

# Behavior Responses and Attitude of the Public to COVID-19 Pandemic During Movement Restrictions in Saudi Arabia

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**Background:** The behavior of the general public and the adoption of precautionary measures during a pandemic determine the fate of the country in the absence of any specific cure. This study aimed to determine the public attitude and behavior responses to the COVID-19 pandemic in Saudi Arabia during movement restrictions, and the predictors of behavioral responses.

**Methods:** A community-based cross-sectional study of 2470 adult individuals in Saudi Arabia, 17–29 April 2020 was conducted via Survey Monkey, using an anonymous validated e-questionnaire. Data were collected on demographic characteristics, COVID-19-related attitudes, and behavioral responses in terms of; precautionary measures, preparedness, and self-quarantine activities, to be responded to by 4-point Likert scales. Multiple linear regression analyses were performed to identify the significant predictors of compliance with different behaviors. Significance was considered at  $p < 0.05$ .

**Results:** Participants reported positive attitudes towards governmental actions (95%), self-hygiene (93.2%), social distancing (97.1%) and choice of healthy food (89.6%), and negative attitudes towards the current worldwide situation of the pandemic (81.0%) and hearing someone tested positive (77.8%) or died from COVID-19 (83.7%). High rates of compliance to behavior were reported by only 55.8% of participants in terms of precautionary measures (71.3%), preparedness (38.4%), and self-quarantine activities (46.1%). After adjusting for all possible confounders, the total attitude score was a significant predictor of the total scores of precautionary measures ( $t=12.01$ ,  $p<0.001$ ), preparedness ( $t=9.29$ ,  $p<0.001$ ), self-quarantine activities ( $t=12.05$ ,  $p<0.001$ ), and overall behavior response ( $t=14.09$ ,  $p<0.001$ ). Other significant predictors of higher overall behavior response scores were female gender ( $t=7.22$ ,  $p<0.001$ ) and non-Saudi nationality ( $t=3.40$ ,  $p<0.001$ ).

**Conclusion:** This study provides baseline data on the behavioral response to the national COVID-19 pandemic in Saudi Arabia. The levels of compliance to behavior response and attitude to COVID-19 pandemic were less than satisfactory. Socio-demographics influence public behavior and protective health measures. COVID-19 awareness programs are recommended.

**Keywords:** SARS-CoV-2, lockdown, perception, behavior, compliance, preparedness, precautionary measures, self-quarantine

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## Background

Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) was declared a worldwide pandemic<sup>1</sup> on 11 March 2020. WHO reported 35 million infected persons and more than one million deaths worldwide as of Oct 12, 2020.<sup>2</sup> This

pandemic is a disaster all over the world, with its impact on health, social life and economy, especially when countries are unprepared. Responses of countries to the COVID-19 pandemic have been varied,<sup>3,4</sup> with many countries reopening workplaces, schools, and social gatherings to adapt their economies and resume international travel, while others attempting to suppress transmission of SARS-CoV-2 by restricting businesses, industries, and schools while waiting for future COVID-19 vaccines or treatments.<sup>5</sup>

In response to this pandemic in Saudi Arabia, on 27 February 2020, all visits to Mecca and Medina to perform Umrah and visit the holy mosques have been suspended. Religious gatherings, including daily congregational prayers and Friday weekly congregational prayer in local mosques, have been suspended. Saudi Arabia also suspended operations in many government agencies starting March 16, 2020. All schools and universities were temporarily closed with remote teaching through virtual learning platforms. The operation of many markets and malls was suspended; gatherings in parks, beaches, and resorts have been prohibited. Restaurants were closed except for take-away service. Pharmacies and grocery stores remained open to serve customers through governmental assigned online delivery applications and systems. All international flights, both incoming and outgoing, were suspended from March 15, 2020. All domestic flights, as well as inter-urban bus, taxi, and train transportation, were all suspended beginning on March 21, 2020. On March 26, 2020, travel between regions of the KSA became prohibited. A nationwide 7 PM – 6 AM curfew had been in effect for the entire country.<sup>6,7</sup>

All precautionary preventive measures such as; social distancing, proper handwashing or sanitizing with antiseptic gels, using a tissue or elbow when sneezing or coughing, sanitizing surfaces, and staying home when curfews were announced and home isolation when necessary, were largely practiced by the inhabitants.<sup>6</sup> Health care professionals at entrances of hospitals, supermarkets, and all other communal places were available to measure temperatures and provide sanitizing gels as well as gloves. Although the use of masks was not enforced on the public early on, suitable masks were available, and their use (especially N95 masks) was obligatory for health care staff. Online and mobile apps functioned well for orders of groceries, medicine, food from restaurants, and other purchases. Remote, electronic, and virtual meetings and work implementation from homes took place for all applicable public and private employees to resume work once they were instructed not to report to their original

place of work. Awareness SMS messages in various languages were regularly sent from the MOH to all registered mobile cell phones in the country. On 9 March 2020, the Saudi Arabian government issued a directive ordering the donation of 10 million USD to support the efforts of WHO to combat the disease.<sup>8</sup>

Learning more about the attitudes, and behaviors of the public during an infectious disease outbreak can be crucial to improve communication efforts by public health officials and clinicians. Lessons have been learned from the outbreak of the 1997 avian influenza (H5N1), the 2003 SARS coronavirus, MERS (2012), and Swine influenza (2009), that communication by public health officials and protective health measures taken at the individual level can limit the effects of a pandemic.<sup>9</sup> Previous studies have been published on individual knowledge and behavior concerning SARs and Avian influenza,<sup>10,11</sup> and behavioral responses of the public, and attitude to the 2009 swine influenza pandemic.<sup>12–16</sup> Hypothetical pandemic scenarios<sup>17,18</sup> showed that the number of cases increases with a poor behavioral response to public health measures. This study aimed to determine the attitude and behavioral responses toward COVID-19 pandemic in Saudi Arabia during movement restrictions, and to investigate the association between levels of attitude and behavioral responses. To the best of our knowledge, this is the first study from the Kingdom of Saudi Arabia that focuses on understanding the public's behavioral response toward a pandemic threat. Although, from a global perspective, it is necessary to increase and join efforts in order to develop an effective vaccine and make it available for everyone, as this would be the most effective preventive measure for both diseases,<sup>19</sup> the behavior of the general public and the adoption of precautionary measures will determine the fate of the country in the absence of any specific cure. Thus, this study will assist government health agencies in Saudi Arabia to understand the behavior and the perception of the general public concerning COVID-19.

## Methods

### Study Design

A community-based cross-sectional survey.

### Study Population and Sampling Technique

For the physical distancing strategy and to minimize face-to-face interaction, we developed an online questionnaire

via Survey Monkey (<https://www.surveymonkey.com>) that limits 1-time participation per unique internet protocol (IP) address. This questionnaire was designed to be sent to a convenient sample of the public in different cities of Saudi Arabia during April-May 2020, via groups on Facebook, Twitter, Instagram, etc. Based on the assumption of 50% compliance with precautionary measures, and with a margin of error of 0.02 and 95% confidence limits, the sample size of 2396 was estimated. To compensate for an average of 50% non-response to the e-questionnaire and incomplete data collection, a sample size of ~ 5000 was targeted. A total of 2470 participants agreed to participate and responded with completed questionnaires. Inclusion criteria were; Saudi citizens, permanent residents or non-residents with employment or work permit, who can read and communicate with the Arabic or English language, and aged  $\geq 18$  years at the date of the survey. Exclusion criteria were; lack of access to the internet, or inability to complete an online survey.

## Data Collection

A self-administered questionnaire was designed after reviewing the literature to have a validated tool to collect data on the following:

### Attitudes Toward COVID-19 Pandemic

Based on surveys previously used in studies of avian influenza and severe acute respiratory syndrome (SARS),<sup>13,20–23</sup> the disease, its severity, governmental efforts to combat it, and disease outcomes were assessed by 14 attitudinal statements. Agreement with the nine statements “1,3,5,6,8,9,11,13,14” and disagreement with the five statements “2,4,7,10,12” imply a positive attitude towards COVID-19 pandemic. For the positive statements, a scale of 1 to 4, with 4 = strongly agree, and 1 = strongly disagree was used, and for the negative statements, the opposite score was applied, with 1 = strongly agree and 4 = strongly disagree. A total score was obtained by summing the scores for the 14 statements that ranged from 14 to 56 points and then a total percent score was calculated. Levels of attitude were categorized according to this percent score into positive ( $>75\%$ ), neutral (50–75%) and negative ( $<50\%$ ) attitudes.

### Behavioral Responses

Based on US the Center for Disease Control (CDC), and WHO reports,<sup>24,25</sup> a self-reported questionnaire was constructed of 21 statements distributed on three response domains; precautionary measures (7 statements),

preparedness (7 statements) and self-quarantine activities (7 statements), to be responded to by a 4-point Likert scale as follows:

1.) Precautionary measures. Each participant was asked to report the precautionary measures that s/he has been using during the epidemic to prevent infection such as; proper handwashing, use of hand sanitizer, wearing a face mask, avoidance of touching face, nose, and eyes, etc. Using a scale of 1 to 4, with 4= Always, 3= Often, 2= Sometimes and 1 = Rarely, a total score was obtained by summing the scores for the 7 statements, which ranged from 7 to 28 points.

2.) Preparedness. Each participant was asked to report the Preparedness measures such as; stocking up enough food and medicines, psychological preparation, and awareness about sick leave, absenteeism, and teleworking policies. Using a scale of 1 to 4, with 4= Definitely, 3= Probably, 2= Possibly and 1 = Never, a total score was obtained by summing the scores for the 7 statements, which ranged from 7 to 28 points.

3.) Self-Quarantine Activities. Each participant was asked to report the self-quarantined activities such as; caring for family members/partners, reading religious books, making benefits of online media to catch up with friends/colleagues/neighbors, doing productive things for family, etc. Using a scale of 1 to 4, with 4 = Always, 3= Often, 2= Sometimes and 1 = Rarely, a total score was obtained by summing the scores for the 7 statements, which ranged from 7 to 28 points.

4.) Overall behavioral response. Participants' responses were assessed by summation of the scores of the 21 statements for the 3 response domains, ranged from 21 to 84 points. A total percent score was calculated for the overall behavior response and each of the 3 behavior response domains. This percent score was categorized into high ( $>75\%$ ), average (50–75%), and low ( $<50\%$ ) compliance.

Data on socio-demographic characteristics were collected such as; gender, age, education, and occupation, nationality, contraction of COVID-19 infection by one of the family members and/or friends. The reliability of the Arabic version of the questionnaire was assessed in terms of internal consistency. Cronbach's alpha was computed, and a coefficient alpha of 0.83 was considered adequate. Test-retest reliability was also assessed using Cronbach's alpha and Pearson's correlation coefficient (r). Construct validity of the checklist was assessed using expert opinion, and the final version was approved accordingly.

## Data Analysis

Data entry and statistical analysis were performed with the Statistical Package for Social Science (SPSS) software program for Windows (version 25.0). Descriptive statistics, such as percentages, means, and standard deviations, were calculated. For categorical data, chi-square test was applied, and for continuous data, both Student's *t*-test and ANOVA were applied. Multiple regression analyses were performed to determine the significant predictors of the percent mean scores for the overall behavior response and the different domains of behavior response, with the following independent variables; age (in years), sex, marital status (married versus others), total attitude score, education (continuous ordinal), occupation (employed versus unemployed), nationality (Saudi versus non-Saudi) and the number of family members. Statistical significance was considered at  $p < 0.05$  for all analyses.

## Results

### Personal and Demographic Characteristics

A total of 2470 subjects participated in the study, 58.5% were females, 76.1% Saudis, 76.9% married, 55% were employed, 80.6% having a Bachelor degree or more, and 65% residing in the central region of Saud Arabia. The number of family members was 6–7 for 41.4% of all subjects, [Table 1](#).

### Attitude Towards COVID-19 Pandemic

[Table 2](#) shows the public perception and attitude towards the COVID-19 pandemic in Saudi Arabia. Nearly one-half of all participants (52.7%) reported a positive attitude towards the COVID-19 pandemic. The majority of participants agreed positively that; effective actions were taken by the government to limit the spread of the disease (95%), that they became more concerned about self-hygiene ((93.2%), committed to social distancing (97.1%), pro-sharing information about COVID-19 (83.6%), make sure of the right source of information on COVID-19 in the region (94.8%), make sure they spread the correct information about the disease (94.4%), have to choose the foods that improve their immunity to combat the disease (89.6%), and that they are so far optimistic the disease will be over shortly (87.2%). Meanwhile, the majority of participants agreed negatively that; they feel scared about the current worldwide situation of the pandemic (81.0%) and feel frightened when they hear someone tested positive (77.8%) or died from COVID-19

**Table 1** Personal and Sociodemographic Characteristics of Participants

Personal Characteristics	No	%
Gender		
Male	1026	41.5
Female	1444	58.5
Age group (years)		
18–30	936	37.9
31–45	852	34.5
46–60	592	24.0
>60	90	3.6
Nationality		
Saudi	1880	76.1
Non-Saudi	590	23.9
Marital status		
Married	1900	76.9
Unmarried	570	23.1
Number of family members		
2–3	478	19.4
4–5	556	22.5
6–7	1022	41.4
8 or more	414	16.7
Educational level		
Less than secondary	62	2.5
Secondary	418	16.9
Bachelor	1322	53.5
Master	406	16.4
PhD	262	10.7
Occupation		
Employed	1358	55.0
Unemployed	1112	45.0
Residency		
Central	1602	64.9
East	296	12.0
West	286	11.6
North	140	5.7
South	146	5.8

(83.7%). More than one-half of participants (58.4%) reported feeling tense from getting excessive information about COVID-19, and 39.5% reported feeling stressed due to the movement restrictions (39.5%).

### Behavioral Responses to COVID-19 Pandemic

[Table 3](#) shows behavioral responses of the public to the COVID-19 pandemic in Saudi Arabia in terms of the following domains:

**Table 2** Saudi Public Perception and Attitude Towards COVID-19 Pandemic

Attitude Statements	SA	AG	DA	SD
	%	%	%	%
1. I believe that the actions taken by the government to limit the spread of COVID 19 are effective.*	84.0	11.0	3.2	1.8
2. I am scared about the current worldwide situation of COVID-19 pandemic.	39.1	41.9	13.6	5.4
3. COVID-19 pandemic made me more concerned about self- hygiene (proper hand washing, using hand sanitizer, facemask).*	71.7	21.5	4.5	2.3
4. I feel frightened when I hear someone got tested positive from COVID-19.	38.5	39.3	14.7	7.5
5. I am committed to social distancing as a protective measure against COVID-19 pandemic.*	83.4	13.7	1.5	1.4
6. I can effectively study/work remotely at home.*	48.7	28.1	15.1	8.1
7. I feel frightened when I hear someone died from COVID-19.	52.6	31.1	11.8	4.5
8. I am pro sharing information about COVID-19.*	57.9	25.7	11.6	4.8
9. I have to be sure of the right source of information/updates on COVID-19 (number of new deaths/numbers of new infectious) in my region.*	81.9	12.9	2.9	2.3
10. Getting excessive information about COVID-19 makes me more tensed.	29.8	28.6	25.8	15.8
11. I make sure that I spread the correct information regarding the COVID-19.*	80.6	13.8	2.9	2.7
12. I feel stressed due to the movement control regulations.	16.9	22.6	28.0	32.5
13. I have to prioritize having foods that improve the immune system to combat with COVID-19 virus.*	62.0	27.6	7.4	3.0
14. I am optimistic that COVID-19 will be shortly over.*	63.1	24.1	9.6	3.2

**Note:** \*Positive attitude statement.

**Abbreviations:** SA, strongly agree; AG, agree; DA, disagree; SD, strongly disagree.

## Precautionary Measures

The majority of participants reported that they always/often carry their hand sanitizer when going outdoors (71.5%), comply with proper handwashing (95.4%), avoid touching their face, nose, or eyes (88.5%), cover nose and mouth with a tissue when coughing or sneezing (92%), disinfect things like food and drinks they bring from outside (84.4%), disinfect high touch surfaces (78.4%) and wear a mask when outdoors (68.3%). Of a total attitude score of 28 points (range 7–28 points), the mean score of  $23.4 \pm 4.2$  points and a percent mean score of  $83.6\% \pm 14.8\%$  were shown, indicating a high level of precautionary measures toward COVID-19 pandemic.

## Preparedness

Less than one-half of all participants reported they definitely prepare their plan for the trip to shop or run errands during the movement restriction period (49.1%), are aware of sick leave, absenteeism, and teleworking policies (49%), have psychological preparation to cope with changes in healthcare during the movement restriction

period (43.2%), and searched for the nearest healthcare center to seek medical care (42.7%). Less than one-fourth of all participants kept enough medicines (21.8%), and food (19.5%) to use during the movement restriction period, and only 27.6% reported discussing with friends/family members what to do if one catches COVID-19 virus.

## Self-Quarantine Activities

The majority of participants reported that, during the movement restriction period, they always/often have spent quality time at home caring for their family (87.2%), making benefits of online media (89.6%), doing productive things for the family such as cooking, cleaning, etc. (85.5%), and obeying their religion (71.2%). Meanwhile, more than one-half of all participants spent that time; planning their future dreams, goals or aims (62.6%), teaching their kids (54.9%), or learning new skills (52.1%).

Table 4 shows the levels of attitude and different behavioral response domains by gender for the population in



**Table 3** Behavioral Responses of the Public to COVID-19 Pandemic in Saudi Arabia

<b>A. Precautionary Measures</b>	<b>Always %</b>	<b>Often %</b>	<b>Sometimes %</b>	<b>Rarely %</b>
1. I carry my own hand sanitizer wherever I go outdoors.	46.6	24.9	14.6	13.9
2. I comply with proper hand washing.	74.0	21.4	3.2	1.4
3. I wear a face mask when I am outdoors to avoid catching the COVID-19 virus.	47.7	20.6	14.7	17.0
4. I avoid touching my face, nose, eyes to protect myself from the COVID-19 virus.	60.8	27.7	8.4	3.1
5. I cover my nose and mouth with a tissue when coughing or sneezing, and throw it directly after use.	74.2	17.8	5.2	2.8
6. I disinfect things I bring from outside (Foods, drinks, etc.).	60.9	23.5	8.0	7.6
7. I clean and disinfect high touch surfaces (Mobile, Doorknobs, Table surfaces, TV remote, etc.).	51.0	27.4	13.0	8.6
<b>B. Preparedness</b>	<b>Definitely %</b>	<b>Probably %</b>	<b>Possibly %</b>	<b>Never %</b>
1. I currently stock up enough food and necessities to last during the pandemic duration prior to Movement restrictions	19.5	32.8	25.7	22.0
2. I currently have enough medicines to keep me going during the pandemic duration prior to Movement restrictions if I fall ill.	21.8	32.3	25.7	20.2
3. I have searched for the nearest healthcare/hospital location and phone number to seek medical assistance if I fall sick with symptoms of COVID-19.	42.7	25.5	14.8	17.0
4. I discuss with a friend/family member on what we need to do if one of us catches the COVID-19 virus.	27.6	26.1	19.3	27.0
5. I have psychological preparation to cope up with any possible changes in Health care during the Movement restrictions period.	43.2	31.7	16.5	8.6
6. I am aware about sick leave, absenteeism and teleworking policies.	49.0	26.3	13.6	11.1
7. I prepare my plan for the trip to shop or run errands in this Movement restrictions period.	49.1	30.5	11.6	8.8
<b>C. Self-Quarantine Activities</b>	<b>Always %</b>	<b>Often %</b>	<b>Sometimes %</b>	<b>Rarely %</b>
1. During the movement restrictions period, I have spent quality time at home by caring for my family members/partners	59.1	28.1	8.9	3.9
2. During the movement restrictions period, I spend quality time obeying my religion (increase worship for God, reading religious books, etc).	29.8	41.4	22.8	6.0
3. During the movement restrictions period, virtually I make benefits of online media to catch up with friends/colleagues/neighbors	56.5	33.1	8.5	1.9
4. During the movement restrictions period, I utilize this time to do productive things for my family (cooking, cleaning, indoor games, etc).	52.9	32.6	10.9	3.6
5. I make benefits of the movement restrictions period to teach my kids.	24.9	30.0	17.6	27.5
6. I use the movement restrictions period to learn new skills (Graphics designing, software, online professional certification course, etc).	25.5	26.6	25.8	22.1
7. I try to benefit from the movement restrictions period to plan my future dreams, goals, aims, and actions.	32.9	29.7	20.2	17.2

Saudi Arabia. More than one-half (52.7%) of all participants reported a positive attitude towards COVID-19 pandemic, with a significantly higher proportion of positive attitude among male participants than among females ( $\chi^2=21.627$ ,  $df$  2,  $P < 0.001$ ). The percent mean score of attitude was  $76.1 \pm 8.4$ , with no significant sex difference. ( $t=1.77$ ,  $p=0.08$ ). Of a total attitude score of 56 (range 18–56 points), the mean attitude score of  $42.6 \pm 4.7$  points and percent mean attitude score of  $76.1\% \pm 8.3\%$  were

shown, reflecting generally, a positive attitude towards COVID-19 pandemic, with no significant sex difference ( $t=1.77$ ,  $p=0.08$ ).

Overall, more than one-half (55.8%) of all participants reported a high level of compliance to behavioral responses to the COVID-19 pandemic. These constituted 71.4% in precautionary measures, 38.4% in preparedness, and 46.1% in self-quarantine activities, with significantly higher proportions among females than among males. The

**Table 4** Levels of Attitude and Different Behavioral Response Domains by Gender for Population in Saudi Arabia

Perception/Attitude	(<50%) No(%)	(50–75%) No(%)	(>75%) No(%)	% Mean Score
	Negative	Neutral	Positive	
Male	18(1.8)	440(42.9)	568(55.3)	76.5±8.9
Female	4(0.3)	704(48.9)	732(50.8)	75.9±7.9
Total	22(0.9)	1144(46.4)	1300(52.7)	76.1±8.4
$\chi^2=21.627$ , $df$ 2, $P < 0.001$ *				$t=1.77$ , $p=0.08$
Behavioral Response	Low Compliance	Average Compliance	High Compliance	% Mean Score
Precautionary measures				
Male	44(4.3)	332(32.4)	650(63.3)	80.3±15.4
Female	28(1.9)	304(21.1)	1112(77.0)	85.9±14.0
Total	72(2.9)	636(25.7)	1762(71.4)	83.6±14.8
$\chi^2=56.814$ , $df$ 2, $p=0.001$ *				$t=9.13$ , $p<0.001$ *
Preparedness				
Male	104(10.1)	542(52.8)	380(37.1)	70.5±15.9
Female	124(8.6)	752(52.1)	568(39.3)	71.9±16.1
Total	228(9.2)	1294(52.4)	948(38.4)	71.3±16.1
$\chi^2=2.449$ , $df$ 2, $P = 0.294$				$t=2.12$ , $p=0.034$ *
Self-quarantine activities				
Male	52(5.1)	582(56.7)	392(38.2)	73.4±15.4
Female	70(4.8)	628(43.5)	746(51.7)	76.3±14.9
Total	122(4.9)	1210(49.0)	1138(46.1)	75.1±15.2
$\chi^2=45.076$ , $df$ 2, $P < 0.001$ *				$t=4.67$ , $p<0.001$
Overall response				
Male	44 (4.3)	500 (48.7)	482 (47.0)	74.7±12.6
Female	20 (1.4)	528 (36.6)	896 (62.0)	78.0±11.8
Total	64 (2.6)	1028 (41.6)	1378 (55.8)	76.4±12.2
$\chi^2=66.27$ , $df$ 2, $p< 0.001$ *				$t=6.59$ , $p<0.001$ *

**Note:**  $\chi^2$  Pearson Chi square test,  $t$  Student's  $t$ -test, \*statistically significant.

highest percent mean score occurred in precautionary measures (83.6%±14.8%, high response), followed by self-quarantine activities (75.1%±15.2%, high response) and preparedness (71.3%±16.1%, average response), with significantly higher proportions among female participants than among male ones in the three response domains ( $p<0.001$  each), [Table 4](#).

[Table 5](#) shows the predictors of different behavioral responses to COVID-19 in Saudi Arabia. The total attitude score was a significant predictor of the overall behavior response score ( $t=14.09$ ,  $p<0.001$ ), and its all domains; namely precautionary measures ( $t=12.01$ ,  $p<0.001$ ), preparedness ( $t=9.29$ ,  $p<0.001$ ) and self-quarantine activities ( $t=12.05$ ,  $p<0.001$ ). Female sex was a significant predictor of compliance to precautionary measures ( $t=9.86$ ,  $p<0.001$ ), preparedness ( $t=2.87$ ,  $p=0.004$ ), self-quarantine activities ( $t=4.67$ ,  $p<0.001$ ) and the overall behavioral response score ( $t=7.22$ ,  $p<0.001$ ). Older age

was significantly and directly associated with higher scores of both precautionary measures ( $t=2.63$ ,  $p=0.009$ ) and preparedness ( $t=1.97$ ,  $p=0.049$ ), while it was inversely associated with self-quarantine activities ( $t=2.84$ ,  $p=0.005$ ). Being married was inversely associated with preparedness score ( $t=1.99$ ,  $p=0.047$ ). Non-Saudi nationality was significantly associated with precautionary measures score ( $t=4.95$ ,  $p<0.001$ ), self-quarantine activities ( $t=2.04$ ,  $p=0.04$ ), and the overall behavioral response score (3.40,  $p=0.001$ ). Higher education was significantly associated with compliance to self-quarantine activities ( $t=2.79$ ,  $p=0.005$ ). The lower the number of family members, the higher was the compliance to precautionary measures ( $t=3.47$ ,  $p=0.001$ ).

[Figure 1](#) shows the relationship between levels of attitude towards the COVID-19 pandemic and behavioral response percent mean scores in Saudi Arabia. It shows that as the level of attitude was shifted from negative to positive,

**Table 5** Predictors of Compliance to Different Behavioral Response (Scores) to COVID-19 in Saudi Arabia

Predictors	Precautionary Measures		Preparedness		Self-Quarantine Activities		Overall Response	
	t-value	p-value	t-value	p-value	t-value	p-value	t-value	p-value
(Constant)	20.04	<0.001	14.15	<0.001	14.44	<0.001	20.51	<0.001
Gender (male <sup>#</sup> versus female)	-9.86	<0.001*	-2.87	0.004*	-4.67	<0.001*	-7.22	<0.001*
Age (in years)	2.63	0.009*	1.97	0.049*	-2.84	0.005*	0.75	0.45
Marital status (married <sup>#</sup> vs others)	1.31	0.19	-1.99	0.047*	1.40	0.16	0.22	0.83
Nationality (Saudi <sup>#</sup> vs non-Saudi)	-4.95	<0.001*	-1.24	0.22	-2.04	0.04*	-3.40	<0.001*
Education (continuous ordinal)	-1.29	0.20	-0.12	0.91	2.79	0.005*	0.60	0.55
Occupation (employed <sup>#</sup> vs unemployed)	-0.17	0.86	1.51	0.13	0.66	0.51	0.89	0.38
Number of family members	-3.47	0.001*	-1.36	0.18	0.30	0.76	-1.88	0.06
Total attitude score	12.01	<0.001*	9.29	<0.001*	12.05	<0.001*	14.09	<0.001*

Notes: \*Statistical significance, <sup>#</sup>reference category. p-value was calculated for each variable after adjusting for all other variables by multiple regression analysis.

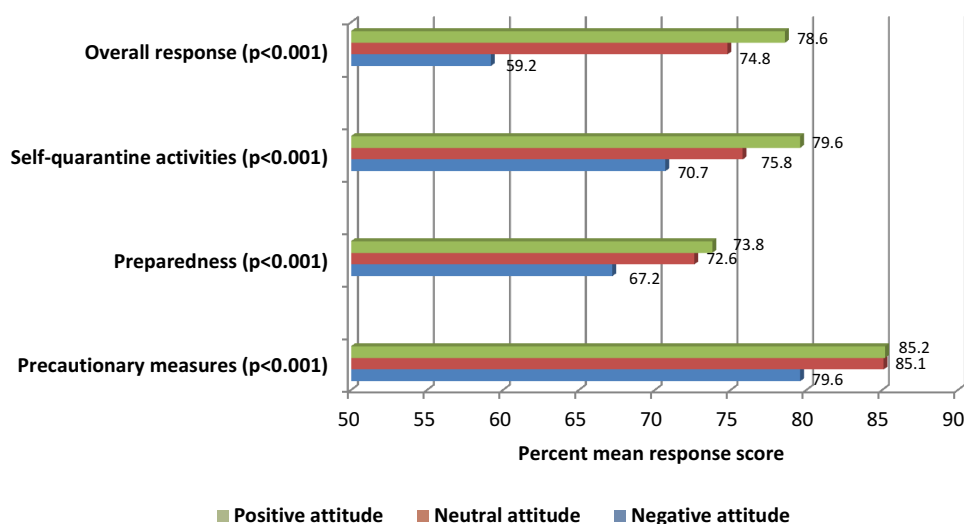
there was a significant increase in percent mean score of overall behavioral responses ( $f=52.77$ ,  $p<0.001$ ), precautionary measures ( $f=35.21$ ,  $p<0.001$ ), preparedness ( $f=34.01$ ,  $p<0.001$ ) and self-quarantine activities ( $f=53.004$ ,  $p<0.001$ ).

## Discussion

The current study was aimed to assess community attitude towards COVID-19 pandemic, its severity, governmental efforts to combat it, and disease outcomes. A positive attitude towards the COVID-19 pandemic was reported by nearly one-half of all participants, and this finding is less than satisfactory. Nearly all participants a reported positive

attitude towards; effective actions were taken by the government to limit the spread of the disease, self-hygiene, social distancing, seeking the right source of information on COVID-19 in the region, spreading the correct information about the disease, choosing the foods that improve their immunity to combat the disease, and the future disappearance of the disease shortly. These figures are similar to the figures in other countries, such as Pakistan and the USA where 80% and 98% of the public respectively reported willingness to stay at home and skip social events.<sup>26,27</sup>

Psychological distress remains one of the main health problems in Saudi Arabia during the pandemic. The majority

**Figure 1** Relationship between levels of attitude towards COVID-19 pandemic and behavioral response (percent mean score) in Saudi Arabia.



of participants, in the present study, reported distress due to the current worldwide situation of the pandemic, hearing that someone was tested positive or died from COVID-19, and getting excessive information about COVID-19 and movement restrictions. This finding was in agreement with the findings of other previous studies that reported distress due to COVID-19 among 40% in Saudi Arabia,<sup>28</sup> 40% in Italy,<sup>29</sup> 38% in France,<sup>30</sup> 59% in Iran.<sup>31</sup> Females were more likely affected by distress due to COVID than males. This finding was in agreement with the findings of previous studies in Saudi Arabia,<sup>28</sup> China,<sup>32</sup> and Italy.<sup>33</sup> This could be attributed to the sex difference in hormonal response to stress.<sup>34</sup> Many studies in the literature revealed that males are more likely to take risks than females.<sup>35,36</sup>

The behavior of the general public is important to fight the spread of this deadly virus, in the absence of a vaccine. Compliance to precautionary measures such as social distancing, use of face coverings, hand and respiratory hygiene, and avoiding crowds and poorly ventilated spaces is challenging in Saudi Arabia, due to its social and religious norms and its annual hosting of high visibility international religious mass gatherings.<sup>28</sup> In the present study, a high level of compliance to precautionary measures was reported by 71.3% of participants. These figures are in agreement with the findings of a study in Pakistan showing a high level of compliance with good hygiene practice by the public,<sup>26</sup> and the findings of a study done on Turkish adults that revealed that the most practiced preventive methods were avoidance of public transportation and frequent handwashing with soap and water or alcohol-based hand rub.<sup>37</sup> Our findings are also similar to figures of other community-based surveys in Saudi Arabia that showed high levels of trust and compliance by the Saudi public, with the precautionary measures against COVID-19 employed by authorities.<sup>38,39</sup> These findings are encouraging for Saudi Arabia, as a key measure to mitigate the transmission of COVID-19. A community-based study in Pakistan showed that 29% did not wear face masks.<sup>40</sup>

Saudi government supported the population during the COVID-19 pandemic in different ways to contain the disease: Online and mobile apps functioned well for orders of groceries, medicine, food from restaurants, and other purchases, persons who suspect that they are ill with SARS-CoV-2 were provided a specific number to call, and a team was dispatched to the caller's location for medical examination; thus, there was no need to go to a hospital, free health care, including prescription medications, was granted to all people, citizens, and residents

(legal or illegal), and a daily press conference was held by the Saudi MOH, providing COVID-19-related updates and events information nationally and internationally, as well as answering questions from reporters.<sup>6</sup> In our study, only one-third of all participants reported a high level of preparedness during the movement restrictions period; preparing their plan for the trip to shop or run errands, being aware of sick leave, absenteeism, and teleworking policies, having psychological preparation to cope with changes in healthcare, and searching for the nearest healthcare center to seek medical care, keeping enough medicines, and food to use, and discussing with friends/family members what to do if one catches COVID-19 virus.

In the initial phase of the pandemic, many countries instituted lockdowns to slow the rapid spread of the virus. This was essential to reduce mortality,<sup>41,42</sup> prevent healthcare services from being overwhelmed, and buy time to set up pandemic response systems to suppress transmission following lockdown. However, in our study, less than one-half of all participants reported a high level of compliance with self-quarantine measures. This finding is similar to that in Southwest Ethiopia, where only 52.3% reported a positive response toward quarantine.<sup>43</sup> Training people to understand the reason for quarantine might increase belief in its effectiveness and thus, their compliance with quarantine.<sup>43</sup> A study conducted in South Korea revealed that most of the participants believed quarantine was ineffective to control the Middle East respiratory syndrome (MERS) or even increases the risk of spreading MERS.<sup>44</sup> This might be related to the study time gap, as the study conducted in South Korea was in 2015 so there is a high information difference related to quarantine compared to the current study.<sup>43</sup> In our study, the majority of participants reported that, during the movement restriction period, they always/often have spent quality time at home caring for their family (87.2%), making benefits of online media (89.6%), doing productive things for the family such as cooking, cleaning, etc. (85.5%), or obeying their religion (71.2%). Meanwhile, more than one-half of all participants spent that time; planning their future dreams, goals, or aims (62.6%), teaching their kids (54.9%) or learning new skills (52.1%). During the 2003 pandemic of the SARS, the use of quarantine, border controls, contact tracing, and surveillance proved effective in containing the global threat in just over three months.<sup>45</sup> However, only once this pandemic ends, one will be able to assess the health, social and economic impact of this global disaster and we should be able to learn lessons especially

in terms of public and global health for any future similar pandemics.<sup>46</sup>

Low-risk perception reduces the frequency of preventive behaviors. Citizens in Saudi Arabia with low-risk perception showed lower uptake of social distancing and behaviors such as wearing masks and hand washing during the H1N1 pandemic,<sup>13</sup> and residents in Sierra Leone with lower anxiety toward SARS were less likely to practice cautious behaviors to protect themselves.<sup>47</sup> The present study showed that as the level of attitude was shifted from negative to positive, there was a significant increase in percent mean score of overall behavioral responses, precautionary measures, preparedness and self-quarantine activities. Even after adjusting for all possible confounders, a significant direct association between the attitude and behavior remained. This finding may reflect the high level of information among those with a positive attitude towards the COVID pandemic, about the disease, its severity, and mode of transmission, and this high information level may act as one of the factors that lead to the high level of compliance to the preventive behaviors.

Socio-demographic characteristics play a vital role in shaping the attitudes and behaviors of a community in the prevention of any pandemic disease. Gender and age are the two main factors that can play a role in people's risk perceptions in terms of their propensity to take the risk.<sup>40</sup> In our study, female sex was a significant predictor of compliance to precautionary measures, preparedness, self-quarantine activities, and overall behavior. Women are usually able to break with tradition to safeguard the health of their children and adjust the community's system to the best advantage of them.<sup>48</sup> Older age was significantly and directly associated with higher compliance to both precautionary measures and preparedness, while it was inversely associated with compliance to self-quarantine activities. This was in agreement with the results of others,<sup>40</sup> where the older respondents were less likely to stay at home as compared to younger respondents. The reason may be the traditional and cultural values of the society in the developing world, where older people spend most of the day time in a social gathering outside the home. Therefore, it may not be easy for them to leave their social gathering and friends.<sup>40</sup> Higher education was significantly associated with compliance to self-quarantine activities, and this finding was in agreement with the findings of another study,<sup>40</sup> where education was one of the most influential factors having a positive effect on the adoption of precautionary measures. A respondent having a higher education

was more likely to leave entertainment outside the home and use a mask going outside the home as protective measures to avoid COVID-19 infection.

It was surprising that married participants were less compliant with preparedness. Moreover, the study also showed that the lower the number of family members, the higher was compliance with the precautionary measures. Living with others was an independent predictor of a high level of concern about COVID-19 infection, most likely due to their fear of transmitting the infection to others if they get infected. In a previous study in Pakistan,<sup>40</sup> married respondents were more likely to stay at home as compared to unmarried respondents. Non-Saudi nationality was significantly associated with compliance to precautionary measures score, self-quarantine activities, and the overall behavioral response score. In a previous study among HCWs in Saudi Arabia, higher concern to COVID-19 pandemic was reported by Saudis than non-Saudis.<sup>49</sup> This was attributed to the difference in their cultural norms and living conditions. Non-Saudi HCWs are expats who are likely to live alone, leaving their family members in their home countries, as compared to the Saudi HCW who live with their families enjoying a very active social life.<sup>50</sup> Therefore, expats are less likely to worry about the risk of infecting their family members and loved ones.

## Limitations and Strengths

This study may offer novel results which would help introduce important behaviors to the literature. It may act as a pilot study to other ones from similar countries. The strength of the study lies in its large sample size, recruited during a crucial period—the early stage of the COVID-19 outbreak in Saudi Arabia. However, this study has some limitations: The survey was conducted via the internet, which could result in selection bias, especially that the sample was over-representative of well-educated people and those who have access to computers and the internet. Hence, it may not truly represent the entire population of the study region. Therefore, the generalization of the findings may suffer from reporting bias. The data were self-reported making it subject to recall bias. The cause and effect relationship is not guaranteed due to the cross-sectional design, thus, it is difficult to determine whether the exposure (attitude and other factors associated) or outcome (behavior response such as self-quarantine activities) came first. As the COVID-19 pandemic is a rapidly evolving situation with national and

local policies being constantly modified, and the survey was conducted during lockdown due to pandemic, it may not fully capture the current situation. Follow-up studies are needed to assess a rapidly evolving and dynamic situation. Larger population-based studies that include areas where individuals are not able to access the internet are necessary.

## Conclusion

This study provides baseline data on the response to the national COVID-19 pandemic at the individual level in Saudi Arabia. The results of this survey indicated that the public compliance with preventive measures and preparedness to fight against COVID-19 was less than satisfactory. The behavior of the general public and the adoption of precautionary measures will determine the fate of the country in the absence of any specific cure. Thus, this study will assist government health agencies in Saudi Arabia to understand the behavior and the perception of the general public concerning COVID-19.

The study showed that only one-half of the respondents have positive perception toward the pandemic. This indicates that efforts have to be made in increasing their perception through health information dissemination regarding the disease and quarantine, especially that perception and attitude do translate into improved practices toward COVID-19 prevention. Demographics and socio-economics influence public behavior and protective health measures taken by and within the community. Future studies are needed to better determine compliance with public health measures to limit the effects of pandemics. This study has some policy implications, which can assist the government in curbing the spread of this virus. It will help the public health policymakers to recognize target populations for COVID-19 prevention and health education.

## Abbreviations

KAMC, King Abdulaziz Medical city; MNG-HA, Ministry of National Guard-Health Affairs; COVID-19, Coronavirus disease 2019; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus-2; MERS-CoV, Middle East Respiratory Syndrome-corona virus; WHO, World Health Organization; CDC, Center for Disease Control; IRB, Institutional Review Board.

## Data Sharing Statement

Most of the data supporting our findings is contained within the manuscript, and all others, excluding identifying/confidential patient data, will be shared upon request.

## Ethics Approval and Consent to Participate

Participation in this study was voluntary. Participants were assured in a written informed consent that their responses would remain anonymous. They were asked to respond to the survey if they agree to the informed consent. The study protocol was approved by the Institutional Review Board (IRB) of the Ministry of National Guard-Health Affairs (MNGHA), Riyadh, Saudi Arabia (Ref.# RC20/185/R). This study was conducted in accordance with the Declaration of Helsinki.

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## Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

## Disclosure

The authors declare that they have no competing interests.

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