diseases contained at least 12% of human pathogenesis (9). It is estimated that about 15 million (> 25%) deaths per year (of 57 million annual deaths) are directly caused by infectious diseases worldwide; this figure excludes millions of deaths due to past infections (such as streptococcal rheumatic heart disease) or complications associated with chronic infections such as hepatic deficiency or hepatocellular carcinoma, or millions of people who are affected by hepatitis B and C. Infectious diseases also lead to 48% of early deaths and are one of the most significant causes of disabilities worldwide (10). Re-emerging infectious diseases are kinds of diseases that have been existed in the past and then disappeared; however, they are now affecting humans again, or they are increasing in a specific geographical area. These kinds of diseases have existed for decades or even centuries, but now their breakout location and approach have changed (11). All public health system workers, according to their responsibilities, are obligated to control, diagnose, and treat infectious diseases. Decreasing the infectious disease threats includes using policies and methods that can reduce the risk of facing infectious diseases (12, 13). Also, health and treatment are considered the most important priorities in each society. Given that this issue is related to human life and their physical and mental health, issues in this area, especially health education issues, are of particular importance (14). Therefore, one of the most effective ways for fighting against infectious diseases is teaching hygiene, as well as transmission and prevention methods, regarding these diseases. Since workers of health departments are more exposed to the risks caused by these diseases, the evaluation of workers' KAP toward these diseases can help keep themselves and society healthier. Due to the recent emergence of COVID-19, measuring the KAP of medical science students toward these types of emerging infectious diseases is one of the most important topics in medical education. Our search in international scientific databases did not show any recent publication in this domain in Iranian universities. Therefore, we believe that working on this topic has a special novelty.

2. Objectives

This survey was conducted to evaluate KAP of students of medicine, dentistry, nursing, and laboratory sciences in Birjand University of Medical Sciences toward emerging and re-emerging infectious diseases.

3. Methods

3.1. Study Population

This cross-sectional survey was conducted on 462 randomly selected students from several constituent colleges of Birjand University of Medical Sciences, including medicine, dentistry, nursing, and paramedical colleges (from October to March 2019). The research used a simple random sampling method to avoid bias that could negatively affect the result's validity. Also, participation in the study was voluntary.

3.2. Eligibility Criteria

Inclusion Criteria

1) All medical science students studying in the main compass of Birjand University of Medical Sciences;

2) Students who had passed medical microbiology courses.

3.3. Exclusion Criteria

1) Students who had not taken part in any additional courses related to emerging and re-emerging infectious diseases as a complementary course;

2) Participants who had reported a history of psychiatric disorders;

3) Participants who did not fill out and sign the written consent form;

4) Students who were studying at the postgraduate level (MSc and PhD).

3.4. Data Collection

Data were collected using a self-constructed, self-administered, and anonymous questionnaire. The questionnaire was designed by a team including microbiologists, infectious diseases experts, epidemiologists, and virologists.

Then, the questionnaire was reviewed and evaluated by specialists in microbiology and statistics for its content, design, relevance, readability, and comprehension.

Moreover, the questionnaire was validated by eight professors from Birjand University of Medical Sciences, and minor corrections were done in terms of their constructive comments. In addition, the content validity ratio (CVR) and the relevance content validity index (CVI) were computed for each part of the questionnaire in terms of Lawshe's content validity. On the other hand, a pilot test was designed for reliability with 80 students from Birjand University of Medical Sciences, and subsequently, obligatory changes were made. The reliability of the questionnaire was measured by calculating Cronbach's alpha coefficients for each part and the total scale. As a general rule, a value of Cronbach's alpha > 0.8 is commonly regarded as satisfactory.

The first part covered the students' demographic data, such as age, qualification, and field of education. The second part covered the knowledge toward emerging and re-emerging infectious diseases consisting of 15 questions. The third part evaluated the attitudes of the par-

ticipants toward emerging and re-emerging infectious diseases involving 10 questions. The fourth part explored the practices of the students by asking 5 questions. The students' performance questions were all based on a specific pattern of self-report on actions they took to prevent any illnesses. For example, a question about the prevention of Crimean-Congo hemorrhagic fever (CCHF) was this: "What do you do to prevent CCHF?"

Grading for answers was considered based on a five-point Likert scale. Total KAP scores were calculated for each respondent, and the maximum scores for knowledge, attitudes, and practices were 15, 10, and 5, respectively.

3.5. Ethical Consideration

The research was confirmed by the deputy of research and technology and the Ethics Committee of Birjand University of Medical Sciences (ethics code: IR.BUMS.REC.1398.156). The students answered the questionnaire anonymously and entered the survey after completing and signing the informed consent form. Students were told that they could leave the study at any time. However, all participants remained until the end of the study.

3.6. Statistical Analysis

The recorded data were analyzed using SPSS V.19. The association between demographic variables and respondents' KAP was evaluated by the test-test, one-way analysis of variance (ANOVA), or chi-square tests, where appropriate.

To compare the results in the study groups, they were subdivided into normal and abnormal variables by the one-sample Kolmogorov-Smirnov test. The –One-way ANOVA test was used for examining normal variables. Descriptive statistics (frequency, percentage, mean, and standard deviation (SD)), one-way ANOVA, test-test, and Pearson's correlation were also used. The significance level was considered as P-values less than 0.05.

4. Results

4.1. Demographics and Other Characteristics of the Study Population

Totally, 462 health science students (mean age = 20.27 ± 3.69 years) participated in this survey (230 of them were female (49.8 %)). The field of education for 15.8 % of the participants was laboratory sciences, 18.4 % were medical students (interns), 30.5 % were dentistry students, 1.9 % were nursery students, and 33.3 % were sophomore medical students. Also, 79.5 % of doctorate students and 20.5 % of bachelor students participated in our survey (Table 1).

Table 1. Characteristics of the Students Participating in the Study

Variables	Number	Knowledge		Attitudes		Practices	
		Mean ± SD	P-Value	Mean ± SD	P-Value	Mean ± SD	P-Value
Gender			0.7		0.008		0.07
Female	230	43.87 ± 18.83		60.51 ± 5.85		64.43 ± 24.5	
Male	232	42.87 ± 18.83		59.04 ± 5.9		60.17 ± 26.05	
Major			0.05		0.13		0.01
Medicine	239	42.53 ± 15.78		60.25 ± 6.13		58.99 ± 25.11	
Dentistry	141	46.24 ± 20.99		59.68 ± 5.86		67.8 ± 25.72	
Laboratory science	73	39.63 ± 15.35		58.6 ± 5.06		62.46 ± 24.48	
Nursing	9	40 ± 19.43		57.77 ± 6.59		62.29 ± 21.08	
Qualifications			0.008		0.3		0.5
Doctorate	367	44.26 ± 17.81		59.9 ± 6.03		62.67 ± 25.48	
Bachelor	95	38.87 ± 16.34		59.26 ± 5.45		60.84 ± 24.91	

4.2. The Knowledge of Students

The mean knowledge score was 43.16 %, which means that on a knowledge scale from 0 to 100, participants gained a mean score of 43.16 regarding the knowledge on emerging and re-emerging infectious diseases. Table 1 shows the distribution of knowledge scores according to the major. Also, dentistry students showed the highest mean score for knowledge. The mean knowledge score of the medical students was significantly higher than that of the laboratory science students (P = 0.048). The mean knowledge score of the dentistry students was much higher than that of the laboratory sciences students (P < 0.001). The doctorate students showed more knowledge compared to the bachelor students (P = 0.002). The results of each of the questions related to the knowledge of students on emerging and re-emerging infectious diseases are shown in Table 2.

Table 2. Health Science Students' Knowledge on Emerging and Re-Emerging Infectious Diseases

Question Category	Percentage of Correct Answers, %					
	Sophomore Medical Students	Intern	Dentistry	Laboratory Sciences	Nursing	All
Definition of emerging diseases	30.5	36.5	50.4	30.1	44.4	37.9
Definition of re-emerging diseases	19.5	14.1	18.4	19.2	0.0	17.7
Differences between emerging and re-emerging diseases	65.6	49.4	63.1	49.3	55.6	59.1
Epidemiology	17.5	37.6	27.0	43.8	44.4	28.8
Flu	47.4	42.4	56.0	45.2	33.3	48.5
Epidemiology in IRAN	24.0	21.2	17.0	39.7	33.3	24.0
What are the most killing re-emerging diseases in West Africa?	65.6	68.2	41.1	49.3	55.6	55.8
Target community of MERS	51.9	51.8	53.9	37.0	33.3	49.8
Epidemiology of Zika	55.2	56.5	73.0	63.0	55.6	62.1
Zika	55.8	54.1	68.8	50.7	55.6	58.7
MERS-CoV	44.2	36.5	51.8	31.5	33.3	42.9
SARS-CoV	43.5	43.5	62.4	35.6	33.3	47.8
Dengue fever	33.1	29.4	30.5	24.7	33.3	30.3
CCHF	59.7	57.6	54.6	38.4	66.7	54.5
Disease transmission	24.7	38.8	25.5	37.0	22.2	29.4

4.3. The Attitudes of Students

The mean attitude score was 59.77 %, which means that on the attitude scale of 0 to 100, participants gained a mean score of 59.77 regarding the attitude toward emerging and re-emerging infectious diseases. The medical students had the highest mean attitude score and showed a higher attitude than the laboratory sciences students (P = 0.008). The mean attitude score of female students was significantly higher than that of male students (P = 0.014). The results of each of the questions related to the attitudes of the students toward emerging and re-emerging infectious diseases are shown in Figure 1.

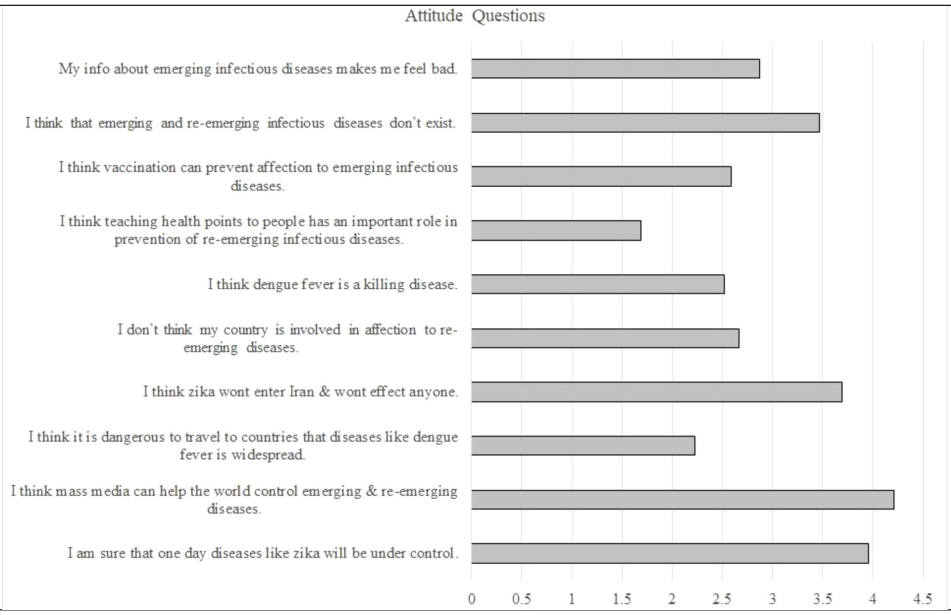

Figure 1. Comparison of the students' mean attitude scores according to the questions.

4.4. The Practices of Students

The mean practice score was 62.29 %. The mean practice score of the dentistry students was significantly higher than that of the medical students. Surprisingly, in this survey, it was observed that most of the participants (400 (86.6 %) people) were aware of Zika prevention. Results showed a significant difference in the practices of the participants according to the major (P = 0.01). The results of each of the questions related to the practices of the students on emerging and re-emerging infectious diseases are shown in Table 3. Moreover, the doctorate students in this study showed (P = 0.008) significantly higher levels of knowledge compared with the bachelor students. Our results also showed that the intern medical students performed better than the sophomore medical students in their practices, while no significant difference was found between their knowledge and attitudes (Figure 2).

Table 3. Health Science Students' Practices on Emerging and Re-Emerging Infectious Diseases

Question Category	Percentage of Correct Answers, %					
	Sophomore Medical Students	Interns	Dentistry	Laboratory Sciences	Nursing	Total
Prevention of CCHF	50.0	68.2	56.7	56.2	22.2	55.8
Prevention of Dengue fever	61.0	57.6	70.9	63.0	77.8	64.1
Prevention of MERS	51.3	63.5	67.4	56.2	66.7	59.5
Prevention of Zika	78.6	94.1	86.5	94.5	88.9	86.6
Prevention of Flu	42.9	31.8	57.4	42.5	55.6	45.5

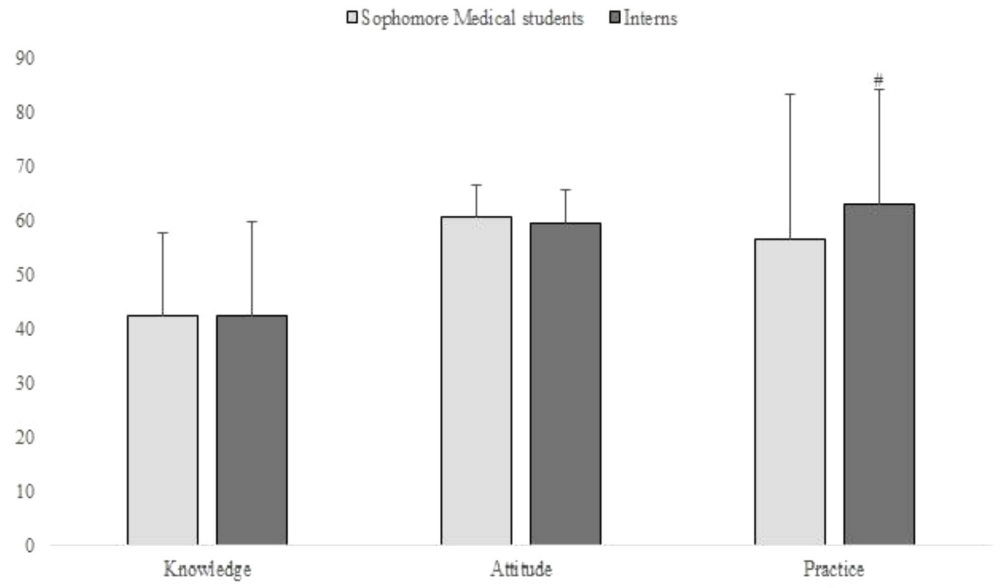

Figure 2. Comparison of the knowledge, attitudes, and paractices' scores among medical students. Data are mean ± SD. #, P < 0.05 as compared tothe sophomore medical students group.

4.5. The Correlation Between the Knowledge, Attitudes, and Practices' Scores

This study showed that health science students had less than half (43.16 %) knowledge on emerging and re-emerging infectious diseases. Results represented medium levels in attitudes and practices of the students toward emerging and re-emerging infectious diseases. Knowledge was significantly correlated with attitudes (P < 0.05) and practices (P < 0.01).

5. Discussion

While COVID-19 infection has developed around the world as one of the most important emerging infections of the last century and has become one of the deadliest infectious diseases in human history, it has highlighted the need for medical staff to prepare for emerging and re-emerging diseases. Unfortunately, as educationists and educational planners, we still do not have enough information on the level of KAP of Iranian medical and paramedical students that facing such illnesses (prevention, diagnosis, care, and treatment) after graduation is one of their most important missions. This survey focused on the role of education in promoting the KAP of health science students in the face of emerging infectious diseases. While COVID-19, as the most important emerging infectious disease, has spread around the world, it has caused one of the deadliest infectious diseases over the last hundred years.

The mean KAP scores for medicine, dentistry, laboratory science, and nursery students were 43.16 ± 17.63, 59.77 ± 5.92, and 62.29 ± 25.35, respectively. Despite all similar studies that evaluated KAP regarding one or two particular infectious diseases, our survey showed a lack of information on infectious diseases among university students. Human immunodeficiency virus (HIV), malaria, tuberculosis, influenza, SARS, West Nile virus, and Marburg virus were expressed as some examples of emerging and re-emerging infectious diseases, against which an advanced paradigm is needed (11). On the other hand, there is an urgent need for performing accelerated research and development for these emerging and re-emerging infectious diseases in terms of the WHO research and development blueprint (2018) (2)i. This means that collaborations among states, industries, and universities are essential to overcome this emerging threat to humanity and must be further enhanced. The study showed higher levels of attitudes and practices in women compared to men towards the concepts of emerging and re-emerging infectious diseases; also, similar responses were observed in similar studies (15, 16). Some studies have revealed that the levels of knowledge on infectious diseases can be affected by the spread of the disease, severity of the disease, and methods for knowledge sharing (17). The results of the present survey showed that the mean knowledge score of health science students on Zika virus was acceptable at 60.4%, contrary to a study conducted in Turkey on midwifery, nursing, and medical students, in which 63% of them were found to have no information on Zika (18). This acceptable level of knowledge was probably caused by those who announced Zika as a public health emergency by the WHO (19). On the other hand, findings of a previous survey conducted on Zika virus in New York City showed that nearly two-thirds of all the participants (64%) believed that they did not have enough knowledge on Zika, and also most of the participants (84%) indicated that they needed more information (20). The results of our study showed that the knowledge of students regarding MERS coronavirus was 42.9%, which was not favorable in contrast to the findings of a cross-sectional study in Saudi Arabia (15). The findings of this study also showed that the mean knowledge score of the students on SARS coronavirus was 47.8. This level of knowledge is not ideal and may result in the students' failure in performing well in community health if the infection reoccurs, and the community faces problems, which has already happened and the WHO characterized the 2019 novel coronavirus (an emerging infectious disease) as a pandemic (21). Knowledge on dengue fever in our study was very low (30%), similar to other findings in previous studies on both popular and expert individuals (22, 23). However, the findings of Yepa and Wijayasiri (24) showed that the knowledge of Seri Lankan students on dengue fever was acceptable, and their medical students had higher information than other students. Notably, the recent outbreak killed 100 people in 2011 in Seri Lanka. Knowledge regarding CCHF was at an average level of 54% among students. Other studies also showed similar findings; for example, the health care worker population in Turkey did not know much about this disease (25). The health personnel in Kermanshah were also poorly aware of CCHF, especially nurses who had risky occupations (26). In the present study, female attitudes were significantly higher than male attitudes, being in contrast with a study by Sharma et al. in India, because in India, men were more socially active than women due to their discrimination and customs existing against women in the community, so they had higher knowledge. However, in Iranian society, the results were quite opposite, and women had higher attitudes than men, which is indicative of non-discrimination and high sensitivity of women toward emerging infectious diseases.

Our research also showed that the more general the question, the less the percentage of right answers. For example, only 17.1% of the students knew the definition of re-emerging infectious diseases. However, a similar study conducted in Tehran universities on avian influenza suggested otherwise (27). The findings of a similar study performed on the health science students of Birjand University of Medical Sciences (28) showed that the level of knowledge in laboratory science students was significantly lower than that of the medical students. This was almost consistent with our study, and it recommends the educationists have a careful revision of the educational curriculum of laboratory science students.

There were some confounding factors in this study that we tried to control. One of these factors was the time gap between taking the microbiology course and completing the questionnaire. This time interval was somewhat diverse in different disciplines. To eliminate this confounding factor, only students who were spending their last semester were included in the study. Another confounding factor was the difference in details as well as the volume of microbiology courses in different disciplines. We considered these differences in comparing the knowledge, attitudes, and practices in different disciplines.

The current study has several limitations. First, this study was conducted based on a cross-sectional design. As a result, the generalizability of the results may be impaired. Second, all data were collected by self-report, which may cause response bias to the current findings and might not

reflect the actual behavior of the students. Moreover, collecting data from only one university in the country limits the external validity of the results. Also, performing further surveys covering the students in other cities is necessary. However, the authors did their best to diminish the effect of this factor on the findings.

5.1. Conclusions

Based on the findings of this study, students' mean KAP was medium, which is not ideal. This shows that there are several weaknesses in the curriculum. It also indicates that inadequate attention has been paid to microbiology topics. It is necessary to provide further education for the students to prepare them to take appropriate measures to prevent the spread of infection. This survey revealed that dentistry students had higher knowledge compared to other groups on emerging and re-emerging infectious diseases. Also, this suggests that dentistry students have been educated better than other students, and how to teach them can be exemplary for other groups. According to the collected information, paying more attention to microbiology topics in all medical disciplines is recommended. Collaborative efforts are needed by focusing on emerging and re-emerging infectious diseases.

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Conflict of Interests:

The authors declared no conflict of interests.

References

1. Burnet M, David O. *White1972 Natural History of Infectious Disease*. Cambridge: Cambridge Univer-sity Press; 1972.
2. Mehand MS, Al-Shorbaji F, Millett P, Murgue B. The WHO R&D Blueprint: 2018 review of emerging infectious diseases requiring urgent research and development efforts. *Antiviral Res.* 2018;**159**:63-7. doi:10.1016/j.antiviral.2018.09.009. [PubMed:30261226]. [PMC7113760:PMC7113760].
3. Venkatramanan S, Lewis B, Chen J, Higdon D, Vullikanti A, Marathe M. Using data-driven agent-based models for forecasting emerging infectious diseases. *Epidemics.* 2018;**22**:43-9. doi:10.1016/j.epidem.2017.02.010. [PubMed:28256420]. [PMC5568513:PMC5568513].
4. Kundu MK, Mandal TK, Bhattacharya M. Study on global public health threats due to emerging or Re-emerging infectious diseases and the strategies to Reduce Threats. *Indian J Public Health Res Develop.* 2018;**9**(11). doi:10.5958/0976-5506.2018.01422.5.
5. WHO. World Health Organization. Emerging diseases. 2015; Available from: http://www.who.int/topics/emerging_diseases/en/.
6. CDC. Centers for Disease Control and Prevention. EID journal background and goals. 2015; Available from: http://wwwnc.cdc.gov/eid/page/background-goals.
7. Feldmann H, Czub M, Jones S, Dick D, Garbutt M, Grolla A, et al. Emerging and re-emerging infectious diseases. *Med Microbiol Immunol.* 2002;**191**(2):63-74. doi:10.1007/s00430-002-0122-5. [PubMed:12410344].
8. Woolhouse ME. Epidemiology: emerging diseases go global. *Nature.* 2008;**451**(7181):898-9. doi:10.1038/451898a. [PubMed:18288175]. [PMC7095335:PMC7095335].
9. Taylor LH, Latham SM, Woolhouse ME. Risk factors for human disease emergence. Philos Trans *R Soc Lond B Biol Sci.* 2001;**356**(1411):983-9. doi:10.1098/rstb.2001.0888. [PubMed:11516376]. [PMC1088493:PMC1088493].
10. World Health Organization. The World health report, 2004: Changing History; 2004Contract
11. Fauci AS. Emerging and reemerging infectious diseases: the perpetual challenge. *Acad Med.* 2005;**80**(12):1079-85. doi:10.1097/00001888-200512000-00002. [PubMed:16306276].
12. Danila S, Harfst SA. *Mosby's dental hygiene.* Philadelphia, PA: Mosby Co; 2002.
13. Taiwo JO, Aderinokun GA. Assessing cross infection prevention measures at the Dental Clinic, University College Hospital, Ibadan. *Afr J Med Med Sci.* 2002;**31**(3):213-7. [PubMed:12751559].
14. Haghpanaah S, Sadeghi Hassanabadi A. Assessment Scientific Knowledge of Medical Interns about Four Common Infection Diseases in Fars. *J Guilan Univ Med Sci.* 2000;**9**(33):79-87.
15. El-Gharabawy R, Abdallah AS, Aldowyan N. Knowledge, Attitude and Practice (KAP) Study about Middle East Respiratory Syndrome Coronavirus (MERS-CoV) among Population in Saudi Arabia. *Int Arch Med.* 2017;**10**. doi:10.3823/2524.
16. Karimi-Sari H, Bayatpoor ME, Aftabi Khotbesara M, Ebrahimi MS, Sattari Z, Sattari P, et al. Knowledge, attitude, and practice of Iranian health sciences students regarding hepatitis B and C virus infections: A national survey. *Am J Infect Control.* 2017;**45**(11):e135-e41. doi:10.1016/j.ajic.2017.07.012. [PubMed:28893448].
17. Al-Hazmi A, Gosadi I, Somily A, Alsubaie S, Bin Saeed A. Knowledge, attitude and practice of secondary schools and university students toward Middle East Respiratory Syndrome epidemic in Saudi Arabia: A cross-sectional study. *Saudi J Biol Sci.* 2018;**25**(3):572-7. doi:10.1016/j.sjbs.2016.01.032. [PubMed:29686521]. [PMC5910645:PMC5910645].
18. Sert H, Pelin M, Seven A, Cetinkaya S, Yuksel ZO, Aygin D, et al. Do we know about Zika virus infection? *Biomed Res.* 2017;**28**(15).
19. Munjal A, Khandia R, Dhama K, Sachan S, Karthik K, Tiwari R, et al. Advances in Developing Therapies to Combat Zika Virus: Current Knowledge and Future Perspectives. *Front Microbiol.* 2017;**8**:1469. doi:10.3389/fmicb.2017.01469. [PubMed:28824594]. [PMC5541032:PMC5541032].
20. Samuel G, DiBartolo-Cordovano R, Taj I, Merriam A, Lopez JM, Torres C, et al. A survey of the knowledge, attitudes and practices on Zika virus in new York City. *BMC Public Health.* 2018;**18**(1):98. doi:10.1186/s12889-017-4991-3. [PubMed:29291723]. [PMC5748954:PMC5748954].
21. WHO. Coronavirus disease 2019. 2020 Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.
22. Abdo Abkar M, Al Alimi A, Al Sharabi BA, Shueai Al Awfi M. Knowledge, Attitudes and Practices Regarding Dengue Fever in a Cohort of Nursing Students. *J Adv Med Med Res.* 2019:1-9. doi:10.9734/jammr/2019/v29i330073.
23. Vo TQ, Phuong Pham TT. Revisiting dengue-related knowledge, attitudes and practices: A cross-sectional study in Ho Chi Minh City, Vietnam, 2018. *J Pak Med Assoc.* 2019;**69**(Suppl 2)(6):S108-S17. [PubMed:31369541].
24. Yapa H, Wijayasiri W. Knowledge on dengue fever among undergraduates; 2012. Report No.: 2012-9912Contract
25. Aydın M, Dumanlı N. Knowledge levels regarding ticks and Crimean-Congo Haemorrhagic Fever among veterinarians, nurses and nursing students. *Van Vet J.* 2017;**28**(1):31-5.
26. Head JR, Bumburidi Y, Mirzabekova G, Rakhimov K, Dzhumankulov M, Salyer SJ, et al. Risk Factors for and Seroprevalence of Tick-borne Zoonotic Diseases among Livestock Owners, Kazakhstan. *Emerg Infect Dis.* 2020;**26**(1):70-80. doi:10.3201/eid2601.190220. [PubMed:31855140]. [PMC6924887:PMC6924887].
27. Davati A, Jafari F, Kholdi N, Jafaritabar H. Studying knowledge of medical students of Tehran universities toward avian influenza. *Med Sci J Islam Azad Univ.* 2010;**20**(3).
28. Abdollahi-Karizno M, Pursalehi F, Mirzaei M, Salmany F, Zare-Bidaki M. 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. *J Surg Trauma.* 2018;**6**(3):101-7.