



2019-nCoV2: An Overview of Awareness about Emerging and Re-emerging Infectious Diseases and Sustainable Development: A Retrospective and Cross-sectional Study

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Authors' contributions

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ABSTRACT

The doctrine of Sustainability is known to be a holistic approach and there is an increased recognition that Sustainable Development Goals (SDGs) are linked to one another. Within less than two decades, the present pandemic (COVID19) is the third emerged highly pathogenic and deadly

human coronaviruses. Hence, risk of emerging infectious diseases (EIDs) is a key component of the sustainable development approach. In order to determine knowledge, awareness and attitude, an online questionnaire-based survey was conducted in a total of 114 members of Saudi Arabian's staff. Results about knowledge and awareness varied between 98.2 % and 38.59%. About 77.21% (Mean value) of the participants are well awarded about the subject of the study. The constant collation of the showed that the majorities of the correlation between variables were very strong (20.87%) or strong (38.46%). Synthetically, themes such as human impact on the environment, human health and global stability, SDGs and pandemics, human susceptibility for diseases and uses of drugs were found to be interdepend in the perception of the academic staff in the Saudi Arabian universities. It is suggested that there is a need to introduce time-oriented policy, and implement awareness plans in the country for the future generation.

Keywords: *Sustainable development; Emerging infectious disease; Awareness; cross-sectional study; Saudi Arabia's Universities.*

ABBREVIATION

HWB:	<i>Human Well Being</i>
SARS:	<i>Severe Acute Respiratory Syndrome.</i>
SARS-CoV-2:	<i>Severe Acute Respiratory Syndrome Coronavirus 2.</i>
MERS:	<i>Middle East Respiratory syndrome.</i>
SDGs:	<i>Sustainable Development Goals</i>

1. INTRODUCTION

“An emerging infectious disease (EID) is that has appeared and affected a population for the first time, or has existed previously but is rapidly increasing, either in terms of the number of new cases within a population, or its spread to new geographical areas” [1,2]. EIDs such as Ebola, influenza, SARS, MERS and recently the actual pandemic Coronavirus (2019-nCoV) cause large-scale mortality and morbidity, disrupt trade and travel networks, and stimulate civil unrest [3,4]. Infectious diseases are emerging at an unprecedented rate with significant impacts on global economies and public health [5-8].

Over the past three decades, more than 30 new infectious diseases have emerged to threaten the health of millions of people worldwide. Wilcox and Colwell [9] reported that EIDs can be induced according to the host range (e.g tuberculosis, cholera, malaria,ect); or according to new emerged variants assigned to known pathogens (e.g., HIV, Nipah virus, Ebola virus..ect), or according to bacteria newly resistant to antibiotics, notably the multiple resistant strains that render the armamentarium of antibiotics useless [10].

The doctrine of Sustainability Science (SS) is widely acknowledged as a tool for attaining

global sustainability and is becoming the core philosophy of national and international developmental agendas [11]. The concept is known to be a holistic approach regarding its aspect to be embedded on economic, environmental and social issues and policies [12]. The concept will be successful by the integrated engagement of key actors, national and local governments, organizations and population; and capital - human, natural, institutional and infrastructure, financial and technological [12].

Scientifically, the virus is named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [13] and will be referred to as coronavirus. Severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), which also are caused by coronaviruses [14]. Within less than two decades, there have emerged three highly pathogenic and deadly human coronaviruses, namely SARS-CoV, MERS-CoV and SARS-CoV-2. Research evidence suggests that SARS-CoV and MERS-CoV originated in bats, and it is likely that SARS-CoV-2 did as well. SARS-CoV then spread from infected civets to people, while MERS-CoV spreads from infected dromedary camels to people. Scientists are trying to determine how SARS-CoV-2 spread from an animal reservoir to people. This paper explores how the emerging and re-emerging diseases pandemic (2019-nCoV) may affect addressing awareness issues at the heart of the concept of sustainable development within the Academic staff from Saudi Arabian Universities.

2. METHODS

2.1 Study Design, Population

Using an online questionnaire consisted of 16 questions, a cross-sectional study was

conducted to analyse the knowledge and awareness regarding emerging and re-emerging diseases and the relation with the sustainable development. The questionnaire was carefully distributed between the staff of Saudi Arabian universities.

A prospective cross-sectional study targeted Academic staff of Saudi Universities staff in the period from June 2020 to August 2020 on one hundred and fourteen subjects. The Inclusion criteria for the general targeted population were to be an employee of Saudi Arabian universities and excusing the job on the moment of filling up the questionnaire.

2.2 Data Collection Tool

The data was collected using a self-administered online bilingual questionnaire (Arabic and English). The questionnaire is available via the link on the google forms (Table 1). The two versions of the questionnaire contained fourteen questions covering the following areas: demographics (Age, Gender, the name of the university and the speciality). The second section of the questionnaire deals about the concept of the Sustainable development and its familiarity with the persons that being questioned. Attitudes and opinions of participants regarding the EIDs and the new emerged 2019-nCoV and the level of scientific knowledge were attributed to the last section of the questionnaire.

2.3 Statistical Analyses

Pearson Chi-square tests were used to evaluate the association among various factors related to awareness of sustainable development and emerged and re-emerged infectious diseases. Statistical analysis was carried out using Statistical Package for Social Sciences program (SPSS, version 21.0, IBM). Descriptive statistics via crosstab procedure including Person Chi-square tests and Symmetric measures (Phi and Cramer's V) analysis was applied with 95% CI were also calculated.

3. RESULTS

3.1 Respondent Profile

A total of 114 respondents attended the online questionnaire. Socio-demographic characteristics of respondents (n= 114) were shown by Fig. 1. Most of the respondents were males (65.8%),

and in the age group respectively of 31-40 years (40.5%) and 41-50 (36.9%). In a similar manner, most of the respondents had an educational status of scientific speciality (60.2%) or Art (29.6%). It was found that, the frequency of mid-age group participants is higher than older and young ones because usually the staff of the university finished their diploma after 30 years old. Among the participants, 39.47% were from the Northern Border University, 9.64 % from King Fahd University of Petroleum and Minerals (KFUPM) and 8.77% from Jizan university. The percentage of respondents from the rest of universities (9 universities) varied between 3.50 % (IMSIU: Imam Muhammad bin Saud Islamic University) and 6.14 % (both for Umm al-Qura University and Al Jouf University).

3.2 Awareness Regarding the Relationships between Sustainable Development and Pandemics

The results are summarized as the number of answers given by the respondents for each question (Table 2). A total of 6270 answer were presented by the interviewed respondents, out of them only 156 (about 2.5%) were presented as "Don't know". Accordingly, the perception, knowledge and awareness of Academic staff about sustainable development regarding emerged and re-emerged diseases can be considered as advanced. As showed by Table 2, results about knowledge and awareness on the basis of 16 categorical questions varied between 98.2 (question 6) and 38.59 (question 12). About 77.21% (Mean value) of the participants are well awarded about the knowledge of sustainable development and the relationships with emerged and re-emerged infectious diseases. Moreover, 73 % (81 respondents) of the total number of the academic staff in Saudi Arabian Universities heard about the concept of sustainable development (Table 2). The Sustainable Development Goals (SDGs), can be affected by global pandemics as a suitable answer is known by 112 respondents (more than 98%). The knowledge about the responsibility of human being to live in harmony with nature in order to survive better on the planet showed similar values about knowledge and awareness of the treated subject. Furthermore, 104 of the academic staff (91.22 %) are sure that harmony with nature is possible for the best of the humanity.

90.35 % of the respondents assumed that human impact on the environment may make pandemics

more likely. When we asked about the threats to human health and global stability that can be caused by emerging and re-emerging diseases (question 9, Table 2), 107 respondents (93.85 %) support the doctrine of sustainable development regarding EIDs.

Two advanced questions were asked by the question 10 and 11 (Table 2). It deals about the major factors that underlie emerging and re-emerging diseases. The collected data from the questionnaire showed that the majority of respondents (about 72 %) believe that factors such as human susceptibility for disease, extensive use of drugs and antibiotics, climatic changes, the technology and industry, the upheaval of the ecosystems, ...ect could underlie emerging and re-emerging diseases.

According to UNESCO report (2006), ecotourism also variously referred to as 'sustainable/green/soft' tourism is the focus of the question 12 (Table 2). The question deals about the safety of camping by the present outbreak of COVID19, the decision to avoid camping that should be reported is only believed by 55 respondents (48.24%) and 38.59 % of the academic staff questioned have the readiness to go on a camping trip during the present pandemic. In Saudi Arabia, some natural areas especially the scenic sites are very popular among Saudi citizens for picnics and camping [15]. The question 13 and 14 are related to possibility of animal's infection for the human being and the awareness of the respondent is qualified as high (101 respondents, about 90%). About the half of interviewed academic staff (49.1%) think that an infection with coronaviruses could be originated mainly from 3 animal species (Camel, Bat and Mice). However, about the third of respondents (31.75%) don't have idea about this level of awareness regarding the pathway of contamination originating from animals.

Question 15 (Table 2) focuses on the awareness of the interviewed academic staff about previous pandemic widespread few years ago. Within less than two decades three highly pathogenic coronaviruses have emerged, namely, Severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), and SARS-CoV-2 (actual pandemic COVID19). 78.07 % of the respondents reported that they heard about those pandemics. Moreover, 55 interviewed out of 114 (48.25%; question 16, Table 2) believed that there is a relationship between MERS, SARS and COVID 19. However, more than 50 %

of respondents reported a non-understanding of the relationships between the 3 pandemics (the answer was: Don't Know) or they reported the negation of such relation (Table 2, question 16).

3.3 Association and Correlation between the 14 Categorical Variables

The constant collation of data was analysed via the association between categorical variables using the chi-square and symmetric measures (Phi and Cramer's V) (Table 3 and Table 4).

The Pearson's chi-square test called also the test of association (Table 3), is used to discover if there is a relationship between two categorical variables. In simple terms, it can test that whether two variables are associated with each other or not [16].

The correlation between the analysed variables showed 91 values. Cramer's V varies between 0 and 1 without any negative values. Moreover, a value close to 0 means no association. However, a value bigger than 0.25 is named as a very strong relationship for the Cramer's V; a value superior than 0.15 is qualified strong; a value more than 0.1 is considered Moderate and a value bigger than 0.05 the correlation is considered to be weak [17].

The majorities of the correlation between variables were very strong (20.87%) or strong (38.46%). 21.97 % of the correlation values (Cramer's V) found to be moderate and only 18.68 % were found to be with weak correlation values (Table 3). The question number 9 that focuses on emerging and re-emerging diseases threats regarding human health and global stability was found to be significantly very strong correlated, with the highest values of Cramer's V, to 7 questions (Fig. 2, (a)). Questions varying from speciality (Q3), global pandemics and the possibility of its effect on SDGs (Q6) and the rest of variables are V7, V8, V14, V15 and V16 (Table 1; Fig. 2, (a)). A set of 5 variables was found to be moderately correlated with the question 16 focusing on the relationships between previous pandemic such as MERS, SARS and the present pandemic of COVID19. Moreover, question such as the speciality, the knowledge of the concept of sustainable development by the academic staff of the Saudi Arabian universities, the SDGs and global pandemics among others showed moderate correlation the question 16 (Table 1; Fig. 2, (b)).

The third set of correlation level was explained by a weak correlation of the gender with 6 questions (V3, V5, V6, V7, V11 and V14). Fig. 2, (c) showed the weak correlation set of variables

where the gender is weakly correlated, among others, to the speciality, the knowledge of sustainable development, the SDGs and global pandemics.

Table 1. Questionnaire employed for awareness about Sustainable Development and EIDs

Variables label	Variables
V1	Age
V2	Gender
V3	Speciality
V4	The name of the University (inside Saudi Arabia)
V5	Have you heard before about the concept of sustainable development?
V6	The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. Do you think that those goals can be affected by global pandemics?
V7	Human being should live in harmony with nature so that He can survive better?
V8	Did you think that the human impact on the environment may make pandemics more likely?
V9	Do you think that emerging and re-emerging diseases represent threats to human health and global Stability?
V10	Human susceptibility for disease, extensive use of drugs and antibiotics.... etc are the major factors that underlie emerging and re-emerging diseases. Do you think these are valid reasons?
V11	Other factors that underlie emerging and re-emerging diseases are specific related to the environment such as the climatic changes, the technology and industry, the upheaval of the ecosystems, ...ect. Do you think these are valid reasons?
V12	Is it safe to go on a camping trip during the pandemic of COVID19?
V13	Give example of some animals that can be a potential reservoir of Coronaviruses in Saudi Arabia ?
V14	Do you think that human can be infected with the virus causing COVID19 from an animal source
V15	Have you heard before about MERS and SARS or other pandemic?
V16	Did you think that there are a relationship between MERS, SARS and COVID 19?

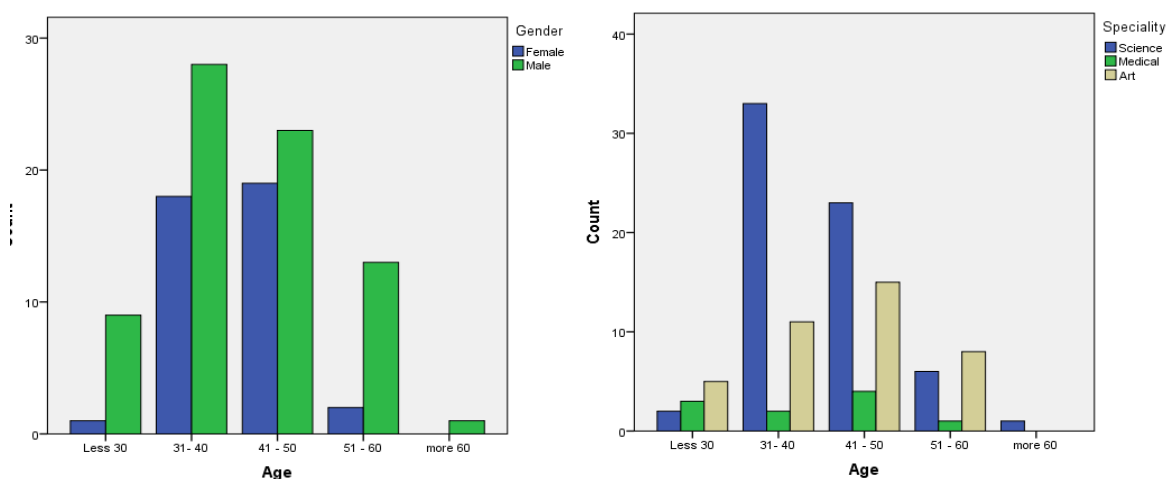


Fig. 1. Socio-demographic characteristics of respondents including gender and speciality of respondents (n= 114)

Table 2. The results of the employed questionnaire for awareness about sustainable development and ERIDs

Q5	a- Have you heard before about the concept of sustainable development?	N (%)
	b- Yes	81 (73)
	c- No	33 (27)
Q6	The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. Do you think that those goals can be affected by global pandemics?	
	a- Yes	112 (98.2)
	b- No	2 (1.8)
Q7	Human being should live in harmony with nature so that He can survive better?	
	a- Agree	104 (91.22)
	b- Don't know	4 (3.51)
	c- Don't agree	6 (5.26)
Q8	Do you think that the human impact on the environment may make pandemics more likely?	
	a- Yes	103 (90.35)
	b- Don't know	5 (4.38)
	c- No	6 (5.26)
Q9	Do you think that emerging and re-emerging diseases represent threats to human health and global Stability?	
	a- Yes	107 (93.85)
	b- Don't know	2 (1.75)
	c- No	5 (3.50)
Q10	Human susceptibility for disease, extensive use of drugs and antibiotics....etc are the major factors that underlie emerging and re-emerging diseases. Do you think these are valid reasons?	
	a- Yes	79 (69.29)
	b- Don't know	21 (18.42)
	c- No	14 (12.28)

	Other factors that underlie emerging and re-emerging diseases are specific related to the environment such as the climatic changes, the technology and industry, the upheaval of the ecosystems, ...ect. Do you think these are valid reasons?	N (%)
Q11	a- Yes	85 (74.56)
	b- Don't know	16 (14.03)
	c- No	13 (11.40)

Table 2. (continued)

Q12	Is it safe to go on a camping trip during the pandemic of COVID19?	
	a- Yes	44 (38.59)
	b- Don't know	15 (13.15)
Q13	Give example of some animals that can be a potential reservoir of Coronaviruses in Saudi Arabia?	
	a- Camel	27 (23.68)
	b- Bat	18 (15.78)
	c- Don't know	36 (31.75)
Q14	Do you think that human can be infected with the virus causing COVID19 from an animal source?	
	a- Yes	101 (88.60)
Q15	Have you heard before about MERS and SARS or other pandemic?	
	a- Yes	89 (78.07)
	b- Don't know	10 (8.77)
Q16	Did you think that there is a relationship between MERS, SARS and COVID 19?	
	a- Yes	55 (48.24)
	b- Don't know	46 (40.36)
	c- No	13 (11.40)

Table 3. Person Chi- square test of 14 variables related to Sustainable Development and EIDs. Variable V4 and V13 are not included; The acronyms of the variables were adopted from Table 1

	V1	V2	V3	V5	V6	V7	V8	V9	V10	V11	V12	V14	V15	V16
V1	1													
V2	0.07	1												
V3	0.046*	0.877	1											
V5	0.029*	0.957	0.049*	1										
V6	0.274	0.909	0.021*	0.666	1									
V7	0.000***	0.906	0.047	0.435	0.000***	1								
V8	0.004**	0.129	0.465	0.362	0.404	0.000***	1							
V9	0.378	0.146	0.000***	0.178	0.000***	0.000***	0.000***	1						
V10	0.292	0.161	0.605	0.195	0.820	0.648	0.000***	0.013*	1					
V11	0.725	0.653	0.394	0.309	0.760	0.026*	0.080	0.145	0.036*	1				
V12	0.491	0.009**	0.201	0.023*	0.564	0.428	0.632	0.174	0.861	0.147	1			
V14	0.009**	0.335	0.082	0.723	0.272	0.179	0.747	0.000***	0.812	0.728	0.061	1		
V15	0.419	0.140	0.874	0.791	0.132	0.000***	0.000***	0.012*	0.372	0.009**	0.333	0.962	1	
V16	0.093	0.247	0.289	0.457	0.231	0.478	0.011*	0.045*	0.171	0.111	0.346	0.066	0.000***	1

* $p < 0.05$
 ** $p < 0.01$
 *** $p < 0.001$

Table 4. Symmetric measures (Phi and Cramer’s V) of 14 variables related to Sustainable Development and EIDs. Variable V4 and V13 are not included; The acronyms of the variables were adopted from Table 1

	V1	V2	V3	V5	V6	V7	V8	V9	V10	V11	V12	V14	V15	
V2	0.275													
V3	0.263	0.048												
V5	0.308	0.005	0.23											
V6	0.212	0.011	0.26	0.04										
V7	0.378	0.042	0.205	0.121	0.37									
V8	0.194	0.189	0.125	0.133	0.126	0.412								
V9	0.194	0.184	0.337	0.174	0.469	0.417	0.427							
V10	0.206	0.179	0.109	0.169	0.059	0.104	0.323	0.236						
V11	0.152	0.086	0.134	0.144	0.069	0.221	0.191	0.173	0.213					
V12	0.181	0.286	0.162	0.257	0.1	0.13	0.106	0.167	0.076	0.137				
V14	0.344	0.09	0.209	0.033	0.1	0.174	0.072	0.378	0.06	0.075	0.222			
V15	0.189	0.186	0.073	0.064	0.188	0.332	0.339	0.238	0.137	0.243	0.142	0.026		
V16	0.244	0.157	0.148	0.117	0.16	0.124	0.239	0.207	0.168	0.181	0.14	0.219	0.323	
	Very Strong			Strong			Moderate				Weak			

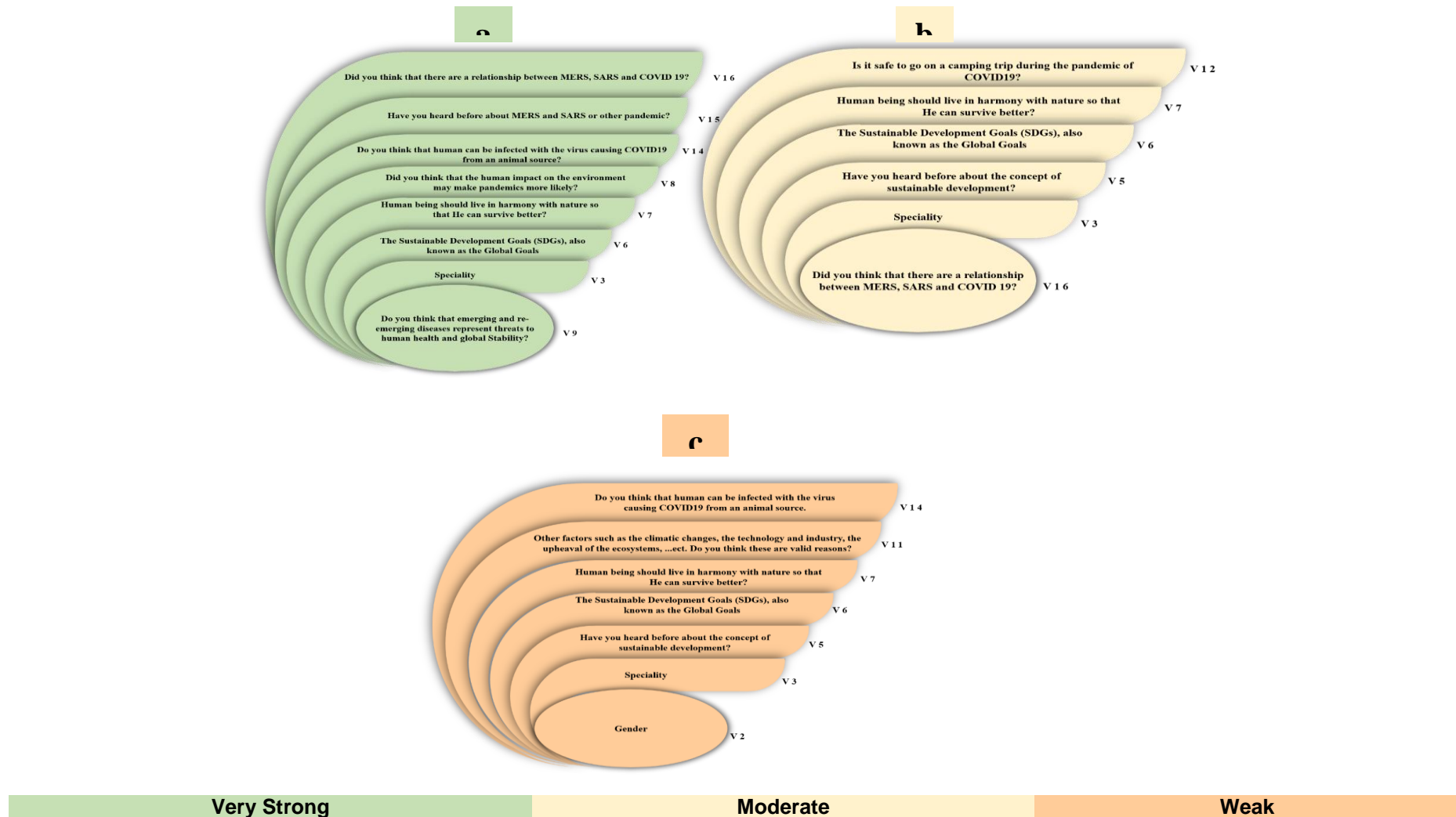


Fig. 2. Infographic showing the correlation between the different variable (data as showed by Table 4 and Table 1)

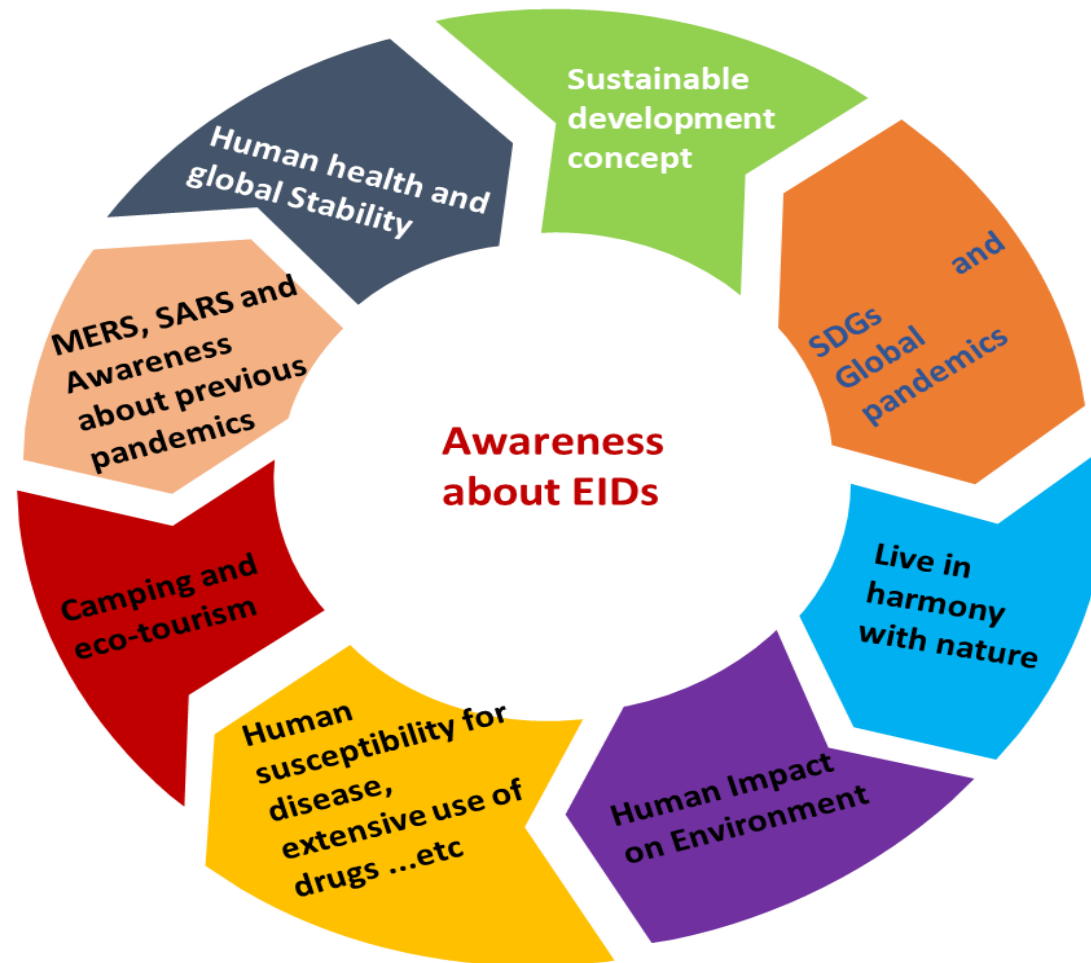


Fig. 3. Summary of questionnaire focusing on the relationships between EIDs and Sustainable development. (SDGs: Sustainable Development Goals; EIDs: Emerged Infectious Diseases)

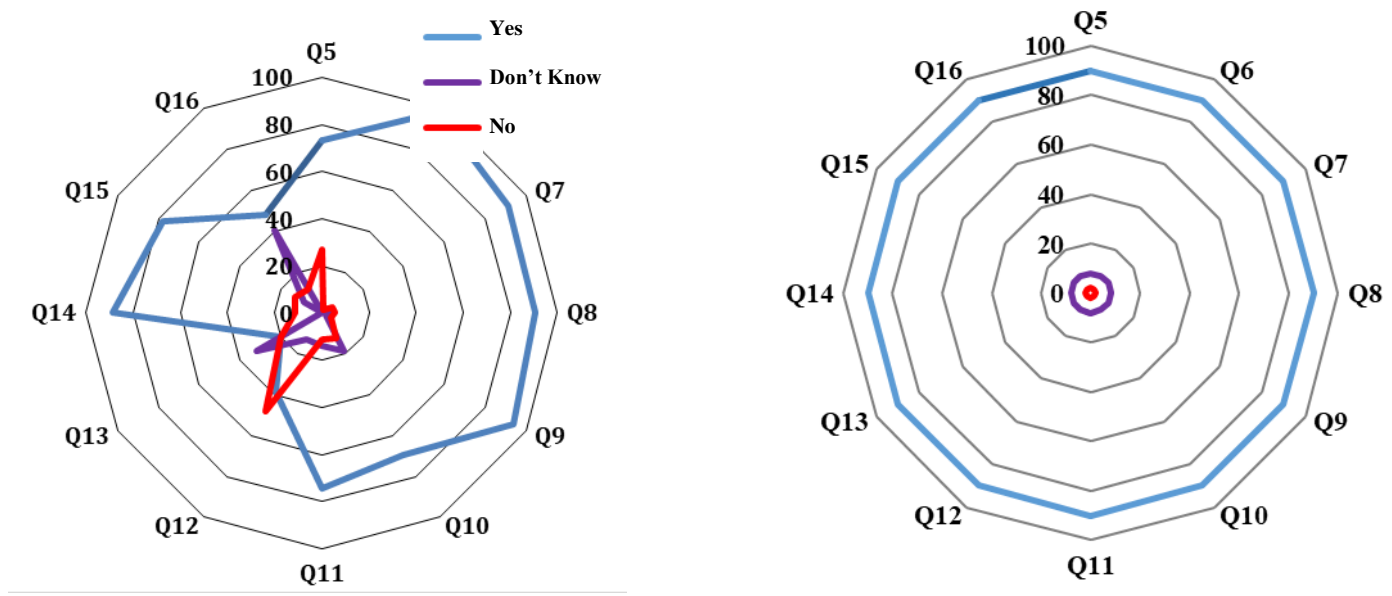


Fig. 4. Radar diagram showing the participants' perception about the relationships between the doctrine of sustainable development and EIDs. (a): the answers of the participants, (b) a simulated answer showing an awareness level of about 90%

4. DISCUSSION AND CONCLUSION

The outbreak of the novel coronavirus-caused infectious disease (COVID-19) has posed a severe threat to the healthy lives and well-being of millions of people around the world. On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a global pandemic. By February 1st, COVID-19 had affected 223 countries, with more than 100,000,000 confirmed cases and about 2200,000 reported deaths globally.

Within less than two decades, the present pandemic is the third emerged highly pathogenic and deadly human coronaviruses. The doctrine of Sustainability is known to be a holistic approach regarding its aspect to be embedded on economic, environmental and social issues. There is an increased recognition that Sustainable Development Goals (SDGs) are linked to one another, and priorities such as food production, biodiversity conservation, and climate change mitigation cannot be considered in isolation. Hence, risk of emerging infectious diseases (EIDs) is a key component of sustainable development planning and awareness about it is extremely important by the way of the holistic approach of the sustainable development. Building awareness of the sustainable development could be the line of defence especially for the young generations. The present study is the first cross sectional approach that support the originality to diffuse the idea of awareness among members of a University Community in order to ameliorate the awareness about the relationships between emerging and re-emerging diseases and the sustainable development concept. Linkages between sustainable development and human health is reported by many authors [18].

According to the World Health Organization [19] Health "is state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". These led to the innate relationships between human health with surrounding environment. One manifestation of this relationship is the occurrence, presence and spread of emerging and re-emerging infectious diseases. Human Well Being (HWB) is the stated intention of sustainable development and will be possible by the improvement of education, health and environmental quality [20,21].

By the present study we report knowledge about awareness and relationships between sustainable development and EIDs in a

population of Academic Staff in Saudi Arabian universities. The perception, knowledge and awareness of Academic staff about sustainable development regarding emerged and re-emerged diseases can be considered as advanced (only 2.5% of the answer were reported as "Don't know"). The idea is more supported by more values related, among others, to the hearing of respondents about the concept of sustainable development (73%), the relationships. Moreover, the effect of EIDs including pandemics on Sustainable Development Goals (SDGs) was reported by more than 98% of the respondents. A set of eight questions were found to be very strong correlated (Fig. 2 (b); Table 3 and Table 4). Furthermore, a set of 6 questions were found to be strong correlated (Fig. 2 (b); Table 3 and Table 4). When we focus about these two sets of questions, is clearly that the level of knowledge and awareness of the respondents about the relationships between sustainable development and EIDs can be summarized in Fig. 3. Additionally, themes such as human impact on the environment, human health and global stability, SDGs and pandemics, human susceptibility for diseases and uses of drugs were found to be interdepend in the perception of the academic staff in the Saudi Arabian universities (Fig. 4). This image is disturbed by some confusion as showed by the weak correlation between the gender and 6 questions (Table 4, Fig. 3). Fig. 4 showed a Radar diagram of the participants' perception about the relationships between the doctrine of sustainable development and EIDs. A simulation of answer showing an awareness level of about 90% (b) against the answers of the participants demonstrate some weakness in the level of knowledge and awareness about the relationships between sustainable development and EIDs.

AVAILABILITY OF DATA AND MATERIALS

The data generated and analysed during this study are not publicly available due to concerns about confidentiality. Instead, quotations and analytical categories are included in the text. It will be a great pleasure for us to discuss the findings or the analysis if any arose questions.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely

no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICS APPROVAL

The consent of the respondents was reserved before starting filling up the survey, and their names remained anonymous. All the participants were informed about the specific objective of this study before proceeding to fill-up the questionnaire. Formal ethical permission of this study was taken from the authority inside the university (Ethical Committee of Scientific Research and Bioethical Committee: HAP-09-A-043).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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