

Identification of information types and sources by the public for promoting awareness of Middle East respiratory syndrome coronavirus in Saudi Arabia

Jradi Hoda^{1,*}

¹Community and Environmental Health, College of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, PO Box 22490, Riyadh 11426, Saudi Arabia

*Correspondence to: H. Jradi. E-mail: Jradiho@ngha.med.sa

Received on March 5, 2015; accepted on October 22, 2015

Abstract

Middle East Respiratory Syndrome (MERS) is a viral respiratory disease of serious consequences caused by MERS Coronavirus (MERS-CoV). Saudi communities still lack awareness of available protective measures to prevent the transmission of the virus. It is necessary to explore the current information-seeking strategies and preferences for communication tools among the Saudi population to promote dissemination of accurate information. Guided by McGuire's Input–Output Persuasion Model and focusing on input variables (receiver characteristics, sources, message, channel and destination), we explored the current information-seeking strategies and preferences for different communication tools among residents of Riyadh ($n = 658$). Preferred and sought-after information sources on MERS. Most participants in the sample were female (61.7%), and the majority (98.2%) had internet access at home. The internet was the most commonly used source of information (39.5%) and the most endorsed channel for a MERS awareness campaign. Physicians were the preferred source of information (45.6%), followed by other health care providers (31.3%). In univariate multinomial logistic regression models, males and individuals aged ≤ 27 years were more likely to seek information from the internet than from physicians. Residents of southern and western Riyadh preferred physicians as a credible source of information over

the Ministry of Health. The results of this survey provide valuable information on how to reach this population and for understanding how to launch an effective MERS risk communication campaign in a Saudi population.

Introduction

Middle East Respiratory Syndrome (MERS) is a viral respiratory disease caused by the MERS Coronavirus (MERS-CoV), also called the human coronavirus–Erasmus Medical Center (HCoV-EMC) or novel coronavirus (nCoV) [1]. Although it is unclear how human coronaviruses spread, it is believed that they are transmitted by air via the coughing and sneezing of an infected person, or via close personal contact such as by touching or shaking hands with an infected person [2]. These viruses may also spread when people touch contaminated objects or surfaces and then their mouth, nose or eyes [2]. By May 2014, the total number of cases of MERS-CoV reported to the World Health Organization (WHO) was 632 including 193 deaths [2]; most of these cases were in the Middle East [3]. Saudi Arabia had the highest rate of cases, followed by the United Arab Emirates [3]. Confirmed cases of MERS-CoV have been reported in the following countries: Saudi Arabia, the United Arab Emirates, Qatar, Jordan, Oman, Kuwait, Egypt, the United Kingdom, Germany, France, Italy, Greece, Tunisia, Malaysia, the Philippines and the United States [3].

From March 2012 to May 2014, the global incidence of cases was <50 per month, except during April 2014, when there were more than 200 cases [3]. Currently, the case fatality rate is ~29%, and there are 50% more cases in male than female [3]. Most cases have been reported in people aged 40–69 [3]. According to the Saudi Ministry of Health (MOH), as of May 2014, the total number of confirmed cases in Saudi Arabia was 544, including 176 deaths, corresponding to a fatality rate of over 30% [4]. Similar to trends in other countries, in Saudi Arabia, cases in males exceed cases in females (67.3% of cases were male); moreover, Saudi citizens cases (72.9%) outnumbered non-Saudi (residents with other nationalities) cases [5]. Regionally, Jeddah and the capital Riyadh reported the highest numbers of cases (34.6 and 33% of total cases, respectively), whereas the lowest numbers were reported in the Asir, Tabuk and Ta'if regions (each of which accounted for <2.5% of cases). In approximately one-third of cases, at least one pre-existing chronic disease (e.g. cancer) was present, while in 29.6% of cases, the individual had come into direct contact with an infected person (e.g. health care worker or family member) [5].

In an attempt to limit the spread of MERS-CoV, the Saudi MOH has implemented a series of preventive measures, including strategies to promote public health awareness using social media, and distribution of educational materials in shopping malls, schools and mosques, as per WHO recommendations [2]. Despite efforts to raise community awareness of the virus, to promote behavioral practices to limit its spread, the MOH has reported a positive correlation (14.5%) between MERS-CoV infection (52 of 358) and direct contact with infected family members during the period from May 2013 to May 2014 [4]. Based on this correlation, it is clear that people in Saudi Arabia still lack the necessary awareness regarding the virus's mode of transmission, and available protective measures to limit exposure. Over the past 10 years, the Saudi community has depended on the internet as its main source of information for causes and modes of transmission of disease. Consequently, information distributed on

the internet by non-specialists, which has not been subject to careful scientific scrutiny or recognized by the medical community, may have contributed to ineffective practices and approaches to disease prevention in Saudi Arabia, as well as adversely influencing individuals' attitudes to prevention strategies. Indeed, in one survey that measured awareness, attitudes and practices related to swine influenza, more than 38.3% of the responders were unconvinced that the reports from the Saudi MOH about the severity of disease were true, which may explain an apathy among people in Saudi Arabia to engage with disease management interventions conceived by the Saudi MOH, aimed at minimizing viral transmission [6]. To promote greater awareness among the Saudi population, further research to develop more effective and engaging methods for communicating critical information on prevention strategies is needed, to limit the spread of MERS-CoV.

Owing to the serious threat posed by MERS-CoV to public health, and the importance of public awareness of preventive measures, strategies that promote dissemination of accurate information are needed to limit the spread of the virus; such approaches may include health promotion and awareness campaigns originating from credible sources and transmitted via reputable channels [7, 8, 9].

To maximize effectiveness, the development of a health promotion campaign should be guided by theoretical principles that have been well established [10]. Based on his communication-persuasion model, McGuire's Input-Output matrix [11] provides an effective framework for developing an informative public health campaign to promote better awareness of MERS-CoV. This model defines the desired characteristics of an effective campaign message to maximize its effectiveness. First, it specifies the characteristics (i.e. model inputs) of the campaign message, and how these may be modified—according to population characteristics—to achieve the best results (model inputs include the source, i.e. the credibility, attractiveness and trustworthiness of the sender; the message, i.e. the type and strength of the argument; the channel,

Table I. *Information persuasion matrix, adapted from McGuire (2001)*

Input communication factors		
	<i>INPUT</i>	<i>Factors in this 'input' section include:</i>
1	Source	Demographics, credibility, attractiveness etc.
2	Message	Appeal, organization, style etc.
3	Channel	Type of media used, i.e. television
4	Receiver	Demographics, social/psychological factors
5	Destination	Immediacy/delay, prevention/cessation
Output persuasion techniques		
	<i>OUTPUT</i>	<i>Description of what happens at each step:</i>
1	Tuning in	Exposure to the message
2	Attending	Paying attention to the message
3	Liking	Liking and being interested in the message
4	Comprehending	Understanding the message
5	Generating	Related cognitions
6	Acquiring	Gaining the appropriate skills to act on the message
7	Agreeing	Agreeing the message is correct
8	Storing	Saving the message to memory
9	Retrieval	Retrieval of the message from memory when needed
10	Decision	Acting on the message
11	Acting	Performing the action
12	Post-action	Integration of the action into behavior
13	Converting	Advising others to behave likewise

i.e. the way in which the information is broadcast and the type of media and modality used; the receiver, i.e. demographics, attitudes, knowledge and level of perceived risk and worry; the destination, i.e. where participants looked for information or sources). Second, the model specifies the desired changes (i.e. model outputs) that the campaign will target (model outputs include the levels of exposure, attention, comprehension, acceptance, retention and action variables (behavioral changes following exposure to campaign messages) (Table I). Input characteristics as described earlier are of particular interest when designing persuasive health communication campaigns.

Information seeking strategies in Saudi population are unknown and preferences for different communication tools for health related topics are scarce in the literature. There is no guide to how to reach the population of the largest city in Saudi Arabia—Riyadh. This exploratory study used McGuire's Input–Output model to guide the development of a campaign to promote public awareness of

MERS-CoV in the Saudi population. The purpose of this descriptive study was to identify effective characteristics, for the model input variables, that would support an effective campaign, in a sample representative of the Saudi population. Key to the development of an effective campaign to increase disease awareness and promote behavioral changes is the identification of information-seeking behaviors; for example, the particular source and choice of channel/media may influence receptivity to, and impact of, the messages. Thus, receiver variables relating to information-seeking behaviors were studied to determine whether campaign efforts should differ as a function of these characteristics.

Methods

Procedures

Approval to conduct the study was obtained from the King Abdulaziz International Medical Research Center (KAIMRC). The study included 658 Arabic-speaking Saudi men and women, all aged 18 years or

over, randomly selected from five regions of Riyadh (central, north, east, west and south). The later described three-step sampling design was used for data collection. Two shopping centers were randomly selected from each of the five regions, for a total of 10 centers. Over a 2-week period (including weekdays and weekends), a total of 854 randomly selected individuals were approached and invited to participate in our survey. Of these, 196 refused to participate (positive response rate: 77%), while the rest provided oral consent (when the purpose of the study had been explained to them) and completed the survey. The average time needed to complete the survey was ~7 min. Participants did not receive any compensation.

Study instrument

In a pilot study, the survey was initially validated (comprehensibility, feasibility and acceptability) in a sample of adults ($n = 20$) living in Riyadh, and several modifications were applied as a result of findings from this preliminary test. Test–retest reliability was also tested on the final instrument in 30 adults (who were not included in the final sample), using Cronbach's alpha (Cronbach's alpha value = 0.82, $P < 0.05$). Measures for the instrument were developed to be consistent with McGuire's model input variables (receiver, source, channel, message and destination variables).

Receiver variables included demographics (age, gender, marital status, region of residence, education and employment type and status); participants' previous knowledge of the Corona virus (i.e. if they had ever heard of the virus's existence); their previous infection status (i.e. if they had experienced previous infection by the Corona virus); friends or family members who had been infected by the MERS-CoV; whether they had knowledge of the infectious agents for the; whether they had knowledge regarding the virus's transmission modes; participants' level of worry about acquiring the infection; the participants' estimate of the fatality rate (actual fatality rate of 30%) and whether

participants had internet access. Source variables included participants' receptivity to a message from a number of sources (physician, health care workers, the MOH, friends, family, neighbors, mosque preachers and others). Channel variables included the preferred modalities and locations for message dissemination, such as newspapers, local television, international television and radio, announcements in mosques, schools, hospital and clinic programs, the internet, a special website for MERS-CoV, mobile phone SMS messages and others. To assess the message's perceived impact, two message types were tested in the survey: (i) 'Know the transmission modes of Corona virus: it will help you protect yourself and protect your family' and (ii) 'One of the best ways to protect yourself and protect your family from Corona virus is prevention: learn the ways of prevention'. Perceived impact with these messages was assessed using a 4-point response scale, which ranged from 'very much' to 'not at all'. Other message variables included locations for posting messages, based on places frequently visited by participants. Participants were not given particular options for places visited in the last week but could enter any information in this field. To further assess variables related to the message input characteristic, participants were also asked to reply 'yes', 'no' or 'I don't know', to establish their interest in learning more about transmission modes and prevention methods. Destination variables included options for sources to which patients referred to obtain disease information (including physicians, health care workers, the internet and others).

Data analysis

Descriptive statistics (mean \pm SD) were calculated for all study variables (i.e. receiver characteristics and preferences), and percentages were determined for their various categories. The chi-squared test was used to identify any significant variations in preferences for deriving information from a particular source, or disseminated via a particular channel/media type among this population. In addition,

Table II. Frequencies of the model components

	% (n)
Receiver characteristics	
Age (years) (N = 618)	
≤20	23.0 (142)
21–30	48.5 (300)
31–40	18.8 (116)
41–50	8.4 (52)
≥51	1.3 (8)
Gender (N = 658)	
Male	61.7 (408)
Female	38.3 (252)
Education (N = 652)	
Illiterate	0.3 (2)
Elementary school	0.9 (6)
Middle school	2.4 (16)
High school	20.2 (132)
Diploma	6.7 (44)
University	59.8 (390)
Graduate school	9.5 (62)
Income (N = 652)	
≤7000 SARs	27.3 (178)
>7000 SARs	72.7 (474)
Occupation (N = 620)	
Unemployed	45.5 (282)
Owner of a business	2.3 (14)
Government employee	11.6 (72)
Private sector employee	11.6 (72)
Teacher	10.6 (66)
Health care worker	14.2 (88)
Military personnel	4.2 (26)
Region of residence in Riyadh (N = 646)	
Central	7.1 (46)
North	33.1 (214)
South	12.0 (76)
East	39.6 (256)
West	8.4 (54)
Internet access at home (N = 652)	
Yes	98.2 (640)
No	1.8 (12)
Internet access anywhere (N = 646)	
Yes	86.4 (558)
No	13.6 (88)
Awareness of MERS-CoV (N = 658)	
Aware	98.5 (648)
Unaware	1.5 (10)
Proposed transmission modes (N = 658) ^a	
Cough and sneeze droplets	86.6 (570)
Direct contact with an infected person	31.3 (206)
Using an infected person's possessions	45.0 (296)
Sexual relations	14.0 (92)

(continued)

Table II. Continued

	% (n)
responses regarding possibility of person-to-person transmission (N = 632)	
Yes	92.4 (584)
No	1.6 (10)
Don't know	6.0 (38)
Participants previous infected by MERS-CoV (N = 650)	
Yes	0.6 (4)
No	99.4 (646)
Participants with friends or family infected by MERS CoV (N = 654)	
Yes	9.8 (64)
No	86.8 (568)
Don't know	3.4 (22)
Number of infected people known by each participant (N = 56)	
1	64.3 (36)
2	21.4 (12)
3	10.7 (6)
4	3.6 (2)
Participants' level of worry (N = 646)	
Not worried	5.3 (34)
A bit worried	13.9 (90)
Worried	42.7 (276)
Very worried	38.1 (246)
Participants' estimates of fatality rate (N = 464)	
Below actual range	34.0 (158)
Within actual range (25–50%)	39.2 (182)
Above actual range	26.7 (124)
Infectious agent proposed by participants (N = 658)	
Virus	86.3 (569)
Other	13.7 (89)
Preferred source (N = 658)^a	
Physician	45.6 (300)
Health care workers	31.3 (206)
MOH	29.2 (192)
Friends	21.2 (140)
Family	19.1 (126)
Neighbors	2.4 (16)
Minister of religion	0.6 (4)
Other	8.8 (58)
Preferred channel (N = 658)^a	
Newspaper	17.3 (114)
Local TV	29.5 (194)
International TV	16.7 (110)
Radio	8.2 (54)
Preaching in mosques	4.6 (30)
Schools	7.3 (48)
Hospital and clinic programs	35.9 (236)

(continued)

Table II. Continued

	% (n)
Internet	40.4 (266)
Special website on MERS-CoV	32.5 (214)
Mobile phone messages (SMS)	26.4 (174)
Other	1.2 (8)
Participants' endorsement of test campaign messages (N = 658)	
1. Know the transmission mode of Corona virus: it will help you protect yourself and protect your family	91.1 (600)
2. One of the best ways to protect yourself and protect your family from Corona virus is prevention: learn the ways of prevention	87.8 (578)
Message: discrepancy from pre-message	
Participants' interest in knowing the prevention methods (N = 634)	
Yes	75.1 (476)
No	19.9 (12.6)
Don't Know	5.1 (32)
Participants' interest in knowing about transmission modes (N = 630)	
Interested	74.6 (470)
Not interested	21.6 (136)
Don't know	3.8 (24)
Message: places visited by participants in the past week (N = 658)^a	
Academic institutions	25.5 (168)
Shopping centers and supermarkets	29.2 (192)
Restaurants and coffee shops	5.5 (36)
Parks and outdoor entertainment venues	10.3 (68)
Hospitals and clinics	8.8 (58)
Government offices	1.2 (8)
Airports and travel stations	1.8 (12)
Workplace	2.4 (16)
Mosques	2.1 (14)
Family visits	3.0 (20)
Destination variables (sources sought) (N = 658)	
Physician	24.0 (158)
Health care workers	21.0 (138)
Internet	39.5 (260)
Call to information line	1.5 (10)
Other	9.1 (160)

^aMore than one answer option was allowed.

univariate multinomial logistic regression models were developed to detect trends in choices and preferences for specific information sources. Statistical significance was defined at $P < 0.05$.

Results

Receiver characteristics

Of the 658 participants, 38.3% were men and 61.7% were women (Table II). Average age was 27.3 years (SD = 9.1) and 24% of participants had only a high school education or less (1.9%). Twenty-three percent of participants reported an income below 7000 Saudi riyals (SAR) (approximately equivalent to 2000 USD). Many of the participants were married (59.5%) and almost one-fifth (21.2%) had at least five children. The majority of participants was residents of the capital Riyadh (98.2%; $n = 646$). Among these, 39.6% resided in the eastern region of Riyadh, with others residing in the northern (30.3%), southern (12%), western (8.4%) and central (7.1%) regions. Approximately 45% of them reported not being employed (the majority was women). Most of the participants stated that they had heard of the Corona virus (648, 98.5%), four (0.62%) claimed that they had been infected with the virus, 64 (10%) reported knowing someone who had been infected, and 36 (5.5%) reported having at least one friend or family member that had contracted the virus. Almost 20% of participants in the sample reported being 'worried' or 'very worried' about contracting MERS-CoV, and 42.7% were 'slightly worried'. The majority of participants (86.5%) was aware that the infection is caused by a virus, and the remaining participants attributed the cause either to bacteria (3.8%), genetics (0.9%), immunodeficiency (5.4%) or others (3.4%). Of all respondents, 92.4% were aware of the disease's 'person-to-person' mode of transmission, and 86.6% were aware that the disease can be transmitted via droplets from coughing and sneezing. However, many of the respondents were unaware that infection can occur through direct contact with an infected person, or by using an infected person's possessions (personal items or tools) (67.6 and 51.3%, respectively). Approximately 30% of the individuals did not provide an estimate of the disease's fatality rate because they were unable to; however,

Table III. The odds ratios and 95% confidence intervals (CIs) for preferred source of information based on the univariate multinomial logistic regression models (MOH as a reference)

Characteristics	Physician OR (95% CI)	Health care workers OR (95% CI)	Friends and family OR (95% CI)	Other OR (95% CI)
Gender				
Female	1.0	1.0	1.0	1.0
Male	0.7 (0.4–1.1)	1.3 (0.6–2.1)	0.9 (0.5–1.3)	1.2 (0.7–2.2)
Age (years)				
≤27	1.0	1.0	1.0	1.0
>27	0.6 (0.4–1.0)	1.7 (1.0–2.8)	1.1 (0.7–1.8)	0.7 (0.4–1.2)
Education				
≤High school	—	—	—	—
>High school	—	—	—	—
Income				
≤7000 SARs	1.0	1.0	1.0	1.0
>7000 SARs	0.8 (0.4–1.3)	1.1 (0.6–2.1)	0.6 (0.3–1.0)	0.9 (0.5–1.7)
Region of residence				
Central Riyadh	1.0	1.0	1.0	1.0
North Riyadh	2.5 (0.5–12.5)	1.4 (0.4–5.0)	0.8 (0.3–2.2)	1.1 (0.2–5.7)
South Riyadh	6.4 (1.2–35.1)	1.4 (0.3–6.1)	1.2 (0.4–4.1)	2.1 (0.4–12.9)
East Riyadh	3.1 (0.6–14.8)	1.3 (0.4–4.3)	1.1 (0.4–2.9)	1.5 (0.3–7.3)
West Riyadh	4.2 (6.7–23.6)	1.7 (0.4–7.2)	1.0 (0.4–7.2)	0.8 (0.1–5.2)
Transmission mode				
Not knowledgeable	1.0	1.0	1.0	1.0
Knowledgeable	1.7 (0.8–3.5)	2.2 (1.0–5.0)	1.1 (0.6–2.1)	1.4 (0.6–3.0)
Worry of infection				
A bit worried/not worried	1.0	1.0	1.0	1.0
Very worried/worried	1.2 (0.6–2.4)	2.5 (1.4–4.6)	1.8 (1.0–3.0)	1.9 (0.6–2.1)
Participants' estimates of fatality rate				
Below actual range	1.0	1.0	1.0	1.0
Within range (25–50%)	1.5 (0.8–2.8)	1.2 (0.7–2.5)	1.4 (0.8–2.8)	4.6 (2.0–10.4)
Above range	0.4 (0.2–0.9)	0.6 (0.3–1.2)	0.8 (0.4–1.6)	0.7 (0.3–1.9)

OR, odds ratio; SARs, Saudi riyals.

27.7% estimated fatality rate following infection within the range of 25–50% (actual reported range). Among the participants, 98.2% confirmed that they had access to the internet from home, and 86.3% were able to access the internet from other locations. For receiver characteristics, few statistically significant differences were detected between males and females; in particular, Significantly more females had a college degree ($\chi^2 = 91.9$, $P < 0.001$), aware that the infection is caused by a virus ($\chi^2 = 10.1$, $P = 0.002$), worried about becoming infected ($\chi^2 = 16.0$, $P = 0.001$) and reported a fatality rate within the range of 25–50% (as reported in the literature-males reported a fatality rate within a lower range) ($\chi^2 = 30.2$, $P < 0.001$). In addition, differences were

detected for some variables across age groups, with participants who were aged <30 years being more likely to report higher fatality rates ($\chi^2 = 28.2$, $P = 0.005$), to have greater awareness of the transmission modes ($\chi^2 = 19.2$, $P = 0.001$) and to be less worried about contracting the disease ($\chi^2 = 31.9$, $P = 0.001$). Participants who reported that they were aware of the Corona virus were more likely to be unemployed (mostly women) or employed in the health care sector ($\chi^2 = 90.3$, $P < 0.001$), and to have received education up to high school level or above ($\chi^2 = 172.5$, $P < 0.001$). Having a friend or relative that had been infected with MERS-CoV were found according to participants' region of residence ($\chi^2 = 119.3$, $P < 0.001$); these reports were

mainly from participants from northern and eastern Riyadh. Data for receiver characteristics are presented in Table II.

Preferred information sources and channels

In terms of participants' preferred information source delivered via a health promotion campaign, participants could select more than one answer. Generally, the preferred sources were physicians (45.6%), other health care providers such as nurses and health educators (31.3%), and the MOH (29.2%). Participants also endorsed family members and friends as 'reliable' or 'preferred' sources for an awareness campaign (19.1 and 21.3%, respectively). When participants were considered according to their first choice of preferred information source (i.e. physicians, health care workers, family and friends, the MOH or others), significant differences were found in some receiver characteristics (i.e. demographics, attitudes, knowledge and level of perceived risk and worry). Thus, physicians were preferred by those who resided in southern and western Riyadh, and other health care workers were preferred by those who reported being worried about the Corona virus. Table III presents the univariate multinomial logistic regression models for preferred sources of information as a function of participant characteristics. In terms of media channels for this campaign, an internet campaign was the most endorsed (a special website for MERS-CoV; selected by 40.4% of participants), followed by hospital and clinic programs (32.5%), local television (29.5%) and SMS (i.e. mobile phone; 26.4%).

Messages and places visited

Based on responses from participants in this study, the two messages that were tested were highly endorsed. The first message, 'Know the transmission mode of Corona virus: it will help you protect yourself and protect your family', was endorsed by 91.2% of participants. The second message 'Learn how to protect yourself from Corona virus: help yourself and help your family', was endorsed by 87.9% of participants. After exposure to these messages, 75.1% of

participants expressed an interest in learning about prevention strategies, and 74.6% expressed an interest in learning about the transmission modes of the virus. When participants were questioned on places they had visited within the last week, 29.2% reported grocery stores, malls or souks and 26.1% reported that they had frequented academic institutions such as universities and schools. Smaller percentages reported having visited outdoor public places (10.3%), hospitals and clinics (8.8%) or restaurants (5.5%). The least-frequented places were exercise and fitness venues (0.9%) (Table II).

Information sources sought by participants

Choices on destination for finding disease information, selected by participants in this study, included the internet (39.5%) and other destinations (encompassing brochures and printed material, television, hospital posters, and family and friends) (24.3%). Physicians and other health care workers were selected as preferred destinations for 23.4 and 12.8% of participants, respectively. An information helpline was selected as a preferred destination by 10 individuals (1.5%). Participants' receiver characteristics were found to influence whether the internet was selected as their primary destination for disease information, over physicians, health care workers or other destinations. For the types of information that participants sought, statistically significant associations were found for four variables; gender, age, region of residence in Riyadh and estimated fatality rate. Males and younger participants (aged ≤ 27 years) were more likely to seek information from the internet than from physicians. Thus, those residing in southern Riyadh were more likely to seek information from health care workers (other than physicians), whereas those residing in eastern and western Riyadh more often selected 'other destinations', rather than the internet, for finding disease information. Moreover, the internet was less often selected as the destination of choice among participants who overestimated the fatality rate of the Corona virus. Table IV presents the multinomial logistic regression model for the participants' selected

Table IV. The odds ratios and 95% confidence intervals (CIs) for information locations (sources sought by participants) from the univariate multinomial logistic regression models (internet as a reference)

Characteristics	Physician OR (95% CI)	Health care workers OR (95% CI)	Other OR (95% CI)
Gender			
Female	1.0	1.0	1.0
Male	0.4 (0.3–0.7)	0.7 (0.4–1.1)	0.93 (0.6–1.4)
Age (years)			
≤27	1.0	1.0	1.0
>27	0.5 (0.3–0.8)	0.8 (0.4–1.1)	0.9 (0.5–1.3)
Education			
≤High school	1.0	1.0	1.0
>High school	0.8 (0.2–3.8)	—	0.4 (0.1–1.3)
Income			
≤7000 SARs	1.0	1.0	1.0
>7000 SARs	0.8 (0.5–1.3)	0.8 (0.4–1.5)	0.7 (0.4–1.3)
Region of residence			
Central Riyadh	1.0	1.0	1.0
North Riyadh	0.9 (0.3–2.7)	2.8 (0.9–9.3)	3.3 (0.7–15.9)
South Riyadh	1.2 (0.4–4.2)	4.5 (1.2–16.4)	3.7 (0.7–9.5)
East Riyadh	1.0 (0.3–2.7)	1.3 (0.4–4.4)	6.4 (1.4–29.8)
West Riyadh	1.3 (0.4–4.6)	1.5 (0.3–6.7)	6.0 (1.1–32.8)
Transmission mode			
Not knowledgeable	1.0	1.0	1.0
Knowledgeable	0.7 (0.3–1.3)	0.8 (0.4–1.6)	1.1 (0.6–2.3)
Worry of infection			
A bit worried/not worried	1.0	1.1	1.0
Very worried/worried	1.4 (0.8–2.4)	1.1 (0.6–2.0)	1.2 (0.7–2.1)
Participants' estimates of fatality rate			
Below range	1.0	1.0	1.0
Within range (25–50%)	1.2 (0.6–2.4)	0.8 (0.4–1.5)	1.4 (0.7–2.8)
Above range	0.7 (0.4–1.5)	0.3 (0.1–0.6)	1.1 (0.6–2.1)

OR, odds ratio; SARs, Saudi riyals.

destinations for finding information on MERS-CoV, as a function of the receiver characteristics.

Discussion

The purpose of this study was to describe information-seeking behaviors with regard to emerging MERS, in Saudi communities located in Riyadh. Using constructs of McGuire's Input–Output model (receiver, source, message, channel and destination were considered as input variables), the various characteristics of this population were explored to obtain information that could be used to guide the mapping of an awareness campaign, and

to determine whether strategies used to disseminate public health messages should differ based on particular characteristics of the target population. The majority of participants had internet access, highlighting it as a viable source and media channel for online awareness campaigns.

In terms of receiver characteristics, women had higher levels of worry, were more likely to estimate fatality rates within the correct range, and were more likely to be aware of transmission modes and vehicles of transmission. Participants who belonged to younger age groups did not report being worried about contracting the disease, even though they had high awareness of transmission modes and

more often overestimated fatality rates. Such low levels of worry may be associated with poor prevention behavior, and other harmful or reckless behaviors commonly found in younger age groups [12] (which may also increase vulnerability to other diseases). In general, our survey data indicate room for improvement in awareness of transmission modes, protective behaviors and seriousness of disease knowledge of MERS-CoV. To be effective, an awareness campaign needs to promote basic education about transmission modes; otherwise its messages could be perceived as selective, e.g. in highlighting risks and a particular need for preventative behaviors in vulnerable individuals or those more likely to be exposed to the virus. The Saudi MOH has reported a positive correlation of MERS-CoV cases and contact with other infected family members [4]. Thus, individuals identified as having frequent contact with an infected person may be most in need of education on virus.

Physicians, as authoritative sources of information on diseases, were participants' preferred information source. Physicians are usually an effective source of preventative health information and promoters of healthy lifestyles [13]. When compared with the MOH, physicians were seen as a more reliable source of information by residents in the southern region of Riyadh (a population with lower socioeconomic status than the rest of Riyadh). The consideration of regional variations and preferences is essential to the success of any disease awareness campaign in any community (regions may differ in demographics).

Saudi communities have depended on social media and other information available on the internet as their main sources of information for the last decade. Dissemination on the internet of information supplied by non-specialists on prevention practices—which has not been subjected to careful scientific scrutiny and is unrecognized by the medical community—may have affected individuals' attitudes toward preventative behavior for infectious disease control in Saudi Arabia. Indeed, in a study that measured the awareness, attitudes and practices related to swine influenza, it was found that many participants remained unconvinced that Saudi MOH

reports about the disease were true, which created undue resistance, apathy and lack of interest to all interventions offered to the community [6]. The MOH has implemented a series of preventive measures to limit the spread of MERS-CoV, including the promotion of public health awareness via social media and distribution of educational materials at shopping malls, schools and mosques, as per WHO recommendations [2]. However, it is unclear whether messages on prevention strategies are reaching the general population in all regions.

Of the channels listed, the internet was most frequently selected as the preferred channel for supplying disease information (delivered by a website on control of MERS-CoV). Moreover, the internet was actually more frequently sought as a media channel and a source of information by males than females, and by those aged <27 years (the average age of participants who took part in this survey), compared with other age groups. There are no reports on search strategies for information; thus, further research is needed to determine how the internet—and in particular, the types of media channels used on the web—can be used to effectively promote awareness of emerging infectious diseases in Saudi Arabia. Interestingly, participants who underestimated the fatality rate of Corona disease were those who most often sought disease information on the internet; thus, the credibility of the sources they consulted, and the search strategies they employed, may have been questionable.

The messages presented were highly endorsed by most participants. This may be due to the similarity of their wording and a general understanding among the general population that protection is important. It may be feasible to formulate messages that will contribute to increased motivation of individuals to use a credible source of information, such as a health care provider or website for MERS. Careful attention to cultural appropriateness is highly recommended when formulating health communication messages. There is currently no available literature related to cultural appropriateness of health communication messages in Saudi Arabia,

and an understanding of the cultural components of health education and promotion is lacking.

Preferred destinations for finding disease information (i.e. where participants looked for sources) differed as a function of residential location in Riyadh. Participants from the south, east and west sought information from health care workers (source and destination other than physicians) and from source other than the internet. Although access to the internet was less of a barrier than we anticipated, those with a lower socioeconomic status may require alternative channels for communicating information about risk and prevention. Strategies that focus on attracting the attention of this segment of the population in the places that they most frequently visit (such as grocery stores and souks) are therefore highly recommended.

A limitation of this study is that, despite the fact that all regions of Riyadh were represented, the majority of the participants was from the eastern region; thus, the generalizability of the results is limited, owing to lack of equal representation. Nevertheless, this study supports the use of theory-driven approach in pre-campaign efforts to enhance the development of effective awareness campaigns for this population. The results and the constructs of the model can be used for other communities, and in the design of awareness campaigns for threats to public health other than Corona disease. Greater efforts are needed to highlight the role of physicians, public health practitioners and health care providers as credible sources of information, which can assist the public in accessing reliable and valuable information resources for health promotion via the internet. In addition, by endorsing the messages, these health care professionals can increase the credibility of awareness campaigns, as perceived by the populations targeted by the campaign [14].

Acknowledgements

The authors thank all those that contributed to data collection and data entry.

Funding

This research was supported by a grant (RC14/044) from the King Abdullah International Medical Research Center (KAIMRC).

Conflict of interest statement

None declared.

References

1. McIntosh K. Middle East respiratory syndrome coronavirus. Up-to-date. 16 April 2014. Available at: <http://www.uptodate.com/contents/middle-east-respiratory-syndrome-coronavirus>. Accessed: 21 May 2014.
2. Middle East respiratory syndrome coronavirus (MERS-CoV)—update. 15 May 2014. Available at: World Health Organization [online] (http://www.who.int/csr/don/2014_05_22_mers/en/). Accessed: 23 May 2014.
3. Epidemiological update: Middle East respiratory syndrome coronavirus (MERS-CoV). 6 May 2014. European Centre for Disease Prevention and Control. Available at: <http://ecdc.europa.eu/en/healthtopics/coronavirus-infections/Pages/index.aspx>. Accessed: 25 May 2014.
4. European Center for Disease Prevention and Control. 12 May 2014. Available at: (http://www.ecdc.europa.eu/en/press/news/_layouts/forms/News_DispForm.aspx?List=8db7286c-fe2d-476c-9133-18ff4cb1b568&ID=998). Accessed: 23 May 2014.
5. Media Statements. Ministry of Health. 21 April 2014. Available at: (<http://www.moh.gov.sa/en/CoronaNew/PressReleases/Pages/default.aspx>). Accessed: 21 April 2014.
6. Corona New Page. Ministry of Health. Saudi Arabia. 12 May 2014. Available at: <http://www.moh.gov.sa/CoronaNew/Pages/default.aspx>. Accessed: 13 June 2014.
7. Balkhy HH, Abolfotouh MA, Al-Hathloul RH *et al.* Awareness, attitudes, and practices related to the swine influenza pandemic among the Saudi public. *BMC Infect Dis* 2010; **10**: 42.
8. Martensson C, Soderfeldt B, Halling A *et al.* Knowledge of periodontal disease before and after a mass media campaign. *Swed Dent J* 2004; **28**: 165–71.
9. Silver FL, Rubini F, Black D *et al.* Advertising strategies to increase public knowledge of the warning signs of stroke. *Stroke* 2003; **34**: 1965–8.
10. White C, Kolble R, Carlson R *et al.* The impact of a health campaign on hand hygiene and upper respiratory illness among college students living in residence halls. *J Am Coll Health* 2005; **53**: 175–81.

11. Green J. The role of theory in evidence-based health promotion practice. *Health Educ Res* 2000; **15**: 125–9. doi:10.1093/her/15.2.125.
12. McGuire W. Theoretical foundations of campaigns. In Rice R and Atkin C (eds). *Public Communication Campaigns*, 2nd edn. Newberry Park, CA: Sage Publications, Inc, 1989, 43–65.
13. Robb KA, Miles A, Wardle J. Perceived risk of colorectal cancer. Sources of risk judgments. *Cancer Epidemiol Biomarkers Prev* 2007; **16**: 694–702.
14. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. *Arch Fam Med* 2000; **9**: 426–33.