Original Article

Ebola outbreak preparedness and preventive measures among healthcare providers in Saudi Arabia

Khalid M Almutairi[1], Abdulaziz A Alodhayani[2], Mahaman Moussa[3], Ahmad E Aboshaiqah[3], Regie B Tumala[3], Jason M Vinluan[1]

[1] *Department of Community Health Science, College of Applied Medical Science, King Saud University, Saudi Arabia*
[2] *Department of Family and Community Medicine, College of Medicine, King Saud University, Saudi Arabia*
[3] *College of Nursing, King Saud University, Saudi Arabia*

Abstract

Introduction: As medical professionals on the front lines in the outbreaks of infectious disease like Ebola Virus Disease (EVD), healthcare providers must have sufficient knowledge, skills, and best practices to protect themselves and the public from the disease. The purpose of this study is to identify the level of awareness, attitudes and practices among healthcare workers in relation to precautionary measures to EVD.
Methodology: A total of 177 physicians and 545 nurses participated in a descriptive cross-sectional study from a tertiary government hospital in Saudi Arabia. All subjects answered a self-administered questionnaire focusing on their level of awareness, concerns, and clinical practice related to EVD.
Results: Majority of the participants were knowledgeable about the etiology, mode of transmission, signs and symptoms, and treatment of EVD. All of the participants had high levels of concern about EVD (p=0.001) and about the implementation of strict standard infection control precautionary measures. The study found that greater infection control measures were taken by the participants including frequent hand washing, use of personal protective equipment, and avoiding normal activities such as going to work, school, travel, etc. if fever symptoms appear.
Conclusion: A combination of evidence based knowledge about EVD and high levels of concern of healthcare providers in relation to precautionary measures to EVD are the main factors leading to strict compliance with the infection control measures recommended in this study. Additionally, healthcare providers must be trained in infection control and adhere to the universal infection control standard guidelines to facilitate prevention and precaution.

Key words: Ebola virus disease; healthcare professionals; preparedness; Saudi Arabia.

Introduction

In 2014, the world experienced the most devastating Ebola epidemic in human history. The cases of Ebola outbreak rose to 21,121 by January 9, 2015, according to the data from the World Health Organization (WHO) and additional information supplied by the Ministries of Health (MOH) in the affected countries [1,2]. Ebola virus disease (EVD) is a febrile and hemorrhagic illness with severe gastrointestinal symptoms like nausea, vomiting, and diarrhea [3-5].

This largest outbreak of Ebola to date is currently affecting many countries in West Africa. The fatality rates are high, averaging about 50% [2,6]. As of September 2015, widespread transmission was reported in Guinea (3,339 cases, 2,531 deaths), and Sierra Leone (13,785 cases, 3,955 deaths) [1]. Localized transmission was reported previously in Mali (8 cases,

6 deaths) and the United Kingdom (1 case, 0 deaths). In other parts of the world, EVD cases were reported but contained. These countries include Nigeria (20 cases, 8 deaths), Senegal (1 case, 0 death), Spain (1 case, 0 death), and United States of America (4 cases, 1 death) [1]. Nigeria, Mali, Italy, Senegal, Spain, the United Kingdom and the U.S. are now officially Ebola free [1,2]. Currently, there are no FDA-approved vaccines or medicines (*e.g.,* antiviral drugs) available for EVD and the rate of infection and death caused by EVD is alarming and resulted in an international response to the tragedy [1,2,7,8]. The WHO initiated a Global Alert and Response (GAR) to holistically address the challenges caused by EVD. Often there is misinformation, misperception, and fear about the disease both from the general public and healthcare providers.

According to a survey by the Pew Research Center, public concern about the spread of the Ebola virus in the U.S. has increased (41%) since early in October 2014 [9]. Healthcare providers, who are armed with evidence-based information and who deal with infection control on a daily basis, have a critical role to play in helping minimize both the incidents and the prevalence of EVD. Additionally, to address the healthcare worry and concern about EVD, and empower healthcare providers to comfortably provide safe and high quality care to Ebola patients, the World Bank chief appealed to healthcare professionals for volunteering during the EVD outbreak as a strategy for containing a needless epidemic of fear and misinformation [9].

In the Kingdom of Saudi Arabia (KSA) the EVD concern among the general public and clinicians was accentuated by the 2012 Coronavirus outbreak, which had 1,564 cases and 564 deaths globally [10]. Like many countries, KSA has invested a lot of resources in Ebola preparedness including the rigorous screening of pilgrims, the training of clinicians on how to manage EVD and designate special rooms and teams in many hospitals for the care and treatment of EVD patients. To date no Ebola case has been identified or reported in KSA. However, like other healthcare providers across the globe, in KSA the clinicians are also challenged by misinformation and fear of EVD. To our knowledge, there is no study that has explored the knowledge, concern, and preventive measures related to EVD among healthcare workers in KSA.

The current study will have high significance, especially to healthcare workers. About 6 U.S. healthcare workers have been infected with Ebola virus disease while in West Africa [11]. In addition, approximately 140 African healthcare workers have been infected with EVD, with 80 deaths [12]. Healthcare workers particularly physician and nurses are considered front liners in caring for patients. Furthermore, healthcare workers are at the highest risk of getting infected because they may come in close contact with infected blood or body fluids while caring for Ebola patients, their families and friends [11]. In a similar study, nurses reported, in order to have the safest EVD care they must be educated and trained with infection control practices, including appropriate PPE use in evidence-driven practices [13]. This study will empower clinicians with evidence-based and culturally tailored information that will foster their knowledge about EVD. Clinicians are ultimately responsible for caring, protecting and educating their patients, families and the community. This study will be beneficial in helping the government, MOH, and healthcare workers in KSA to disseminate easy to understand and accurate information about EVD. The purpose of this study is to assess healthcare workers' awareness, attitudes and practices in relation to precautionary measures to EVD.

Methodology

Study Design

A descriptive cross-sectional study design was used.

Setting

The study was conducted at King Saud University Hospital (King Khalid University Hospital) between November 2014 and January 2015. King Saud University Hospital is a tertiary hospital with an 800 bed facility and considered one of the largest hospitals in Riyadh, Saudi Arabia. Ethical approval of this study was granted by the ethical review committee of the College of Applied Medical Science (CAMS - 07/3536) and College of Medicine of King Saud University.

Study Subjects

Male and female physicians and nurses working in the hospital were asked for their consent to participate in the study. Other healthcare providers and those non-willing to participate were excluded from the study.

Procedure

Before starting the survey, the investigator received permission from hospital administrators and department heads to administer the survey. One of the authors facilitated the survey with the physicians. Nurse educators accompanied by a trained researcher distributed the questionnaires among nurses. A thorough explanation about the study's aims and objectives were given to the participants and their questions were addressed by the researchers prior to data collection. The questionnaire also stated that each individual had the right to decline to complete the survey or to answer any specific questions. All participants were informed that no names or other identifying information was needed and collected. Two researchers reviewed the surveys in order to ensure that all questionnaires were filled out completely and correctly before being entered in a computer.

Measures

A self-administered survey was divided into three parts: demographics, knowledge, attitudes and precautionary measures used by the participant. Demographic characteristics include age, marital status,

professional role and gender. Questions included those about knowledge of the Ebola virus disease, its nature, mode of transmission, symptoms and signs, incubation period, period of communicability, and preventive measures. These questions were assessed by 20 factual statements that participants responded to with "yes" or "no." A scoring system was applied to assess the level of knowledge of each subject: one point was given for each correct answer. No point was given for an incorrect answer. The correct answer was based on information provided by the World Health Organization (WHO) about the disease.

Questions related to attitudes and perceptions towards the disease, its severity, governmental efforts to prepare, and disease outcomes were assessed by six attitudinal statements that participants responded to with "strongly agree," "agree," "neutral," "disagree," or "strongly disagree." A scoring system was applied using the Likert 5-point scale; five points were assigned to "strongly agree," and one point was assigned to "strongly disagree." The participant was considered extremely concerned in each statement if he or she agreed or strongly agreed. Level of concern was categorized as: extremely concerned (if the agreement was evident in 5-6 statements), quite concerned (if the agreement was evident for 3-4 statements), and little concerned (if agreement was evident for two or fewer statements).

Participants were asked to report the precautionary measures they used to prevent infection. Participants' responses were assessed in accordance with the precautionary measures recommended by the World Health Organization (WHO) [14]. The WHO provides protective measures that individuals can take to reduce human transmission. These protective measures were grouped into different factors such as reducing the risk of wildlife-to-human transmission, human-to-human transmission, and sexual transmission and outbreak containment measures. A scoring system was applied in which each participant was given one point for each precautionary measure taken. Thus, the total precaution score ranged from zero to six points. A high level of precaution was considered to be 5-6 points, a moderate level was 3-4 points, and a poor level was two points or less. The instrument was piloted and tested on a small group of healthcare professionals and were modified to meet the validity and reliability of the survey.

Data Analysis

Data were entered and analyzed using Statistical Package for Social Science (SPSS) software program for Windows (version 21.0). Frequencies were presented in percentage (%). Chi-squared test was used for categorical data and Student t-test and ANOVA was applied for continuous data. Statistical significance was considered at $p < 0.05$.

Results

The results are presented in full in the tables, but are discussed in the text in three main categories: (1) demographic characteristics of the study sample, (2) knowledge about Ebola virus disease (EVD), and (3) attitudes, concern statements and precautionary measures against EVD.

Demographic characteristics of the study sample

Demographics of the participants were presented in Table 1. From the pool of 850 invited participants, a total of 722 respondents participated in the study (84.9%). Of the total number of participants, one-fourth (25%) were physicians and three-fourths (75%) were nurses. Almost all of the participants were females (82%). Most of the participants were in the age group 26-30 (42%). Majority of the respondents were married (60%).

Table 1. Demographic characteristics of the study sample

Characteristics	Frequencies N = 722	
	No.	**%**
Age Group		
20 – 25 yr.	58	8
26 – 30 yr.	297	42
31 – 35 yr.	84	12
36 – 40 yr.	89	12
41 – 45 yr.	67	9
46 – 50 yr.	71	10
51 yr. or more	56	7
Marital Status		
Single	281	39.3
Married	436	60
Widowed	2	0.3
Divorced	3	0.4
Professional Role		
Physician	177	25
Nurse	545	75
Gender		
Male	132	18
Female	590	82

Knowledge about EVD

The results of level of knowledge of participants were shown in Table 2. The majority of the participants (74.7%) were aware that the cause of EVD is not inherited. Furthermore, nearly one hundred percent of the participants were knowledgeable that the cause of the disease is virus and it is communicable (96.5%). However, only a total of 32.8% were knowledgeable that EVD is not airborne (p < 0.001). More than two-thirds of the participants were significantly aware (p=0.015) that the disease can be transmitted through touching and shaking hands with an infected person (79.3%). In addition, majority of participants responded correctly that the disease can be transmitted to human from bats, monkeys and primates (73.1%, p=0.002). Most of the participants (76.3%) were well informed about the signs and symptoms of the disease such as the symptoms of the disease appear 2 to 21 days after infection (p=0.005). The majority of the respondents (81.5%) were aware that no vaccine for EVD was available at the time of the study (p < 0.001). Nearly

three-fourths of the participants (73.9%) were aware that the disease can be managed through supportive therapy such as rehydration (p < 0.001).

Attitudes, concern statements and precautionary measures against EVD

Table 3 shows the participants concerns and the precautions used by participants in reducing the risk of human-to-human transmission against EVD. All the participants were concerned that the Ministry of Health (MOH) and hospital administrators should implement strict standard infection control precautions against EVD (p < 0.001). Furthermore, almost all of the participants (98.8%) were concerned that the government should do more health education activities and raise awareness targeting relevant groups within the community, restrict travel from and to the areas of disease to avoid the spread of disease (95.7%), isolate infected patients in special hospitals (99.3%), disseminate health information in healthcare facilities

Table 2. Knowledge about the Ebola disease

No.	Items	Physician (N=177)		Nurse (N=545)		P - value
		N	%	N	%	
The causes the disease is						
1	Virus	176	24.2	521	71.8	0.390
2	Inherited disease	126	17.4	413	56.9	**0.018**
3	Communicable disease	165	22.7	510	70.2	0.988
The disease is transmitted through						
4	Airborne	82	11.3	155	21.3	**0.000**
5	Transmitted through direct contact	169	23.3	517	71.2	0.979
6	Touching and shaking hands with an infected person	157	21.6	416	57.3	**0.015**
7	Use the same objects by an infected person	135	18.6	453	62.4	0.213
8	Transmitted through contact with infected dead bodies	155	21.3	493	67.9	0.902
9	Sexual contact	134	18.5	432	59.5	0.115
10	Transmitted from humans to monkeys and vice versa	111	15.3	385	53.0	0.108
11	Ebola virus can be infected from bats, monkeys and primates	121	16.7	407	56.1	**0.002**
12	Ebola virus can affect humans more than once in his life	20	2.8	77	10.6	0.405
What are the signs and symptoms of the disease?						
13	Disease begins with acute fever, diarrhea and vomiting	169	23.3	504	69.4	0.691
14	Other symptoms includes headache, nausea, abdominal pain, dysphagia, epistaxis, and bleeding gums	165	22.7	516	71.1	0.184
15	Ebola could lead directly to death	159	21.9	468	64.5	0.737
16	Symptoms appear after infection	151	20.8	400	55.1	**0.005**
17	Vaccine for Ebola virus	135	18.6	454	62.5	**0.000**
18	Specific treatment available for Ebola virus	134	18.5	408	56.2	0.246
19	Minimal trauma - patients must be kept to a minimum.	146	20.1	419	57.7	0.359
20	Supportive management	150	20.7	384	52.9	**0.001**

Note: Significance was set P < 0.05.

Table 3. Responses (%) of participants to concern statements and self-reported precautionary measures against Ebola virus disease

No.	Items	Physician (N=177)		Nurse (N=545)		P - value
		N	%	N	%	
1	Implementing strict standard infection control precautions	177	25	545	75	**0.000**
2	Health education activities and raising awareness within the community	174	24	540	75	0.798
3	Restrict travel from and to the areas of the disease to avoid spread of disease	172	24	519	71	0.724
4	Isolate patients in special hospitals	177	24	540	75	0.909
5	Disseminate health information in health-care facilities	176	24	535	74	0.471
6	Train/retain staff in community based surveillance	176	24	530	73	0.588
7	Hand washing	169	23.3	534	73.6	0.184
8	Avoid touching the eyes, nose, and mouth	173	23.8	536	73.8	0.838
9	I use disposable medical examination gloves	176	24.2	541	74.5	0.959
10	I use gown and eye protection before procedures and patient-care activities	173	23.8	538	74.1	0.633
11	Avoid normal activities when symptoms appeared	121	16.7	473	65.2	**0.000**
12	Follow the standard infection control precautions	174	24.0	538	74.1	0.895

Note: Significance was set P < 0.05

(98.4%), and train or retain staff in community-based surveillance (97%).

Nearly one hundred percent (97.3%) of the participants responded that frequent hand washing is a precautionary measure that can use to reduce human-human transmission against EVD. Additionally, the largest number of participants said avoiding touching the eyes, nose and mouth (98.1%). Almost all of the participants used personal protective equipment (PPE) as a precaution in EVD (98.4%) and following the standard infection control precautions implemented by the hospital and recommended measures of prevention by MOH (98.6%). In addition, the majority of the participants (82.2%) reported avoiding normal activities such as going to work, school, travel, shopping, if symptoms such as fever appeared. However, 18.1% of the participants responded not likely and this was considered statistically significant (p < 0.001).

Discussion

This study examined the awareness, attitudes and practices towards EVD in a government hospital in Riyadh, KSA. The findings revealed that a significant number of participants were knowledgeable about the etiology of EVD. However, the majority perceived it as airborne. These findings highlighted the misinformation and the widespread misconception about EVD regarding its mode of transmission, which has resulted in many cases with the fear factor within the general public and in the healthcare community. This was consistent with the conclusions of many related studies that the disease is not airborne or spread like influenza, but rather through direct contact (through broken skin or mucous membranes in, for example, the eyes, nose, or mouth) with blood or body fluids (including but not limited to urine, saliva, sweat, feces, vomit, breast milk, and semen) of a person who is sick with Ebola; objects (like needles and syringes) that have been contaminated with the virus; and infected fruit bats or primates like apes and monkeys [1,2,15]. Although EVD has not previously been known to occur in Saudi Arabia, the Ministry of Health (MOH) must conduct efforts, for example, public health awareness or focus groups of multidisciplinary healthcare teams where clinicians will be encouraged to voice concerns, fear, and misconceptions about EVD.

To reduce the risk of human-to-human transmission and respond appropriately during an outbreak of an infectious disease like EVD, healthcare providers need to have evidence-based knowledge about the disease, for example, its mode of transmission, incubation period and about whether there is a vaccine against the disease or if there is an available treatment that is effective to manage once someone is infected. Many reports have been conducted about knowledge towards infectious diseases like SARS, avian influenza, swine influenza, and with cases reported in KSA regarding coronavirus (MERS-CoV) outbreaks [1,16]. In the current study, the majority of the participants were knowledgeable about the incubation period of EVD that signs and symptoms appear in 2 to 21 days after exposure. Furthermore, more than two-thirds of the participants were aware that there is no available

vaccine for Ebola virus and can be managed through supportive therapy at the time the study was conducted.

Similar to other related studies, signs and symptoms of EVD may appear 2 to 21 days after exposure (17,18). To date, there are no FDA-approved vaccines or medicines (*e.g.,* antiviral drugs) available for Ebola Virus Disease [1,2,7,8]. Symptoms of Ebola and complications are treated symptomatically. However, T-705 (favipiravir) an antiviral drug successfully treated an advanced Ebola virus disease infection in a small animal model, which suggests it is a candidate to treatment of Ebola hemorrhagic fever [8,19]. The current protocol of caring for EVD is mainly supportive care such as intravenous fluids (IV) and electrolytes replacement [1-5,8,20]. Other interventions include maintaining oxygen status and blood pressure; and treating other infections if they occur including super infection [1,5]. Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness. Although the studies are not definitive [21], the use of verified cardiovascular drugs like Amiodarone, Doxazosin, Statin, Pentoxifylline, Propanolol and Verapamil may have some effect on treating EVD. These drugs remain as important opportunity and hope to the treatment of Ebola virus disease (EV). Since there are no vaccines or treatment available, it is essential, particularly for the healthcare providers in the hospitals are conversant with EVD to prevent this outraging disease. The absence of vaccines and treatment calls for higher priority in the prevention of this communicable disease. Assessing the level of knowledge, attitudes and concerns of healthcare providers about the EVD is important as they are more prone to different communicable diseases such as EVD.

This study reflects the findings of a similar study regarding high levels of concern about massive outbreaks of infectious diseases like swine influenza and corona virus [14,22] in which a large proportion of the population is expected to take more precautions. In this study, majority of participants said the MOH and hospital administrators should implement strict standard infection control protocols. Many related studies highlighted the value of standard infection control precautions to combat rising concerns of the Ebola outbreak, including the use of appropriate personal protective equipment (PPE) like gloves, gowns, goggles, masks and plexiglass shields [1,5,23–25]. Other precautionary measures stated in the literature include, the practice of proper infection control and sterilization measures; isolating patients with Ebola from other patients; avoiding direct contact with persons with EVD [1,6], and protected contact with the bodies of people who have died from Ebola. In addition, they believe health officials should be notified if an individual has had direct contact with the blood or body fluids, such as but not limited to, feces, saliva, urine, vomit, and semen of a person who is sick with Ebola [1,2]. The highest priority must be given to infection control measures and best practices [8]. Other related studies also support these findings: identification of high risk patients, and use of risk management strategy [26,27]; use of universal blood and body fluid precautions [26]; and safe provision of intensive treatment with specifications like airlock and negative pressured room, and wearing of intensive care unit (ICU) itemized PPE, including wearing of single-use impermeable gowns, hoods, face masks, goggles, two pairs of gloves and one with extended cuffs, and boots [5,25], will considerably decrease the spread of EVD among healthcare workers.

In order to mitigate the mortality rate, several steps should be taken to address the fear of the public at large and healthcare workers concerning EVD. Healthcare workers and clinicians must be prepared to attack misinformation, eradicate worry and safeguard themselves against the infectious agent and manage patients with EVD. In this study, majority of the participants strongly agreed the Saudi government must do more to conduct health education activities and raise awareness targeting relevant groups within the community, restrict travel to and from the areas of the disease to avoid its spread, isolate infected patients in special hospitals, disseminate case definitions in healthcare facilities, and train or retain staff in community based surveillance. Many related studies conducted following Ebola outbreak, also suggest a need to increase the awareness and public education by the government through the ministries of health. Healthcare administrators should be under control and resolve Ebola-related stigma best by increasing awareness and disseminating clear and accurate information about EVD transmission and prevention [3, 28, 29].

The study is limited in terms of that it cannot be generalized as it only involved nurses and physician and was done in one government hospital in KSA. However, it helps to develop recommendations that could be useful nationally and internationally in an effort to minimize the incidence and prevalence of EVD through identifying knowledge, practice and attitude gaps.

In conclusion, there were serious misconceptions about the mode of transmission of EVD among HCW

in this study. Also, there were significant number of healthcare workers who were not aware of the cause (25.3%), transmission (67.1%), unavailability of vaccine (18.5%), and the treatment (25%) of EVD. The MOH and health administrators need to place accurate information dissemination by trained healthcare personnel through health education activities and awareness. Hospitals in KSA may also develop EVD preparedness plans or training to all their healthcare workers. The risk of human-to-human transmission or spread of this infectious disease may be prevented through implementation of strict standard infection control precaution measures. Travel restrictions to and from the areas of EVD outbreak may also be implemented to prevent the transmission of EVD and this can also be achieved by providing special hospitals for infected patients. Fear, misinformation, misperceptions on EVD and the EVD outbreak itself resulted in a high level of concern among healthcare workers who were included in this study. The Saudi government through the MOH must incorporate inter/intra professional communication about EVD transmission, diagnosis, treatment, and prevention. This study could serve as baseline data for future researches and will provide information among healthcare administrators in formulating a health awareness campaign for EVD. The data collected in this survey could be used to fill the gap between the levels of knowledge of the healthcare professionals and monitor their perception and behavior in the event of a future outbreak.

References
1. Centers for Disease Control and Prevention (CDC). Ebola (Ebola Virus Disease) (2015). Available: http://www.cdc.gov/vhf/ebola/treatment/index.html. Accessed 12 September 2015.
2. World Health Organization (WHO) (2014) "2014: The year Ebola challenged humanity." Available: http://www.who.int/csr/disease/ebola/en/ Accessed: 12 September 2015.
3. Roberts I, Perner A (2014) Ebola virus disease: clinical care and patient-centered research. The Lancet 384: 2001-2002.
4. Lyon GM, Mehta AK, Varkey JB, Brantly K, Plyler L, McElroy AK, Kraft CS, Towner JS, Spiropoulou C, Ströher U, Uyeki TM, Ribner BS; Emory Serious Communicable Diseases Unit (2014) Clinical care of two patients with Ebola virus disease in the United States. N Engl J Med 371: 2402-2409.
5. West TE, von Saint André-von Arnim A (2014) Clinical presentation and management of severe Ebola virus disease. Ann Am Thorac Soc 11: 1341-1350.
6. Camacho A, Kucharski AJ, Funk S, Breman J, Piot P, Edmunds WJ (2014) Potential for large outbreaks of Ebola virus disease. Epidemics 9: 70-78.
7. Geisbert TW, Jahrling PB (2003) Towards a vaccine against Ebola virus. Expert review of vaccines 2: 777-789.
8. Yazdanpanah Y, Arribas JR, Malvy D (2015) Treatment of Ebola virus disease. Intensive Care Medicine 41: 115-117.
9. Pew Research Center. (2014) Ebola Worries Rise, But Most Are 'Fairly' Confident in Government, Hospitals to Deal with Disease 2014. Available: http://www.people-press.org/2014/10/21/ebola-worries-rise-but-most-are-fairly-confident-in-government-hospitals-to-deal-with-disease/ Accessed: 13 September 2015.
10. Global alert and response: novel coronavirus infections. Available: http://www.who.int/csr/don/archive/disease/coronavirus_infections/en/. Accessed 12 September 2015
11. Centers for Disease Control and Prevention (CDC) (2015). Ebola Virus Disease (EVD): Risk of Exposure. Available: http://www.cdc.gov/vhf/ebola/exposure/index.html Accessed 12 September 2015
12. Gostin LO, Lucey D, Phelan A (2014) The Ebola epidemic: A global health emergency. JAMA 312:1095-1096. doi:10.1001/jama.2014.11176.
13. Speroni KG, Seibert DJ, Mallinson RK (2015) Nurses' perceptions on Ebola Care in the United States, Part 2 A qualitative analysis. JONA, 45: 544-550.
14. World Health Organization (WHO). Ebola Virus Disease. Available: http://www.who.int/mediacentre/factsheets/fs103/en/ Accessed: 12 September 2015
15. Feistritzer NR, Hill C, Vanairsdale S, Gentry J (2014) Care of patients with Ebola virus disease. Journal of Continuing Education in Nursing 45: 479-481.
16. Balkhy HH, Abolfotouh MA, Al-Hathlool RH, Al-Jumah MA. (2010) Awareness, attitudes, and practices related to the swine influenza pandemic among the Saudi public. BMC Infectious Diseases 10: 42.
17. Brizendine KD (2014) Ebola virus: Questions, answers, and more questions. Cleveland Clinic Journal of Medicine 81: 729-735.

18. Fletcher TE, Fowler RA, Beeching NJ (2014) Understanding organ dysfunction in Ebola virus disease. Intensive Care Med. 40:1936-9.
19. Oestereich L, Lüdtke A, Wurr S, Rieger T, Muñoz-Fontela C, Günther S (2014) Successful treatment of advanced Ebola virus infection with T-705 (favipiravir) in a small animal model. Antiviral Research 105: 17-21.
20. Perner A, Fowler RA, Bellomo R, Roberts I (2015) Ebola care and research protocols. Intensive Care Med. 41: 111-114.
21. Patane, Salvatore. (2014) Ebola: Is there a hope from treatment with cardiovascular drugs? International Journal of Cardiology 177: 524-526.
22. Ministry of Health (MOH), Kingdom of Saudi Arabia (KSA). Update in Statistics: Ministry of Health Institutes New Standards for Reporting of MERS-CoV, 2014. http://www.moh.gov.sa/en/ CCC/News/Pages/News-2014-06-03-001.aspx Accessed on January 30, 2015.
23. Katz LM, Tobian, AAR (2014) Ebola virus disease, transmission risk to laboratory personnel, and pretransfusion testing. Transfusion 54: 3247-51.
24. Martin-Moreno JM, Llinás G, Martínez-Hernández J (2014) Response to "Maclntyre et al., 2014: Respiratory protection for healthcare workers treating Ebola virus disease (EVD): are facemasks sufficient to meet occupational health and safety obligations?" International Journal of Nursing Studies 51: 1693.
25. Pasquier P, Ficko C, Mérens A, Dubost C (2015) Preparing an ICU room to welcome a critically ill patient with Ebola virus disease. Intensive Care Med 41: 118-119.
26. Richards GA, Murphy S, Jobson R, Mer M, Zinman C, Taylor R, Swanepoel R, Duse A, Sharp G, De La Rey IC, Kassianides C (2000) Unexpected Ebola virus in a tertiary setting: clinical and epidemiologic aspects. Crit Care Med 28:240-4.
27. Parkes-Ratanshi R, Elbireer A, Mbambu B, Mayanja F, Coutinho A, Merry C (2014) Ebola Outbreak Response; Experience and Development of Screening Tools for Viral Haemorrhagic Fever (VHF) in a HIV Center of Excellence Near to VHF Epicentres. PLoS One. 9: e100333. doi: 10.1371/journal.pone.0100333.
28. Georges-Courbot MC, Leroy E, Zeller H (2012) "Ebola: a virus endemic to central Africa?" Medecine tropicale 62: 295-300.
29. Davtyan M, Brown B, Folayan MO. (2014) Addressing Ebola-related Stigma: Lessons Learned from HIV/AIDS. Global Health Action 7 (2014).

Corresponding author
Dr. Khalid M. Almutairi M.Sc., PhD
Associate Professor
Department of Community Health Sciences
College of Applied Medical Science
P.O. Box 10219 Riyadh, 11433 Saudi Arabia
Phone:+966 530619761
Email: Kalmutairim@ksu.edu.sa

Conflict of interests: No conflict of interests is declared.