

Preparedness against the Middle East Respiratory Syndrome Corona Virus (MERS-CoV) and the Effect of the Educational Booklet on the Vigilance of Taif University Students for Self-Care

Youssef H. A. M.¹, Khader K. A.², Hawsawi N. M..³, Mansour M. A.M⁴, Al-Shehri S. S. A.⁵, and Al- Mawajdeh N. A. A.⁶

¹Associate Professor of Medical-Surgical Nursing–College of Applied Medical Sciences-Taif University

dr_h_911@hotmail.com

²Assistant Professor of Adult Nursing, College of Applied Medical Sciences, Taif University
khaledkhader@yahoo.com

³Assistant Professor of Molecular Biology and Microbiology, College of Applied Medical Sciences, Taif University

nahedhawsawi@tu.edu.sa

⁴Professor of Medical-Surgical Nursing -Faculty of Nursing-Assiut University.

magda_albeah@hotmail.com

⁵Assistant Professor of Biochemistry, Dean of College of Applied Medical Sciences, Taif University

sa.alshehri@tu.edu.sa

⁶Lecturer of Adult Nursing, College of Applied Medical Sciences, Taif University

nabeelmawajdeh@yahoo.com

The Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is a serious and emerging issue in Saudi Arabia since it was first identified in September 2012. We now stand at the precipice of health care transformation where disease prevention and health promotion in people, animals, and our environment have become a critical strategic need. Health education for the community especially highly educated group about Infection prevention and control is a key element in prevention and control of disease outbreak. **Objectives:** Assess the preparedness for self-care against (MERS-CoV) among Taif University students and the effectiveness of the educational booklet on triggering a vigilance for their Self-Care. **Methods:** A quasi-experimental research design (the pre-post intervention) was conducted to assess the level of knowledge, practice and attitude for 930 university students from medical and non-medical education fields 3 months before and after distribution of educational booklet for self-care against MERS-CoV infections during the year 2017. **Results:** There was a satisfactory significance change in the students' level of knowledge, preventive practice measures and attitude that they become well prepared and have the vigilance for self-care against MERS-CoV infections. **Conclusion & Recommendations:** Guidance booklet was successful in achieving significant improvement in students' self-care vigilance against MERS-CoV which was reflected in improvement of their knowledge and changing their attitude. Continued education and further research study should be open to all community especially nurses according to their needs to increase their awareness about disease prevention. The psychological and social factors should be considered as important factors for full recovery.

Key words: MERS-CoV, Corona virus, Self-Care vigilance, Health Education

فيروس كورونا المسبب لمتلازمة الشرق الأوسط التنفسية هو قضية خطيرة وناشئة في المملكة العربية السعودية منذ أن تم تحديدها لأول مرة في سبتمبر ٢٠١٢. ونحن الآن نقف على شفا التحول في الرعاية الصحية حيث الوقاية من الأمراض وتعزيز صحة البيئة والبشر والحيوانات أصبحت بحاجة لاستراتيجية حاسمة. ويعد التثقيف الصحي للمجتمع وخاصة فئة طلاب الجامعة من السكان حول الوقاية من العدوى ومكافحتها، عنصرا رئيسيا في الوقاية من تفشي الأمراض ومكافحتها. **الأهداف:** تقييم التأهب للرعاية الذاتية ضد فيروس متلازمة الشرق الأوسط التنفسية - كورونا بين طلاب جامعة الطائف وفعالية الكتيب التعليمي على إثارة اليقظة لرعايتهم الذاتية. **الطريقة:** أجريت دراسة شبه تجريبية لتقييم مستوى المعرفة والممارسة والإتجاهات عند ٩٣٠ طالب/ة جامعي/ة بشقيه الطبي والغير طبي قبل ٣ أشهر من توزيع الكتيب التعليمي للعناية الذاتية ضد عدوى فيروس كورونا المسبب لمتلازمة الشرق الأوسط التنفسية وبعده خلال العام ٢٠١٧. **النتائج:** كان هناك تغيير واضح في مستوى المعرفة لدى الطلبة، وتدابير الممارسة الوقائية، واليقظة في

الرعاية الذاتية ضد عدوى فيروس كورونا المسبب لمتلازمة الشرق الأوسط التنفسية. الخاتمة والتوصيات: نجح الكتيب الإرشادي في تحقيق تحسن كبير في اليقظة الذاتية للرعاية الذاتية لدى الطلاب ضد فيروس كورونا المسبب لمتلازمة الشرق الأوسط التنفسية والتي انعكست في تحسين معرفتهم وتغيير موقفهم ويجب أن يكون التعليم المستمر متاحاً لكافة المجتمع ومقدمي الرعاية الصحية وخاصة الممرضين/ات وفقاً لاحتياجاتهم لزيادة الوعي حول الوقاية من المرض. وينبغي اعتبار العوامل النفسية والاجتماعية لمن لديه خبرة مع المرض عوامل هامة للشفاء التام. الكلمات المفتاحية: فيروس كورونا المسبب لمتلازمة الشرق الأوسط التنفسية، اليقظة للرعاية الذاتية، التثقيف الصحي.

Introduction

Emerging Infectious Diseases (EIDs) are infectious diseases ‘whose incidence in humans has increased in the past two decades or threatens to increase in the near future [1] EIDs may cause localized epidemics, or become pandemics if given the correct environmental factors, causing significant suffering and deaths worldwide. From 1940 to 2004, 335 EID events are thought to have emerged, of which 60% have been from animal reservoirs [2]. The first decade of the 21st century has witnessed an increase in the number of coronaviruses that have been identified, along with a corresponding increase in the number of coronavirus genomes that have been sequenced. Such increases were due to the discovery of the severe acute respiratory syndrome coronavirus (SARS-CoV), which resulted in a global outbreak of pneumonia in 2003 that affected persons in approximately 30 countries and resulted in about 800 deaths [3, 4]. Middle East Respiratory syndrome coronavirus (MERS-CoV) has seen an increase in incidence since May 2015 with the Republic of Korea investigating the largest known outbreak outside the Arabian Peninsula, including 182 confirmed cases and 33 deaths [5]. MERS-CoV is a newly recognized respiratory pathogen first identified in a patient from Saudi Arabia in June 2012 and causes acute respiratory disease that has a high case-fatality rate [6]. All cases have been linked to countries in or near the Arabian Peninsula; more than 85% of cases have been reported from Saudi Arabia. Outbreaks of MERS-CoV have been associated primarily with transmission in healthcare settings [7]. The Command and Control Center, Ministry of Health, Saudi Arabia provides the Ministry of Health the ability and capacity to monitor developing health concerns across the Kingdom in real time and ensures that health challenges are managed with a systematic, holistic and comprehensive approach. They give updated report about MERS-CoV cases on the kingdom around the clock, the following 1282 cases were notified from starting the outbreak till now, above half of them were recovered (56.7%), 43% were dead, while 3% still active [8] Since it was first identified in Saudi Arabia in September 2012, more than 1000 MERS-CoV cases have been detected in over 20 countries. In Europe, seven countries have reported confirmed cases, all with direct or indirect connection with the Middle East. The clinical presentation of MERS-CoV infection ranges from asymptomatic to very severe pneumonia with acute respiratory distress syndrome, septic shock and multi-organ failure resulting in death. Nosocomial transmission has been a hallmark of MERS and the majority of cases have been reported from hospital outbreaks in Saudi Arabia and United Arab Emirates [5, 9]. MERS-CoV cases were first reported from Taif Governorate (population 1.1 million) in the Makkah Region of Saudi Arabia in June 2013, and 15 cases were reported during June 2013–June 2014. Beginning in September 2014, additional cases of MERS were reported from multiple healthcare facilities in Taif, including a cluster associated with a dialysis unit [10]. One of the most important changes is the increased human demand for meat and animal products and consequent increase in animal husbandry, which is thought to be one significant cause of the increased emergence of novel influenza virus strains in Asia [11]. Recently, several publications reported detection of high loads of MERS-CoV nucleic acid in nasal swabs from dromedary camels using RT-PCR and recovery of live virus through culture with high seroprevalance of MERS-like CoV in dromedary camels but not in other domestic animals has also been reported frequently. Therefore, history of contact with

camels in the 14 days before the onset of illness is an important epidemiological clue to suspect MERS-CoV infection. Such contact may be either direct i.e. the patient had the history of contact with camels, or indirect, i.e. the patient had contact with another healthy person who had the history of contact with camels [12].

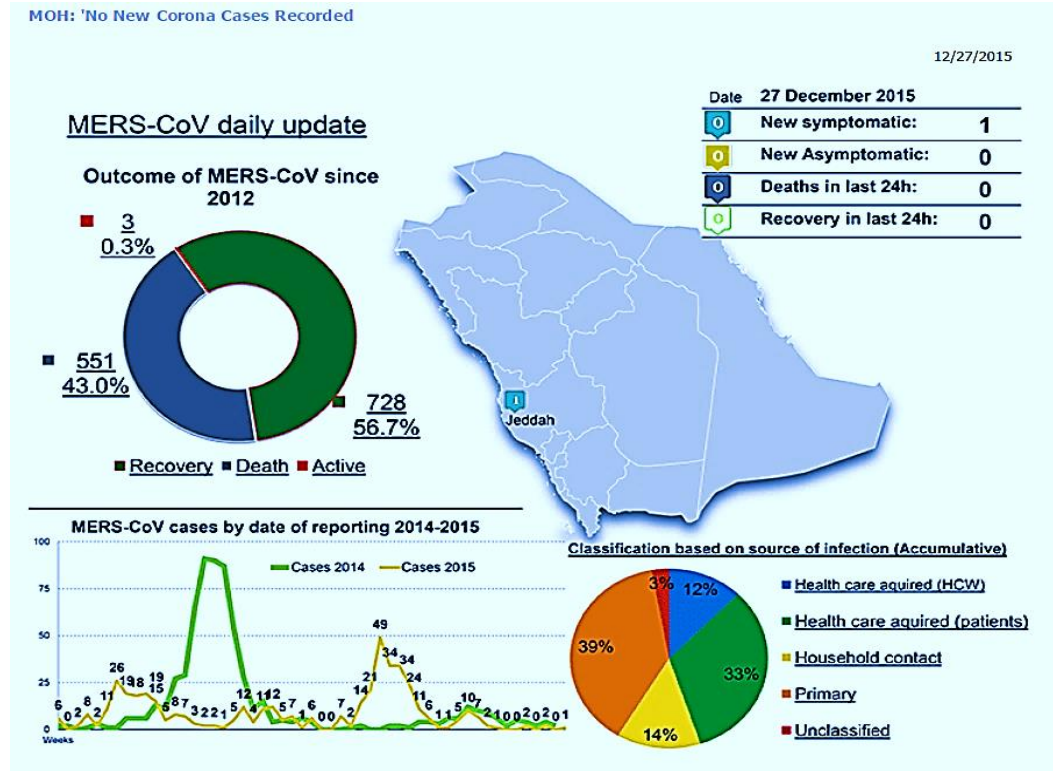


Figure (1) represents the last statistics for the disease.

So, it was confirmed that dromedary camels are primary sources of human infection. Additionally, Human-to-human transmission has also been well documented and account for the vast majority of cases [13]. In contrast with this, the findings of Gierer et. al., (2013) who used a lentiviral vector bearing the viral spike protein to detect neutralizing antibodies against MERS-CoV in persons from the Eastern Province of Saudi Arabia, showed none of their 268 samples tested displayed neutralizing activity, which suggests that MERS-CoV infections in humans are infrequent in Eastern Province, Saudi Arabia [13]. And that was in congruence with previous study of Zaki et. al., (2012) who was emphasized that although most infections with human coronaviruses are mild and associated with common colds, certain animal and human coronaviruses may cause severe and sometimes fatal infections in humans. Although Human Coronavirus Erasmus Medical Center (HCoV-EMC) does not have many of the worrisome characteristics of SARS-CoV, we should take notice of the valuable lessons learned during the 2003 SARS outbreak with respect to outbreak investigations and management [4]. The challenges and obligations of health professionals have never been tested as we are today to truly reestablish our social responsibility. We now stand at the precipice of health care transformation where disease prevention and health promotion in people, animals, and our environment have become a critical strategic need. The strategy to better understanding and addressing the contemporary health issues created by the convergence of human, animal, and environmental domains is the concept of One Health [15].

Countries, whether MERS cases have been reported in them or not, should maintain a high level of vigilance, especially those with large numbers of travelers or migrant workers on the Middle East. Surveillance should continue to be enhanced in these countries according to WHO guidelines, along with infection prevention and control procedures in health-care facilities. World Health Organization continues to request that Member States report to WHO all confirmed and probable cases of infection with MERS-CoV together with information about their exposure, testing, and clinical course to inform the most effective international preparedness and response [16]. Responding quickly to an epidemic is important to facilitate disease control and to protect students, staff and the community from fear and disruption of work. While there was some awareness and concern about the MERS-CoV, unified activities were limited until the rate of diagnosis and death from the virus began to be regularly reported in the media (Table 1). The WHO guidance states that infection prevention and control measures are critical to prevent the possible spread of MERS-CoV in health care facilities. Advice given by the Ministry of Health, Kingdom of Saudi Arabia includes that people should avoid close contact with animals when visiting farms (especially barn areas) where the virus is known to be potentially circulating. This is difficult as camels and farms are an integral part of the Saudi culture [17]. A response was required to reduce possible disease transmission between the hospital and university. In Taif university many educational sessions were conducted as an orientation about the diseases, but no one committed to the scientific methods to be sure that self-care against this serious disease was fulfilled.

Objectives:

- 1- Assessment of the preparedness for Self-Care against (MERS-CoV) among Taif University students.
- 2- Assessment for the effectiveness of infection control and prevention measures in the educational booklet on Triggering a Vigilance of Taif University Students for Self-Care against (MERS-CoV).

Research Questions:

- 1- Are Taif University students prepared for self-care against catching (MERS-CoV) infection?
- 2- What is the knowledge of Taif University students about prevention of (MERS-CoV) infection?
- 3- What is the attitude of Taif University students toward prevention (MERS-CoV) infection?
- 4- Are there any differences between the knowledge and attitude of Taif University Students before and after taking the educational booklet about Self-Care against (MERS-CoV) infection?

Subject and Methods:**Research design**

A quasi-experimental research design (the pre-post intervention) was implemented to assess the Preparedness for Self-Care against (MERS-CoV) among Taif University Students before giving the educational booklet and post-submission of the booklet within 3 months. Also, assessment was done for examining the effectiveness of infection control and prevention measures in the educational booklet on the knowledge, preventive practice measures and attitude of Taif University Students for Self-Care against (MERS-CoV).

Sample

A sample of 930 students, male & female students who are studying in the Taif University was selected randomly at different educational level, from medical (represented by College of applied medical sciences in which four departments were included, Nursing, Physiotherapy, Radiological and Laboratory Sciences Departments) and non-medical

faculties (College of Admins and Financial Sciences in which 6 departments were included, Accounting, Business Administration, Investment and Finance, Marketing, Management Information Systems and Project Management and Economics).

Inclusion Criteria:

- Students who are willing to participate in this study.

Exclusion Criteria:

- Students who attend previously official certified educational program about infection control and prevention measures against (MERS-CoV) infection.

Instrumentation

1- A self-administered questionnaire was created in Arabic after a thorough search in the literature based on the most recent available information from the World Health Organization, Centers for Disease Control and prevention and Saudi' Ministry of Health websites. The initial draft was sent to a group of experts chosen according to their experience and expertise in the related fields to reflect on questions in terms of relevance, simplicity and importance. Pilot study was carried out using 85 of the expected sample of the main study sample to evaluate the questionnaire and check on whether the length and structure of questions are problematic. The validity and reliability of the questionnaire was also checked at the pilot study stage, and the time needed to apply scale and fulfill sheet was estimated. The questionnaire was finalized after a series of group discussion. The data obtained by pilot study was removed from final analysis because there is a modification in the questionnaire based on pilot results. The questionnaire was divided into 4 parts; **Part I:** Socio-demographic data of students included (age, gender, marital status, education fields and resident's city). **Part II:** Identifies respondents' source of knowledge and measure their level of knowledge regarding infection control measures against MERS-CoV infection. To measure the level of knowledge, different types of questions were used, the rubric system for scoring the answers was dichotomized to good knowledge (score ≥ 50) or poor knowledge (score < 50) **Part III:** Students' participants preventive practices against MERS-CoV infections as, Frequencies hand washing for 20 second with soap and water, Use tissue paper during sneezing and cough, Use of upper arm instead of tissue, etc., to measure the level of practice, description of measures were mentioned and participants gave feedback about their application to it, the rubric system for scoring the answers was dichotomized to satisfaction (score ≥ 50) or un-satisfaction (score < 50). **Part IV:** was to determine students' attitude towards prevention of MERS-CoV infection. Questions of attitude was measured by 3 points Likert scale of agreement (agree, neutral or disagree) with overall attitude scores was dichotomized to positive attitude (score ≥ 50) and negative attitude (score < 50). **Part V:** 2 questions were added to the questionnaire that was distributed 3 months after introducing of educational booklet to participants to evaluate their vigilance for self-care preparedness against MERS CoV infection.

2- An information booklet was developed pertaining to the general concepts of infection control against airborne MERS-CoV. Conceptual framework of the study was adopted from the Daniel Stufflebeam's CIPP(Context –Input –Process –Product evaluation) model 2003. [18]

Data collection Procedure

After obtaining approval from the institutional review board (IRB) at Al-Taif University and the selected colleges, the participants who meet inclusion criteria were identified. Then, the researchers explain the purpose of the study and distributed the questionnaires to all students participated in the study who sign the informed consent. Students completed the questionnaire while the class instructor was outside the teaching room to ensure that they completed the questionnaire unaided and to ensure confidentiality. After all questionnaires being filled by each participant, all data were installed into computer for data analysis by

utilizing SPSS program. Every participant received a copy of educational booklet through their emails and on the web site of their teachers' Black board. After 3 months, the students completed the same questionnaire again for assessing its' effect on their knowledge and attitude.

Ethics and Human Rights

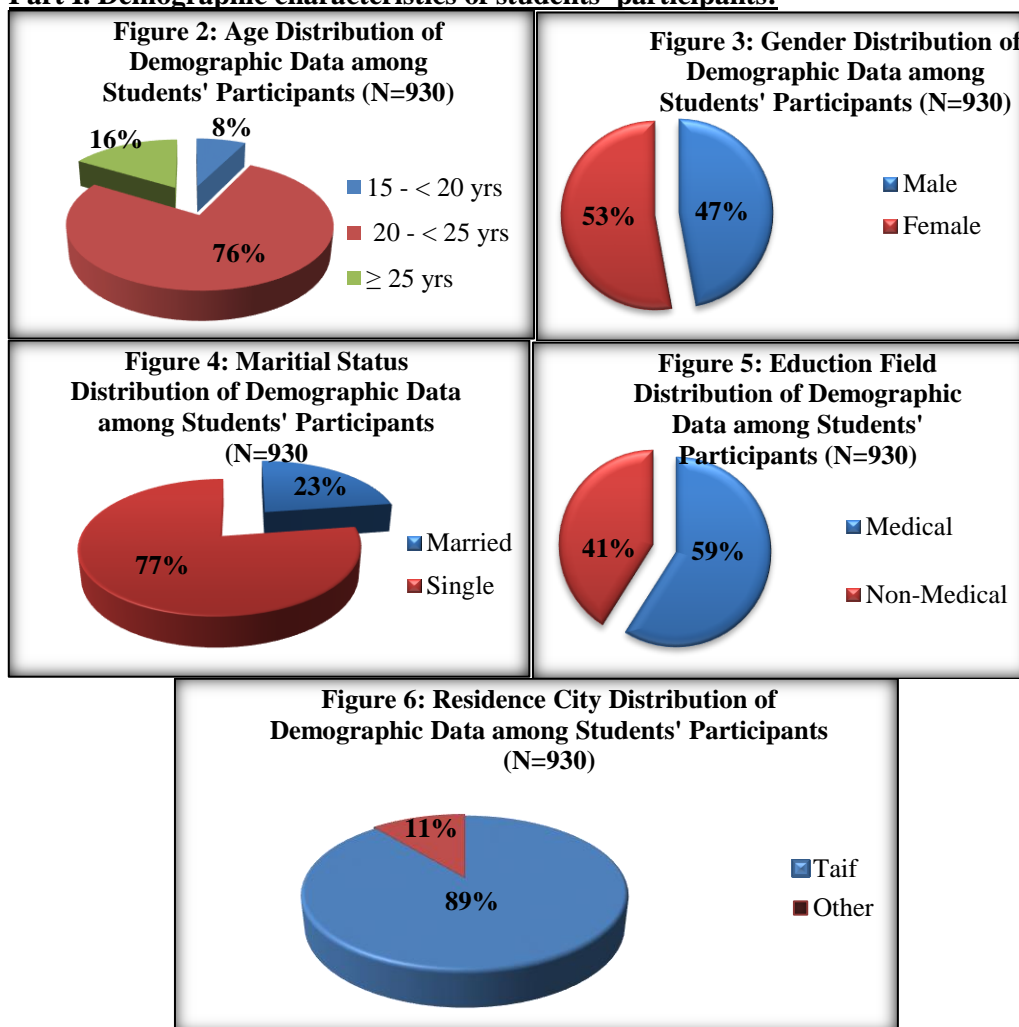
An informed consent was obtained from all the participants before collecting any data. The study aims were explained in a simple and clear manner to each participant. All data were kept securely and considered confidential. Participants were informed about their right to withdraw from the study at any time without giving any reason.

Statistical Analysis

After all questionnaires being filled by each participant, all data were coded and entered into personal computer for data analysis by utilizing SPSS Program as a first stage of the research (Pre-intervention). Descriptive statistics were used for analyzing the quantitative data of the students' participants 3 months after completing the post-intervention phase of the research.

Results:

Part I. Demographic characteristics of students 'participants:



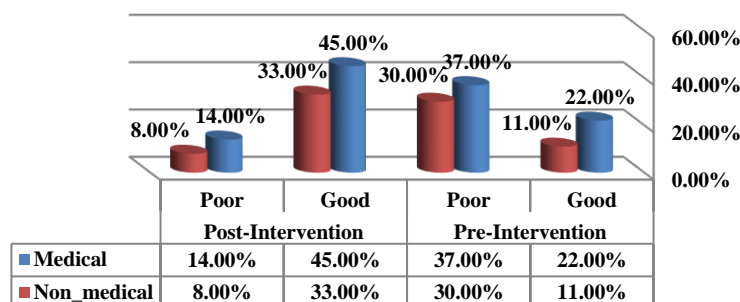
Part II. Students' participants knowledge:**Table 1: Essential knowledge about MERS-CoV among students' participants in three months pre/post distribution educational booklet (intervention) (N=930)**

Knowledge Items	Pre- intervention		Post- intervention		P. value
	N	%	N	%	
Hearing about MERS-CoV					
Yes	539	58%	877	94.3%	0.0000
No	391	42%	53	5.7%	
Causative agent for MERS-CoV					
Virus	481	51.7%	767	82.5%	0.000
Bacteria	331	35.6%	70	7.5%	
Amebia	68	5.2%	31	3.3%	
Don't Know	70	7.5%	62	6.7%	
Infection in Saudi Arabia					
Yes	830	89.2%	834	89.7%	0.94
No	28	3.0%	26	2.8%	
Don't Know	72	7.7%	70	7.5%	
There is a Treatment for MERS-CoV					
Yes	530	57%	210	22.6%	0.000
No	128	13.8%	720	77.4%	
Don't Know	272	29.2%	0	0%	
There is a Vaccine against MERS-CoV					
Yes	726	78.1%	58	6.2%	0.000
No	128	14.2%	820	88.2%	
Don't Know	72	7.7%	52	5.6%	
Transmission of Infection from Camels:					
Yes	636	68.4%	706	75.9%	0.001
No	101	10.9%	83	8.9%	
Don't know	193	20.8%	141	15.2%	
Transmission of Infection from the Infected Bat:					
Yes	217	23.3%	275	29.6%	0.008
No	294	31.6%	282	30.3%	
Don't know	419	45.1%	373	40.1%	
Droplet from the Patient during Sneezing or Coughing					
Yes	824	88.6%	843	90.6%	0.15
No	28	3.0%	25	2.7%	
Don't know	78	8.4%	62	6.7%	
Direct Contact with Infected Patients:					
Yes	831	89.4%	849	91.3%	0.17
No	27	2.9%	23	2.5%	
Don't know	72	7.7%	58	6.2%	
Touch Contaminated Surfaces and Tools:					
Yes	695	74.7%	742	79.8%	0.000
No	92	9.9%	77	8.3%	
Don't know	143	15.4%	111	11.9%	

Table 2: Essential knowledge about MERS-CoV among students' participants in three months pre/post distribution educational booklet (intervention) (N=930)

Knowledge Items	Pre- intervention		Post- intervention		P. value
	N	%	N	%	
Sever elevation in body temperature					
Yes	843	90.6%	861	92.6%	0.14
No	8	0.9%	7	0.8%	
Don't know	79	8.5%	62	6.7%	
Cough					
Yes	798	85.8%	832	89.5%	0.02
No	31	3.3%	25	2.7%	
Don't know	101	10.9%	73	7.8%	
Headache					
Yes	631	67.8%	753	81.0%	0.00**
No	65	7.0%	38	4.1%	
Don't know	234	25.2%	139	14.9%	
Shortness of breath					
Yes	760	81.7%	798	85.8%	0.05*
No	35	3.8%	29	3.1%	
Don't know	135	14.5%	103	11.1%	
Sore throat					
Yes	589	63.3%	645	69.4%	0.01*
No	96	10.3%	87	9.4%	
Don't know	245	26.3%	198	21.3%	
Congestion and running nose					
Yes	616	66.2%	661	71.1%	0.04
No	93	10.0%	87	9.4%	
Don't know	221	23.8%	182	19.6%	
Nausea and Vomiting					
Yes	541	58.2%	607	65.3%	0.01*
No	93	10.0%	77	8.3%	
Don't know	296	31.8%	246	26.5%	
Diarrhea					
Yes	524	56.3%	620	66.7%	0.00**
No	96	10.3%	37	4.0%	
Don't know	310	33.3%	273	29.4%	

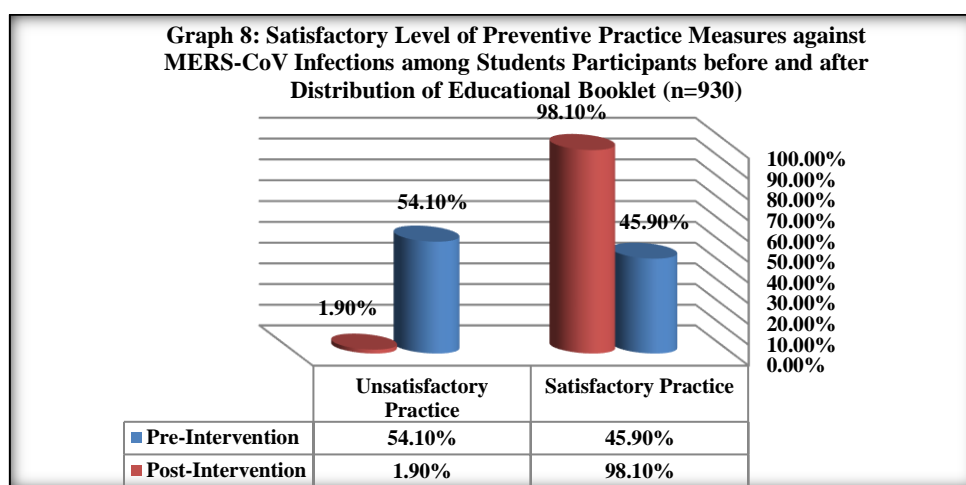
Graph 7: Correlation between Essential knowledge about MERS-CoV and education field of students' participants in 3 months pre- and post-distribution of educational Booklet (N=930)



Part III. Students' participants preventive practices against MERS-CoV infections:

Table 3: Practice Measures of Students' Participants Three Months Pre/Post Intervention for Self-care Against MERS-CoV Infection (N=930)

Practice Measures	Pre-intervention		Post-intervention		P:value
	N	%	N	%	
Frequencies hand washing for 20 second with soap and water					
Yes	778	83.7%	930	100.0%	0.00**
No	152	16.4%	0	0.0%	
Use tissue paper during sneezing and cough					
Yes	879	94.5%	930	100.0%	0.00**
No	50	5.4%	0	0.0%	
Use of upper arm instead of tissue					
Yes	95	10.2%	200	21.5%	0.00**
No	835	89.7%	730	78.5%	
Avoid direct contact with infected persons					
Yes	765	82.3%	930	100.0%	0.00**
No	165	17.7%	0	0.0%	
Face mask usage which recommended by ministry of health					
Yes	840	90.3%	930	100.0%	0.00**
No	90	9.6%	0	0.0%	
Avoid direct contact with animals without cautions					
Yes	501	53.9%	930	100.0%	0.00**
No	429	46.4%	0	0.0%	
Avoid direct contact with camels without cautions					
Yes	623	67.0%	930	100.0%	0.00**
No	307	33.0%	0	0.0%	
Avoid drinking camels' milk without boiling					
Yes	649	69.8%	930	100.0%	0.00**
No	218	30.2%	0	0.0%	
Avoid eating Camels' meat					
Yes	715	76.9%	930	100.0%	0.00**
No	218	23.1%	0	0.0%	
Keep distance not less than 2 meters between you and crowded populations					
Yes	774	83.2%	930	100.0%	0.00**
No	156	16.8%	0	0.0%	



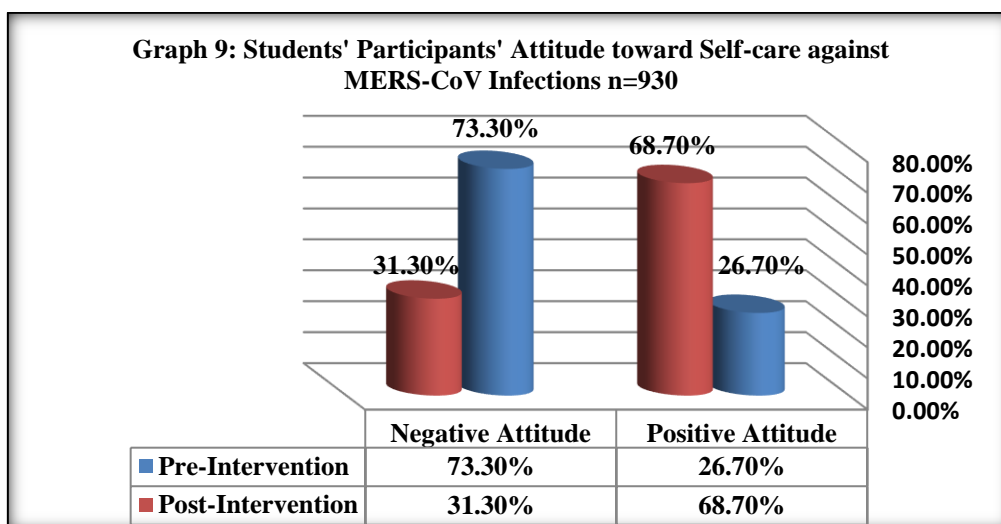
Part IV. Students' participants attitude toward self-care against MERS-CoV infections:

Table 4: Comparison between Pre/Post-Intervention Students' Participants Attitude toward Dealing with Infected Patients with MERS-CoV Infections (N=930)

Variables	Pre-intervention		Post-intervention		P. value
	N	%	N	%	
Disease is not serious.					
Agree	133	14.3%	159	17.1%	0.00**
Neutral	266	28.6%	191	20.5%	
Disagree	531	57.1%	580	62.4%	
Following preventive means reduce the likelihood of getting the disease.					
Agree	822	88.4%	851	91.5%	0.03*
Neutral	85	9.1%	68	7.3%	
Disagree	23	2.5%	11	1.2%	
I can identify the conditions that help in the possibility of infection.					
Agree	32	3.4%	636	68.4%	0.00**
Neutral	355	38.2%	285	30.6%	
Disagree	543	58.4%	9	1.0%	
I am keen on learning more about the disease and how to prevent it.					
Agree	795	85.5%	842	90.5%	0.00**
Neutral	90	9.7%	80	8.6%	
Disagree	43	4.6%	10	1.1%	
Need to deal with the disease according to medical guidance for healing and non-transfer to others.					
Agree	835	89.8%	862	92.7%	0.03*
Neutral	61	6.6%	51	5.5%	
Disagree	34	3.7%	17	1.8%	
No hesitation from get direct contact with infected person when needed.					
Agree	299	32.2%	395	42.5%	0.001**
Neutral	273	29.4%	204	21.9%	
Disagree	358	38.5%	331	35.6%	
I will take the vaccination if there is any possibility of infection.					
Agree	289	31.1%	351	37.7%	0.00**
Neutral	220	23.7%	159	17.1%	
Disagree	421	45.3%	420	45.2%	
The information available from the responsible authorities is sufficient (Ministry of Health, Information, etc.,).					
Agree	430	46.2%	596	64.1%	0.00**
Neutral	330	35.5%	250	26.9%	
Disagree	170	18.3%	84	9.0%	
Actions taken against the disease were sufficient.					
Agree	361	38.8%	454	48.8%	0.00**
Neutral	399	42.9%	371	39.9%	
Disagree	170	18.3%	105	11.3%	
The continuity of preventive measures against the disease are sufficient.					
Agree	420	45.2%	564	60.6%	0.00**
Neutral	347	37.3%	273	29.4%	
Disagree	163	17.5%	93	10.0%	
There was a disturbance in my life because of the emergence of this disease.					
Agree	309	33.2%	160	17.2%	0.00**
Neutral	257	27.6%	211	22.7%	
Disagree	364	39.1%	559	60.1%	
Frequent visiting the patient helps him recover quickly.					
Agree	454	48.8%	250	26.9%	0.00**
Neutral	298	32.0%	215	23.1%	
Disagree	178	19.1%	465	50.0%	
The use of herbs is safer than vaccinations.					
Agree	449	48.3%	63	6.8%	0.00**
Neutral	309	33.2%	0	0.0%	
Disagree	172	18.5%	867	93.2%	

Table 5: Relationship between post-intervention students' participants attitude and their demographic characteristics (N=930)

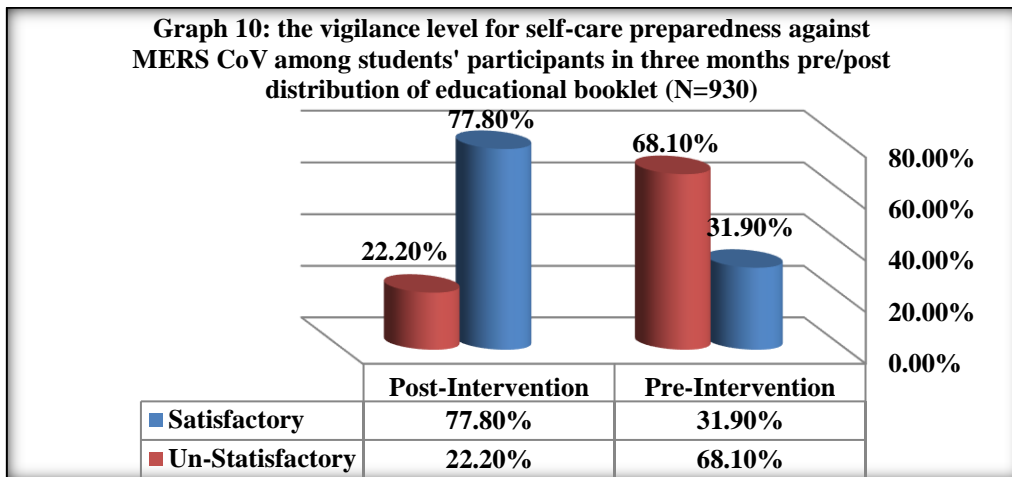
Demographic Characteristics	Total No.	Pre-Intervention		Post-Intervention		P. value
		N	%	N	%	
Age group						
15 - < 20 yrs	69	18	26.1%	51	73.9%	0.001*
20 - < 25 yrs	709	191	26.9%	518	73.1%	
≥ 25 yrs	152	39	25.7%	113	74.3%	
Gender						
Male	438	101	23%	337	77%	0.01*
Female	492	147	29.9%	345	70.1%	
Social Status						
Married	211	52	24.6%	159	75.4%	0.001*
Single	719	196	27.3%	523	72.7%	
Education Field						
Medical	552	152	27.5%	400	72.5%	0.001*
Non-Medical	378	96	25.4%	282	74.6%	



Part V. Vigilance for Self-care:

Table 6: Knowledge, attitude and practice among students' participants 3 months pre/post-intervention that reflect vigilance level for self-care preparedness against MERS CoV (n=930)

Variables	Pre-intervention		Post-intervention		P. value
	N	%	N	%	
Knowledge.					
Good	307	33%	725	78%	0.03*
Poor	623	67.0%	205	22%	
Attitude.					
Positive	248	26.7%	639	68.7%	0.00**
Negative	682	73.3%	291	26.7%	
Practice.					
Satisfactory	427	45.9%	912	98.1%	0.000**
Unsatisfactory	503	54.1%	18	1.9%	



Part I. Demographic characteristics of students 'participants:

930 students from Taif University were included in the current study and recruited from medical education (nursing, Physiotherapy, radiological and laboratory sciences Departments in college of applied Medical sciences), while Non-Medical education (Accounting, Business Administration, Investment and Finance, Marketing, Management Information Systems and Project Management and Economics Departments in College of Admins and Financial Sciences) in (Figures 2-6) most of students (76%) were of age ranged from 20 - < 25 years and more than half of sample were female, single, and in medical education field (53%, 77%, & 59 % respectively). Regarding to residence, the majority (89%) of students live in Taif.

Part II. Students 'participants knowledge:

There were highly significant differences between pre/post-intervention among students' participants regarding all essential knowledge about MERS-CoV infections, except infection in Saudi Arabia (p=0.94) all they were oriented about the disease presence in the kingdom. Also, there were significant differences between Pre/Post intervention among students' participants regarding transmission of infection from camels, transmission of infection from infected bat and touching contaminated surfaces and tools (p value: 0.001, 0.008, & 0.000 respectively) except in their knowledge regarding transmission of infection by droplet from the Patient during Sneezing or Coughing and Direct Contact with Infected Patients (0.15 and 0.17 respectively) Table (1).

Table (2) showed that; there was significant difference between pre/post-intervention among students' participants regarding all clinical manifestations for MERS-CoV infections, except sever elevation in body temperature (p=0.14). Qui square (X²) test used for these comparisons, ** Statistically significant difference (p=0.01)

Graph (Y) illustrated that; there was observable differences between the level of knowledge satisfaction before and after distribution of booklet about self-care against MERS CoV between medical and non-medical students' participants and the results was higher in medical education students than non-medical especially in post-intervention time (45% and 33% respectively).

Part III. Students' participants preventive practices against MERS-CoV infections:

Table (3): illustrated that; there were highly significant differences between pre/post-intervention among students' participants regarding practice measures for self-care against MERS-CoV infection, (p=0.00)

Graph (A) clarified that; majority of students' participants (98.1%) are becoming satisfied with their preventive practice measures against MERS-CoV Infections three months after distribution of educational booklets.

Part IV. Students' participants attitude toward self-care against MERS-CoV infections:

There were significant differences between pre/post-intervention among students' participants regarding their attitudes toward dealing with infected patients with MERS-CoV infections, and there was decrease in their life disturbance due to fear from the infection (p=0.00) Table (4)

Graph 9: Illustrated that; there was highly significant difference between attitude Pre/Post intervention. Positive attitude among students' participants were increased from 26.7% pre-intervention to 68.7% post-intervention.

Table (5): illustrated that; there were significant differences between pre/post-intervention students' participants attitude and their demographic characteristics while no impact of their education field on their attitude (p<0.00)

Part V. Vigilance for Self-care:

In the current study which aimed to examine the knowledge, Preventive measures and Attitude (KAP) three months pre/post distribution of educational booklet, table (6) clarified that there were significance differences among all parameters for self-care against MERS CoV infection among students' participants. Also, Graph (10) illustrated that; there was an observable difference in the vigilance level for self-care preparedness against MERS CoV infection in three months pre/post intervention.

Discussion:

At the end of May 2017, a total of 1980 laboratory-confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV), including 720 deaths (case-fatality rate: 36.4%) were reported globally; the majority of these cases were reported from Saudi Arabia (1613 laboratory-confirmed cases, including 646 deaths with a case-fatality rate of 40.1%).

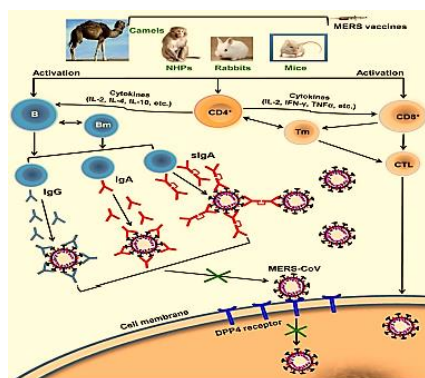
MERS-CoV case reported between 27 September and 31 October 2017*

Please note, data corresponds to Disease Outbreak News as published on 01/11/17
 *Data subject to change due to ongoing investigations. Fields related to the final status of the case are updated as information is available.
 NA = Not available

Case no.	Date of notification to WHO (yyyy/mm/dd)	Reporting country	City of residence	Age	Sex	Health care worker	Comorbidities	Exposure to camels	Camel milk consumption	Exposure to MERS-CoV cases	Date of symptoms onset (yyyy/mm/dd)	Date of first hospitalization (yyyy/mm/dd)	Date of laboratory confirmation (yyyy/mm/dd)	Status	Date of outcome (yyyy/mm/dd)	Last updated
1	2017-09-27	Saudi Arabia	Buraidah	76	M	No	Yes	NA	NA	NA	2017-09-21	2017-09-24	2017-09-26	Alive		2017-12-01
2	2017-09-30	Saudi Arabia	Bisha	31	M	No	Yes	Yes	Yes	NA	2017-09-23	2017-09-28	2017-09-29	Alive		2017-12-01
3	2017-10-03	Saudi Arabia	Tabuk	72	M	No	Yes	Yes	Yes	NA	2017-09-27	2017-09-30	2017-10-02	Deceased	2017-10-09	2017-12-01
4	2017-10-09	Saudi Arabia	Buraidah	77	M	No	Yes	Yes	Yes	NA	2017-09-28	2017-10-06	2017-10-08	Deceased	2017-10-17	2017-12-01
5	2017-10-11	Saudi Arabia	Riyadh	58	M	No	Yes	NA	NA	NA	2017-10-05	2017-10-09	2017-10-10	Alive		2017-12-01
6	2017-10-13	Saudi Arabia	Riyadh	60	M	No	Yes	Yes	Yes	NA	2017-10-06	2017-10-11	2017-10-12	Alive		2017-12-01
7	2017-10-15	Saudi Arabia	Riyadh	25	M	No	No	Yes	Yes	NA	2017-10-12	2017-10-14	2017-10-15	Alive		2017-12-01
8	2017-10-24	Saudi Arabia	Riyadh	77	M	No	Yes	Yes	Yes	NA	2017-10-18	2017-10-22	2017-10-23	Alive		2017-12-01
9	2017-10-26	Saudi Arabia	Tabuk	56	M	No	Yes	Yes	Yes	NA	2017-10-21	2017-10-23	2017-10-25	Alive		2017-12-01
10	2017-10-27	Saudi Arabia	Hufuf	36	M	No	Yes	NA	NA	NA	2017-10-22	2017-10-24	2017-10-25	Alive		2017-12-01
11	2017-10-29	Saudi Arabia	Taif	59	M	No	Yes	Yes	Yes	NA	2017-10-21	2017-10-27	2017-10-29	Alive		2017-12-01
12	2017-10-30	Saudi Arabia	Taif	76	F	No	Yes	Yes	No	NA	2017-10-27	2017-10-29	2017-10-30	Alive		2017-12-01

Table (7): represents updated report about MERS-CoV in different area in Saudi Kingdom. [19] It has been identified both nationally and internationally that education should be a part of any overall strategy for infection prevention and control (IP&C) [20] and this study was aimed to assess the preparedness for Self-Care against (MERS-CoV) among Taif University students with the effectiveness of infection control and effect of preventive measures in the educational booklet on triggering a vigilance of Taif university students for self-care against (MERS-CoV). Interventions caused a significant increase in the mean scores of knowledge, attitude, and behavior of students' participants. Regarding the difference between knowledge of students' participants before distribution of educational booklet for self-care against (MERS-CoV) and after, it was found that only half of the sample were hearing about the disease, while majority becomes more informed in post-intervention time and that is in the contradicting with finding of AL-Dowyan,

Ahmed and El-Gharabawy (2017) who reported that on comparing the knowledge about MERS-CoV, for participants from different regions in Saudi Arabia the participants from Makkah region showed significantly more awareness than other regions (96%, $p \leq 0.01$) and this could be explained by that we are part of Makkah governorate, but we are not included in the responsibility of Hajj, where all information provided to all Makkah territory population to be vigilance about self-care. It is also congruent with our results that all the students' participants were oriented about the disease presence in the kingdom and prior studies demonstrated a high level of awareness in the general Saudi population as well as in dental students that was consistent with the results of the present study [21 & 22]. Regarding the knowledge that there is a vaccination and treatment for MERS-CoV, the students' participants expected that it is available but post-intervention most of them identify that there is neither vaccine nor treatment for MERS-CoV infection and that was confirmed by the study for Du1, Tai1, Zhou, and Jiang (2016), who confirmed that no vaccines against MERS-CoV are currently available for human use. Excler et al., (2015) on behalf of the MERS-CoV Vaccine Working also, reported that current vaccine



development strategies involve a variety of technology platforms, primarily targeting the MERS-CoV S protein that is given to the public health urgency, platforms (or combinations thereof) with an established safety track record in humans should be given priority. Other target species such as dromedary camels should also be considered for the development of veterinary vaccines as a One Health Approach Group [23&24].

Figure 11. Schematic diagram of MERS vaccine-induced immune responses and neutralization.

While one year before Omrani, Al-Tawfiq & Memish (2015) reported that currently, there is no proven therapy, with supportive treatment being the mainstay of treatment. [25]. Regarding information related to transmission of infection from camels and infected bates, most of the students' participants in pre-and post-intervention answered yes and this also congruent with the fact that confirmed by Mohd, Al-Tawfiq and Memish (2016) in their study about Dromedary camels. It showed that the identified reservoir of MERSCoV and close contact with them represent a risk factor for MERS regarding knowledge about clinical manifestation.[26] It was obvious that most of participants recognized the right manifestation especially after distribution of educational booklet that reflect its impact as agreed by Alkot, Albouq, Shakuri, and Subahi (2016) who mentioned that there is no doubt that MERS-CoV awareness is very important for prevention and increasing attention for seeking early medical care and dealing with MERS-CoV infections so, exposure to well-constructed health education programs is critical to fulfill their defect, especially among the least knowledgeable and younger population, as a cornerstone element preventing the virus spread and disease outbreak and it is confirmed by Al-Mohaissen (2016), in her study about Awareness among a Saudi Arabian university community of Middle East respiratory syndrome coronavirus following an outbreak, who reported that this study shows that the awareness of a sample of a Saudi Arabian university community regarding knowledge about MERS-CoV infection following a recent outbreak is very poor. For this reason, educational booklet has had a positive effect on the students' participants in the current study. [20&27] in pre/post intervention. The majority of students' participants in the current

study reported that, frequencies of hand washing for 20 second with soap and water and avoiding direct contact with infected persons are the most effective preventive practices against MERS-CoV infections, and it is congruent with Al-Hazmi et al., (2016) study, who found that the most frequently reported method of protection against virus transmission is hand washing (81% among university students and 75.3% among school students) and avoidance the contact with an infected person were frequently indicated as a prevention methods. while in the part of wearing Face mask usage which recommended by ministry of health, there were a contradiction between two study in the time that current study, pre/post (90.3% & 100.0% respectively) reported the importance of usage and (94.5% & 100.0% respectively) Use tissue paper during sneezing and cough while in Al-Hazmi et al., study reported that, a higher proportion of students either questioned or were unaware of the importance of wearing a facemask as a protective method and 30% of the participants did not suggest using tissues as a method of prevention.[28] Most of the studies were conducted previous to the current study concentrated on the medical workers and the other that concentrated on the non-medical intervention was only survey studies without interventions and most of them had similar findings to pre-intervention results of current study regarding the students' attitude [20,21&28]. Countries, whether MERS cases have been reported in them or not, should maintain a high level of vigilance, especially those with large numbers of travelers or migrant workers on the Middle East. World Health Organization continues to request that Member States report to WHO all confirmed and probable cases of infection with MERS-CoV together with information about their exposure, testing, and clinical course to inform the most effective international preparedness and response and in current study the students' participants exposure to educational booklet had been increasing their vigilance for self-care against MERS-COV as depicted by statistically significance difference between pre/post-intervention results. [16,29,30 &31]

Conclusion & Recommendations:

According to previous published researches in the same topics, this study is the first interventional study was aimed to measure the knowledge, practice and attitude of university students (medical-non-medical educations) pre/post intervention about self-care against MERS-CoV infection, most previous studies were concentrated on assessing only the medical education students, health care workers or secondary school students in different area of Saudi Arabia differed from Taif governorate. Guidance booklet was successful in achieving significant improvement in students' self-care vigilance against MERS-CoV which was reflected in improvement of their knowledge and changing their attitude, so continued education should be open to all community according to their needs to increase their awareness about disease prevention and for who has experience with the disease, informing psychosocial factors that are important to long-term recovery. Further research study should be conducted on the schools, health care providers, especially nurses in different health care settings especially in Taif which is considered during outbreaks as a center for isolation for western region of the kingdom.

Acknowledgement:

This research was supported by a grant from the Deanship for Graduate Studies and Scientific Research - Taif University No., ٥٠٧٤-٤٣٧-١. We want to thank the deanship for their generous support of this project. In addition, the authors wish to express appreciation for all employees and students working in the selected colleges in Taif University for their acceptance to participate in this study, also grateful thanks for our colleague, Prof. Dr. Lila

Dorgham for her valuable and meticulous help with the data analysis for this study and Demonstrator Elvira Bakiran for her valuable cooperation.

References

1. IFMSA Policy Statement Control of Emerging Infectious Diseases: Background and Goals - Emerging Infectious Disease, CDC 2014, Retrieved from: <http://wwwnc.cdc.gov/eid/page/background-goals>. Adopted during the 64th August Meeting General Assembly in Ohrid, FYR of Macedonia, 7th August 2015.
2. Jones, Kate E, Nikkita G Patel, Marc A Levy, et al. 2008. Global trends in Emerging Infectious Diseases. *Nature* 451, no. 7181: 990-994.
3. Peiris JS, Guan Y, Yuen KY. Severe acute respiratory syndrome. *Nat Med* 2004;10: Suppl: S88-S97.
4. Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA (2012) Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *N Engl J Med* 367: 1814-1820.
5. World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) – Republic of Korea [Internet]. 2015 [updated 24 May 2015]. Available from: <http://www.who.int/csr/don/24-may-2015-mers-korea/en/>.
6. Al-Abdallat MM, Payne DC, Alqasrawi S, Rha B, Tohme RA, Abedi GR, et al. Hospital-associated outbreak of Middle East respiratory syndrome coronavirus: a serologic, epidemiologic, and clinical description. *Clin Infect Dis*. 2014; 59:1225–33. <http://dx.doi.org/10.1093/cid/ciu359>
7. Oboho IK, Tomczyk SM, Al-Asmari AM, Banjar AA, Al-Mugti H, Aloraini MS, et al. 2014 MERS-CoV outbreak in Jeddah—a link to health care facilities. *N Engl J Med*. 2015; 372:846–54. <http://dx.doi.org/10.1056/NEJMoa1408636>
8. Korean Centers for Disease Control and Prevention. MERS-CoV overview [Internet]. 2015 [updated 5 June 2015]. Retrieved from: http://www.mw.go.kr/front_new/al/sal0301vw.jsp?PAR_MENU_ID=04&MENU_ID=0403&page=1&CONT_SEQ=322602.
9. Retrieved from <http://www.moh.gov.sa/en/CCC/InformationCenter/Pages/default.aspx>.
10. Assiri A., Abedi G. R., Bin Saeed A. A., Mutwakil A. A., Al-Masry M., Choudhry A.J., et. al., Multifacility Outbreak of Middle East Respiratory Syndrome in Taif, Saudi Arabia, *Emerging Infectious Diseases* • www.cdc.gov/eid • Vol. 22, No. 1, January 2016.
11. American Veterinary Medical Association. One Health: A new professional imperative. 2008. Retrieved from: www.avma.org/KB/Resources/Reports/Documents/onehealth_final.pdf.
12. Azhar EI, El-Kafrawy SA, Farraj SA, Hassan AM, Al-Saeed MS, Hashem AM, Madani TA. Evidence for camel-to-human transmission of MERS coronavirus. *New England Journal of Medicine* 2014 Jun 26;370(26):2499-505.
13. Madani TA, Azhar EI, Hashem AM. Evidence for camel-to-human transmission of MERS coronavirus. *New England Journal of Medicine* 2014 Oct 2;371(14): 1360.
14. Gierer S., Hofmann-Winkler H., Albuali W. H., Bertram S., Al-Rubaish A. M., Yousef A. A., et. al., Lack of MERS Coronavirus Neutralizing Antibodies in Humans, Eastern Province, Saudi Arabia, *Emerging Infectious Diseases* • www.cdc.gov/eid • December 2013 Vol. 19, No. 12.
15. King L., One Health — a New Professional Imperative, One Health Initiative Task Force: Final Report July 15, 2008

16. World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV): Fact sheet N°401, June 2015, Retrieved from: <http://www.who.int/mediacentre/factsheets/mers-cov/en/#>
17. Stirling B. V *, Harmston J. and Alsobaye H. I. An educational programme for nursing college staff and students during a MERS- coronavirus outbreak in Saudi Arabia, *BMC Nursing* (2015) 14:20.
18. Stufflebeam DL. The relevance of the CIPP evaluation model for educational accountability. 2006 February Retrieved from: <http://www.enc.ed.gov/ERIC>
19. <http://www.who.int/emergencies/mers-cov/risk-assessment-july-2017.pdf?ua=1>
20. Alkot M, Albouq MA, Shakuri MA, Subahi MS. Knowledge, attitude, and practice toward MERS-CoV among primary health-care workers in Makkah Al-Mukarramah: an intervention study. *Int J Med Sci Public Health* 2016; 5:952-959
21. AlDowyan N. M., Ahmed A. S., El-Gharabawy R. M, Knowledge, Attitude and Practice (KAP) Study about Middle East Respiratory Syndrome Coronavirus (MERS-CoV) among Population in Saudi Arabia. *International Archives of Medicine* 2017; Vol. 10 No. 254 doi: 10.3823/2524.
22. Al-Mohreja A., Aghab., Are Saudi medical students aware of middle east respiratory syndrome coronavirus during an outbreak? *Journal of Infection and Public Health* (2017) 10, 388—395.
23. Excler J., Delvecchio Ch. J., Wiley R. E., Williams M., Yoon I., Modjarrad K., Boujelal M., Moorthy V. S., Hersi A.S., Kim J. H., on behalf of the MERS-CoV Vaccine Working Group. Toward Developing a Preventive MERS-CoV Vaccine—Report from a Workshop Organized by the Saudi Arabia Ministry of Health and the International Vaccine Institute, Riyadh, Saudi Arabia, November 14–15, 2015. *Emerging Infectious Diseases* • www.cdc.gov/eid • Vol. 22, No. 8, August 2016.
24. Du1 L., Tai1W., ZhouY., and Jiang S. Vaccines for the prevention against the threat of MERS-CoV . *Expert Rev Vaccines*. 2016 September; 15(9): 1123–1134. doi:10.1586/14760584.2016.1167603.
25. Omrani A. S., Al-Tawfiq J. A. & Memish Z. A. Middle East respiratory syndrome coronavirus (MERS-CoV): animal to human interaction. *Pathogens and Global Health Journal*. Volume 109, 2015 - Issue 8.
26. Mohd HA, Al-Tawfiq JA, and Memish ZA. Middle East Respiratory Syndrome Coronavirus (MERS-CoV) origin and animal reservoir. *Virol J*. 2016;13(87).
27. Al-Mohaissen M. Awareness among a Saudi Arabian university community of Middle East respiratory syndrome coronavirus following an outbreak. *EMHJ*. Vol. 23 No. 5. 2017; 351-360.
28. Al-Hazmi, A. et al., Knowledge, attitude and practice of secondary schools and university students toward Middle East Respiratory Syndrome epidemic in Saudi Arabia: A cross-sectional study. *Saudi Journal of Biological Sciences* (2016), <http://dx.doi.org/10.1016/j.sjbs.2016.01.032>.
29. Hassanein S, Abdullah B, Abdullah A Alsalman SN. Effect of One-day Educational Program on MERS- Corona-Virus and Its Determinants on Knowledge and Practice amongst Secondary School Students at Al-Ahsa City. *G J Health Science Nurs*. 2017; 1:104.
30. Alqahtani AS. Knowledge and attitude toward Middle East respiratory syndrome coronavirus among health colleges' students in Najran, Saudi Arabia. *Int J Community Med Public Health* 2017; 4:2641-7.
31. Alsahafi A. J. and Cheng Al. C. Knowledge, Attitudes and Behaviors of Healthcare Workers in the Kingdom of Saudi Arabia to MERS Coronavirus and Other Emerging Infectious Diseases. *Int. J. Environ. Res. Public Health* 2016, 13, 1214.