Worries and Concerns of Healthcare Workers About COVID-19 Pandemic in a Tertiary Care Setting With a Previous MERS-CoV Outbreak Experience

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Abstract

Background

Covid-19 was declared by the WHO as a worldwide pandemic on 11 March 2020. As of 11th June, 2020, Saudi Arabia had 112,288 infected cases, with 77,954 recoveries and 819 deaths. Healthcare workers (HCWs) are at higher risk of acquiring and transmitting this virus, so the concerns of HCWs in Saudi Arabia regarding Covid-19 were evaluated in comparison with their concerns about the previous MERS-CoV outbreak.

Methods.

HCWs at three tertiary hospitals in Saudi Arabia were surveyed via email, by a concern scale about Covid-19 pandemic during 15–30 April, 2020. Concerns of disease severity, governmental efforts to contain it and disease outcomes were assessed using 32 concern statements in five distinct domains. Multiple regression analyses were used to identify predictors of high concern scores.

Results.

A total of 844 HCW responded to the survey. Their average age was 40.4 ± 9.5 years, 40.3% were nurses, 58.2% had direct patient contact, and 77.3% were living with family members and/or others. The majority of participants (72.1%) had an overall concern score of 55 or less out of a maximum score of 96 points. Three-fourth of respondents felt at risk of contracting Covid-19 infection at work, 69.1% felt threatened if a colleague contracted Covid-19, 69.9% felt obliged to care for patients infected with Covid-19 while 27.7% did not feel safe at work using the standard precautions. Nearly all HCWs believed that the government should isolate patients with Covid-19 in specialized hospitals (92.9%), agreed with travel restriction to/from areas affected by Covid-19 (94.7%) and felt safe government implemented curfew and movement restriction periods (93.6%). Predictors of high concern scores were; HCWs of Saudi nationality (p < 0.001), younger age (p = 0.003), undergraduate education (p = 0.044), living with others (p = 0.003) working in the western region (p = 0.003) and direct contact with patients (p = 0.018).

Conclusions.

The current study highlights the high concern among healthcare workers about Covid-19 and identifies the predictors of those with highest concern levels. To minimize the potential negative impact of those concerns on the performance of HCWs during pandemics, measures are necessary to enhance their protection and to minimize the psychological effect of the perceived risk of infection.

Background

In December 2019, a cluster of patients with pneumonia was linked to a seafood wholesale market in Wuhan, China, which lead to the discovery of a new betacoronavirus on 7 January, 2020, named Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) that causes coronavirus disease 2019 (COVID-
With its novelty and rapid national and international spread on 30 Jan 2020, the World Health Organization (WHO) International Health Regulation (IHR) emergency committee declared the disease a Public Health Emergency of International Concern (PHEIC). It was declared by WHO as a worldwide pandemic on 11 March 2020. At the time of this writing, it has infected 7,459,741 individuals, with 3,778,537 recoveries and 419,041 deaths, with an overall estimated case fatality rate (CFR) of 5.6%. On the 2nd of March 2020, a Saudi citizen coming from Iran through Bahrain was tested positive for Covid-19 and reported by the MOH as the first case in Saudi Arabia. As of 11th June, 2020, Saudi Arabia had 112,288 infected cases, with 77,954 recoveries and 819 deaths.

Health care workers face considerable mental and physical stress caring for patients with Covid-19. Several reports around the world suggest that this stress has led some physicians to take their own life. Furthermore, others were overstressed and died from exhaustion. One approach to minimize such stresses during pandemics is for hospitals to organize physician shifts with mandatory rest and meal breaks. Professional societies can also play a significant role by offering online networking to keep doctors connected to provide some level of social support. The government can also play a role by improving the benefits for HCWs and their families. These initiatives can be further enhanced by understanding the level of concerns and worries among healthcare workers and provide targeted strategies that address those concerns. Along this line, several studies have investigated the self-satisfaction of HCW and their personal feelings across several important domains. These domains cover concerns around risks posed to family members, perception of risk at the work place, and perception of the response of government to the epidemic management. Understanding the concern level across these different domains can be of importance to targeted mitigation strategies.

In Saudi Arabia, a previous study has shown that HCWs had, in general, a negative attitude toward MERS-CoV infection. In this study, the majority of the respondents felt that the work environment poses a high risk for contracting the infection and did not feel safe using the standard infection-control measures. One reason for the observed low attitude score might have been the lack of HCW experience with exposure to such outbreaks. Due to the potential rapid dissemination of Covid-19 within the public and a large probability of a countrywide outbreak, along with the country’s experience in battling this similar coronavirus (MERS-CoV), the KSA was amongst the leading bodies in the world for its swift community action and hospital preparedness. This study aims to assess perception and attitude of HCWs in Saudi Arabia with regard to Covid-19, and to identify potential associated predictors.

Methods

Study design and setting

This is a cross sectional study of HCW working at the medical cities of the Saudi Ministry of National Guard Health Affairs (MNG-HA). MNG-HA provide healthcare services to national guard service members and their dependents through large medical cities located in the 3 most densely populated regions of
KSA, namely the Central, Western and Eastern regions. All facilities have been Joint Commission International (JCI) accredited since 2006. During the COVID-19, and following the first reported case in KSA, MNG-HA has taken drastic infection control measures that included the reduction of elective surgeries, stopping in person outpatient services, and introducing ER workflow to minimize Covid-19 cases flow through the main ER.

Subjects and sampling technique

The target population of the current study was all HCW employed by the MNG-HA at all three regions. An e-mail with an anonymous link to the survey was sent to all HCWs on duty across all departments and specialties. The target sample size for the survey was estimated assuming a prevalence of high concern among HCW of 25.2% which was observed in another study in the same setting. We estimated the sample needed for the survey to be 800 participants, assuming 95% confidence limits and 3% precision.

Data collection

A structured, self-administered survey of HCWs was conducted via email, using a concern scale to assess their concern about Covid-19 pandemic. This survey was designed based on a validated concern scale previously used in a study of the concerns of HCWs with regard to MERS-CoV. The scale consists of 32 statements that cover 5 domains; self-satisfaction, social status, work environment, infection control measures, government action and activities. The scale was modified to also include a statement about the perception of HCWs towards curfew: "I feel safe that government implemented the curfew and the movement restriction periods".

Data on gender, age, nationality, marital status, level of education, living status, professional characteristics and contact with patients were collected. HCWs were categorized according to their direct contact with Covid-19 patients to “Direct contact group”, or “Non Direct contact group”. The Direct contact group included all subjects caring directly for patients in the ER, Ward, or ICU. All statements were coded using 4 points Likert scale, taking values from 0 (“strongly disagree”) to 3 (“strongly agree”) resulting in a total concern score that ranges from 0 to 96. Participants were further classified into one of three groups based on their total concern score. The first group included subjects below the first quartile of the concern score (score of 39 and below), the second group included subjects with concern score between the 25th percentile (concern score of 40) and 75th percentile (concern score of 55) and the third group included subjects above the 75th percentile (score of 56 and above). The survey was distributed in the English language, as an electronic survey, to all HCWs via a link attached to a mass e-mail distribution, with no identifiers. A cover letter was attached to an email as a link sent to HCWs in their office emails, during the period between 15 and 30 of April, 2020. Study participants were expected to complete the survey and return it back without identifiers.

Ethical issues
Participation in this study was voluntary. HCWs were assured in a written informed consent that their responses would remain anonymous and would not affect their performance evaluations, work status or compensations. HCWs were asked to respond to the survey if they agree on the informed consent. This study was approved by the institutional review board of the MNG-HA in Riyadh, Saudi Arabia (April 15, 2020; RC 20/173/R).

**Data analysis**

All categorical variables including age, gender, occupation status were summarized and reported using frequency and proportions. The total concern score was summarized and reported using mean and standard deviation. Association of categorical variables with the different levels of concern was analyzed using the Chi square test for homogeneity. All continuous variables were compared across the different concern levels using the student-t test and one-way ANOVA. Multiple regression analyses were used to determine significant predictors of high concern scores to Covid-19 pandemic. A comparison between concerns of HCWs about Covid-19 pandemic and the previous MERS-CoV outbreak was done, adjusting for gender, age, nationality, marital status, educational level and direct patient contact. For all statistical analyses, significance was considered at a p value of $\leq 0.05$. All analyses were performed in the Statistical Package for the Social Sciences software (SPSS version 26.0; IBM Corporation, Armonk, NY, USA).

**Results**

*Personal characteristics*

A total of 844 MNG-HA HCWs responded to the survey (326 males and 518 females). They had an average age of $40.4 \pm 9.5$ years, 436 (51.7%) were from the central region, 183 (21.7%) from the eastern region and 225 (26.7%) from the western region. A total of 40.3% were nurses, 58.2% had direct patient contact, and 77.3% were living with family members and/or others, Table 1.
Table 1
Sociodemographic characteristics of HCWs at Ministry of National Guard-Health Affairs in different regions of Saudi Arabia

|                         | Central Region | Eastern Region | Western Region | Total        |
|-------------------------|----------------|----------------|----------------|--------------|
|                         | no. (%)        | no. (%)        | no. (%)        | no. (%)      |
| **Total**               | 436 (51.7)     | 183 (21.7)     | 225 (26.7)     | 844 (100.0)  |
| **Gender**              |                |                |                |              |
| Male                    | 158 (36.2)     | 75 (41.0)      | 93 (41.3)      | 326 (38.6)   |
| Female                  | 278 (63.8)     | 108 (59.0)     | 132 (58.7)     | 518 (61.4)   |
| **χ² = 2.17, df = 2, p = 0.34** |                |                |                |              |
| **Age (years)**         |                |                |                |              |
| ≤ 30                    | 76 (17.4)      | 18 (9.8)       | 12 (5.3)       | 106 (12.6)   |
| 3–45                    | 253 (58.0)     | 103 (56.3)     | 142 (63.1)     | 498 (59.0)   |
| > 45                    | 107 (24.5)     | 62 (33.9)      | 71 (31.6)      | 240 (28.4)   |
| **χ² = 24.62, df = 4, p < 0.001*** |                |                |                |              |
| **Marital Status**      |                |                |                |              |
| Single                  | 182 (41.7)     | 42 (23.0)      | 59 (26.2)      | 283 (33.5)   |
| Married                 | 254 (58.3)     | 141 (77.0)     | 166 (73.8)     | 561 (66.5)   |
| **χ² = 27.78, df = 2, p < 0.001*** |                |                |                |              |
| **Nationality**         |                |                |                |              |
| Saudi                   | 180 (41.3)     | 66 (36.1)      | 94 (41.8)      | 340 (40.3)   |
| Non Saudi               | 256 (58.7)     | 117 (63.9)     | 131 (58.2)     | 504 (59.7)   |
| **χ² = 1.74, df = 2, p = 0.42** |                |                |                |              |
| **Education Level**     |                |                |                |              |
| Diploma                 | 58 (13.3)      | 29 (15.8)      | 40 (17.8)      | 127 (15.0)   |
| BS                      | 284 (65.1)     | 103 (56.3)     | 120 (53.3)     | 507 (60.1)   |
| MS/PHD                  | 94 (21.6)      | 51 (27.9)      | 65 (28.9)      | 210 (24.9)   |
| **χ² = 10.12, df = 4, p = 0.039** |                |                |                |              |

χ²—Pearson Chi-square test, df—degree of freedom, BS—Bachelor of Science, MS—Master of Science, PHD—Doctor of Philosophy.
### Concerns of HCWs regarding Covid-19 pandemic

The majority of participants (72.1%) had an overall concern score of 55 or less out of a maximum score of 96 points. The responses to the 32 items in the questionnaire varied considerably, from a high of 95.7% agreeing that they should limit their social activities due to Covid-19 to a low of 6.6% agreeing they would feel ashamed telling their managers/colleagues if contracting Covid-19 and 9.1% agreeing that they felt they should change job because of Covid-19 pandemic (Table 2). Of the total, 75.7% of HCWs responded that they felt at risk of contracting the Covid-19 infection at work, 46.0% agreed that this risk was absolute, and 48.1% did not feel safe in the workplace. Sixty two percent felt obliged to care for Covid-19 patients and 69.9% expressed the fear of getting infected from an infected colleague.

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| Job title                          | Central Region | Eastern Region | Western Region | Total  |
|-----------------------------------|----------------|----------------|----------------|--------|
|                                   | no.(%)         | no.(%)         | no.(%)         | no.(%) |
| Physician/dentist/pharmacist      | 106 (24.3)     | 49 (26.8)      | 66 (29.3)      | 221 (26.2) |
| Nursing                           | 189 (43.3)     | 57 (31.1)      | 94 (41.8)      | 340 (40.3) |
| Technician                        | 47 (10.8)      | 36 (19.7)      | 23 (10.2)      | 106 (12.5) |
| Administrative                     | 94 (21.6)      | 41 (22.4)      | 42 (18.7)      | 177 (21.0) |

χ² = 16.66, df = 6, p = 0.011*

| Direct patient contact          | Central Region | Eastern Region | Western Region | Total  |
|---------------------------------|----------------|----------------|----------------|--------|
|                                  | no.(%)         | no.(%)         | no.(%)         | no.(%) |
| Yes                             | 248 (56.9)     | 121 (66.1)     | 131 (58.2)     | 500 (59.2) |
| No                              | 188 (43.1)     | 62 (33.9)      | 94 (41.8)      | 344 (40.8) |

χ² = 4.69, df = 2, p = 0.10

| Any family member/colleague/ friend tested positive for Covid-19 | Central Region | Eastern Region | Western Region | Total  |
|---------------------------------------------------------------------|----------------|----------------|----------------|--------|
| yes                                                                 | 24 (5.5)       | 3 (1.6)        | 17 (7.6)       | 44 (5.2) |
| No/Don't know                                                       | 412 (94.5)     | 180 (98.4)     | 208 (92.4)     | 800 (94.8) |

χ² = 7.30, df = 2, p = 0.026*

| Status of living | Central Region | Eastern Region | Western Region | Total  |
|------------------|----------------|----------------|----------------|--------|
|                  | no.(%)         | no.(%)         | no.(%)         | no.(%) |
| Alone            | 78 (17.9)      | 33 (18.0)      | 51 (22.7)      | 162 (19.2) |
| With others      | 358 (82.1)     | 150 (82.0)     | 174 (77.3)     | 682 (80.8) |

χ² = 2.39, df = 2, p = 0.30

χ²—Pearson Chi-square test, df—degree of freedom, BS— Bachelor of Science, MS—Master of Science, PHD— Doctor of Philosophy.
Table 2
Responses of health-care workers to concern statements about the Covid-19 outbreak in Saudi Arabia.

| A. Self-satisfaction domain                                      | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|----------------------------------------------------------------|-----------------------------|----------------------------------|
| 1. I feel unsafe working at my workplace.                      | 40648.1                     | 43851.9                          |
| 2. I feel anxious while working with a febrile patient.         | 53363.2                     | 31136.8                          |
| 3. I feel at risk to contract a Covid-19 infection at work.     | 63975.7                     | 20524.3                          |
| 4. I feel obliged to care for a Covid-19-infected patient.      | 51961.5                     | 32538.5                          |
| 5. I feel hopeless I might eventually get a Covid-19 at work.   | 38846.0                     | 45654.0                          |
| 6. I feel threatened if one of my colleagues contracted Covid-19 | 59069.9                     | 25430.1                          |
| 7. If I get Covid-19, I don’t feel confident an employee will care for me? | 22726.9                     | 61773.1                          |

| B. Social status-related domain                                 | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|----------------------------------------------------------------|-----------------------------|----------------------------------|
| 1. I feel that I should limit my social activities due to Covid-19 | 80895.7                     | 364.3                            |
| 2. I feel I will transmit Covid-19 to my family members.        | 49258.3                     | 35241.7                          |
| 3. I feel that my family members avoid me since I work in hospital | 21925.9                     | 62574.1                          |
| 4. I feel I should avoid leaving my home due to Covid-19.        | 58269.0                     | 26231.0                          |
| 5. I feel my family will not look after me if I was infected.   | 14216.8                     | 70283.2                          |
| 6. I don’t feel confident telling my family and friends if I was infected. | 13916.5                     | 70583.5                          |

| C. Workplace-related domain                                     | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|----------------------------------------------------------------|-----------------------------|----------------------------------|
| 1. I feel that my institution didn’t support me during the Covid-19 crisis | 16419.4                     | 68080.6                          |
| 2. I feel that my institution is losing control of the Covid-19 crisis | 10312.2                     | 74187.8                          |
| 3. I feel overwhelmed with the new Covid-19 regulations.         | 45954.4                     | 38545.6                          |
| 4. I feel Covid-19 crisis increased my workload.                 | 33840.0                     | 50660.0                          |
| 5. I feel that the increase in workload was not meet with proper staffing. | 33339.5                     | 51160.5                          |
| 6. I feel absence from work reduces the chance of getting Covid-19 | 54264.2                     | 30235.8                          |
| 7. In case I had Covid-19, I feel ashamed telling my manager/colleagues. | 566.6                       | 78893.4                          |

Abbreviation: Covid-19 – coronavirus disease 2019.
### A. Self-satisfaction domain

| Statement                                                                 | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|---------------------------------------------------------------------------|-----------------------------|----------------------------------|
| 8. I feel I should change my current job due to Covid-19 crisis.          | 779.1                       | 76790.9                          |

### D. Infection control-related domain

| Statement                                                                 | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|---------------------------------------------------------------------------|-----------------------------|----------------------------------|
| 1. I am not confident with the current infection control measures.         | 24328.8                     | 60171.2                          |
| 2. I don't feel proper infection control training has been offered to me. | 22927.1                     | 61572.9                          |
| 3. I don't feel an infection specialist is accessible to respond to my concerns. | 18822.3                     | 65677.7                          |
| 4. I don't feel there is Covid-19 outbreak plan set at my area.            | 60471.6                     | 24028.4                          |
| 5. I don't feel safe at work when I use the standard precautions.          | 23427.7                     | 61072.3                          |

### E. Government-related domain

| Statement                                                                 | Agree/Strongly Agree n (%) | Disagree/Strongly Disagree n (%) |
|---------------------------------------------------------------------------|-----------------------------|----------------------------------|
| 1. I feel the government should restrict travel from/to areas of disease. | 79994.7                     | 455.3                            |
| 2. I feel the government should isolate Covid-19 cases in special hospitals | 78492.9                     | 607.1                            |
| 3. I feel government should avoid inviting expatriates from infected areas. | 64075.8                     | 20424.2                          |
| 4. I feel schools and shopping markets need to be closed to control Covid-19. | 71785.0                     | 12715.0                          |
| 5. I don't feel Covid-19 has been highlighted and discussed efficiently in media. | 20023.7                     | 64476.3                          |
| 6. I feel safe that government implemented the curfew and the movement restriction periods. | 79093.6                     | 546.4                            |

Abbreviation: Covid-19 – coronavirus disease 2019.
Table 3
Levels of concern regarding the MERS outbreaks in healthcare workers in Saudi Arabia according to personal characteristics.

| Characteristics | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|-----------------|----------------------------|----------------------------------|-------------------------------|--------------------|
| Total           | 213 (25.2)                 | 396 (46.9)                       | 235 (27.9)                   | 48.5 ± 12.8        |
| **Gender**      |                            |                                  |                              |                    |
| Male            | 83 (25.5)                  | 160 (49.1)                       | 83 (25.5)                    | 47.3 ± 12.2        |
| Female          | 130 (25.1)                 | 236 (45.6)                       | 152 (29.3)                   | 49.2 ± 13.1        |
| \( \chi^2 = 1.62, \text{df} = 2, p = 0.44 \) | \[ t = 2.14, p = 0.33 \] |                                  |                              |                    |
| **Age (years)** |                            |                                  |                              |                    |
| ≤ 30            | 19 (17.9)                  | 47 (44.3)                        | 40 (37.7)                    | 50.4 ± 13.1        |
| 30–45           | 117 (23.5)                 | 231 (464)                        | 150 (30.1)                   | 49.7 ± 13.1        |
| > 45            | 77 (32.1)                  | 118 (49.2)                       | 45 (18.8)                    | 45.2 ± 11.3        |
| \( \chi^2 = 19.52, \text{df} = 2, p < 0.001^* \) | \[ F = 11.60, p < 0.001^* \] |                                  |                              |                    |
| **Marital status** |                        |                                  |                              |                    |
| Unmarried       | 61 (21.6)                  | 129 (45.6)                       | 93 (32.9)                    | 49.5 ± 12.9        |
| Married         | 152 (27.1)                 | 267 (47.6)                       | 142 (25.3)                   | 48.0 ± 12.7        |
| \( \chi^2 = 6.30, \text{df} = 2, p = 0.043^* \) | \[ T = 1.58, p = 0.11 \] |                                  |                              |                    |
| **Nationality** |                            |                                  |                              |                    |
| Saudi           | 72 (21.2)                  | 146 (42.9)                       | 122 (35.9)                   | 51.1 ± 13.7        |
| Non-Saudi       | 141 (28.0)                 | 250 (49.6)                       | 113 (22.4)                   | 46.7 ± 11.8        |
| \( \chi^2 = 18.86, \text{df} = 2, p < 0.001^* \) | \[ T = 4.81, p < 0.001^* \] |                                  |                              |                    |
| **Level of education** |                  |                                  |                              |                    |
| Diploma         | 38 (29.9)                  | 54 (42.5)                        | 35 (27.6)                    | 48.0 ± 14.3        |
| BS              | 107 (21.1)                 | 246 (48.5)                       | 154 (30.4)                   | 49.6 ± 12.4        |
| MSN/PHD         | 68 (32.4)                  | 96 (45.7)                        | 46 (21.9)                    | 46.0 ± 12.4        |

\( \chi^2 \)—Pearson Chi squared test, \( F \)—Analysis of variance (ANOVA) test, \(^*\)—Statistically significant difference, \text{df}—degree of freedom.
| Characteristics                          | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|-----------------------------------------|----------------------------|----------------------------------|----------------------------|--------------------|
|χ2 = 13.48, df = 4, p = 0.009*           | F = 6.26, p = 0.002*       |

### Job title

| Job title                  | Physician/Dentist/Pharmacist | Nurse | Technician | Administrative |
|----------------------------|-------------------------------|-------|------------|----------------|
| 59 (26.7)                  | 105 (47.5)                    | 57 (25.8) | 46.9 ± 10.9 |
| 75 (22.1)                  | 168 (49.4)                    | 97 (28.5) | 49.4 ± 12.3 |
| 35 (33.0)                  | 46 (43.4)                     | 25 (23.6) | 46.7 ± 12.6 |
| 44 (24.9)                  | 77 (43.5)                     | 56 (31.6) | 49.9 ± 15.5 |
|χ2 = 14.54, df = 6, p < 0.001* | F = 3.18, p = 0.023*        |

### Geographical region of employment

| Geographical region of employment | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|----------------------------------|----------------------------|----------------------------------|----------------------------|--------------------|
|Central                           | 124 (28.4)                  | 192 (44.0)                       | 120 (27.5)                  | 47.9 ± 13.5        |
|Eastern                           | 50 (27.3)                   | 88 (48.1)                        | 45 (24.6)                   | 47.8 ± 12.6        |
|Western                           | 39 (17.3)                   | 116 (51.6)                       | 70 (31.1)                   | 50.1 ± 11.2        |
|χ2 = 11.09, df = 4, p = 0.026*    | F = 2.2.58, p = 0.076       |

### Direct patient contact

| Direct patient contact | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|------------------------|----------------------------|----------------------------------|----------------------------|--------------------|
|Yes                    | 120 (24.0)                 | 224 (44.8)                       | 156 (31.2)                 | 49.1 ± 12.5        |
|No                     | 93 (27.0)                  | 172 (50.0)                       | 79 (23.0)                  | 47.7 ± 13.2        |
|χ2 = 6.88, df = 2, p = 0.032* | T = 1.58, p = 0.11    |

### Positive family member

| Positive family member      | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|----------------------------|----------------------------|----------------------------------|----------------------------|--------------------|
|yes                       | 11 (25.0)                  | 21 (47.7)                        | 12 (27.3)                  | 49.4 ± 12.6        |
|No/Don’t know             | 202 (25.3)                 | 375 (46.9)                       | 223 (27.9)                 | 48.4 ± 12.8        |
|χ2 = 0.013, df = 2, p = 0.99 | T = 0.48, p = 0.63        |

### Living condition

| Living condition | Low concern (score = 0–39) | Moderate concern (score = 40–55) | High concern (score = 56–96) | Mean concern score |
|------------------|----------------------------|----------------------------------|----------------------------|--------------------|
|Alone             | 59 (36.4)                  | 70 (43.2)                        | 33 (20.4)                  | 45.1 ± 12.8        |
|With others       | 154 (22.6)                 | 326 (47.8)                       | 202 (29.6)                 | 49.3 ± 12.7        |
|χ2—Pearson Chi squared test, F—Analysis of variance (ANOVA) test, *—Statistically significant difference, df—degree of freedom.
More than two thirds of HCWs agreed they don’t feel there is Covid-19 pandemic plan in their area (71.6%). However, only 28.8% were not confident with the current IC measures, 27.1% did not feel proper IC training has been offered to them, 22.3% did not feel an IC specialist is accessible to respond to their concerns and 27.7% did not feel safe at work when using the standard precautions.

The majority of HCWs questioned agreed that it should restrict travel to and from areas with the disease (94.7%), agreed that the government should isolate patients with MERS in specialized hospitals (92.9%), agreed that schools and markets need to be closed (85%) and agreed that it should avoid inviting expatriates from such areas (75.8%). However, those who agreed that Covid-19 was not discussed efficiently in media constituted only 23.7% of HCWs, Table 2.

Overall, 27.9% of HCWs had high concern, 48.5% moderate concern and 25.2% low concern. The average concern score was 48.5 ± 12.8, out of a maximum possible concern score of 96. There was no difference in the concern level by gender (χ² = 1.62; p = 0.44), however, it differed by age (χ² = 19.52; p = 0.001), marital status (χ² = 6.30; p = 0.043), nationality (χ² = 18.86; p < 0.001), education (χ² = 13.48; p = 0.009), occupation (χ² = 14.54; p < 0.001), geographical location (χ² = 11.09; p = 0.026) and status of living (χ² = 14.54, p = 0.001).

In multiple regression analysis (Table 4), predictors of high concern scores were; HCWs of Saudi nationality (p < 0.001), younger age (p = 0.003), undergraduate education (p = 0.044), living with others (p = 0.003) and working in the western region (p = 0.003) and direct contact with patients (p = 0.018).
Table 4
Multiple regression analysis of concern scores about Covid-19 outbreak among healthcare workers in Saudi Arabia

| Independent variables                                      | β    | SE   | t-value | p-value |
|------------------------------------------------------------|------|------|---------|---------|
| Gender                                                     | -1.381 | .982 | -1.406 | .160    |
| Age (in years)                                             | - .154 | .051 | -3.029 | .003*   |
| Marital status ((married = 1))                             | .009 | 1.012 | .009 | .993    |
| Nationality (Saudi = 1)                                    | 3.825 | .977 | 3.916 | < .001* |
| Level of education (higher education = 1)                   | -2.373 | 1.176 | -2.017 | .044*   |
| Physician versus others (physician = 1)                     | -1.858 | 1.268 | -1.466 | .143    |
| Region of employment (Western = 1)                          | 2.931 | .968 | 3.029 | .003*   |
| Are you living alone or with others? (with others = 1)      | 3.410 | 1.153 | 2.957 | .003*   |
| Was a family member/colleague/friend tested positive for Covid-19 (yes = 1) | .472 | 1.915 | .246 | .806 |
| Are you in direct contact with patients? (yes = 1)          | 2.097 | .882 | 2.378 | .018*   |
| (Constant)                                                 | 49.914 | 2.388 | 20.902 | .000    |

B—beta coefficient, SE—standard error, t— t statistics, *—significant association.

A comparison between concerns of HCWs about Covid-19 pandemic and the previous MERS-CoV outbreak was done, adjusting for gender, age, nationality, marital status, educational level and direct patient contact. HCWs reported significantly higher mean scores about Covid-19 pandemic for overall concern (45.9 versus 40.3, p < 0.001), Self-satisfaction-related concern (11.6 versus 10.8, p < 0.001), social status-related concern (8.8 versus 6.2, p < 0.001), and government-related concern (10.8 versus 8.1, p < 0.001), and a significantly lower mean score for infection control-related concern (6.1 versus 6.5, p = 0.005), Table 5.
Table 5
Comparison of Mean score of different concern domains among HCWs during Covid-19 pandemic and the previous MERS-CoV outbreak in Saudi Arabia

| Concern domains                     | Outbreak | No. | Mean | SD | t-value@ | p-value |
|-------------------------------------|----------|-----|------|----|----------|---------|
| Self-satisfaction-related (max. score = 21) | MERS     | 1031 | 10.8 | 4.0| 5.16     | <0.001* |
|                                     | COVID-19 | 844  | 11.6 | 4.5|          |         |
| Social status-related (max. score = 18)  | MERS     | 1031 | 6.2  | 3.2| 16.55    | <0.001* |
|                                     | COVID-19 | 844  | 8.8  | 3.2|          |         |
| Workplace-related (max. score = 24)    | MERS     | 1031 | 8.8  | 3.6| 0.42     | 0.68    |
|                                     | COVID-19 | 844  | 8.6  | 4.2|          |         |
| Infection control-related (max. score = 15) | MERS     | 1031 | 6.5  | 1.7| 2.80     | 0.005*  |
|                                     | COVID-19 | 844  | 6.1  | 2.9|          |         |
| Government-related (max. score = 15)   | MERS     | 1031 | 8.1  | 2.1| 25.87    | <0.001* |
|                                     | COVID-19 | 844  | 10.8 | 2.4|          |         |
| Overall concern (max. score = 93)     | MERS     | 1031 | 40.3 | 10.7| 10.82    | <0.001* |
|                                     | COVID-19 | 844  | 45.9 | 12.7|          |         |

*—Statistically significant difference, @— adjusted for gender, age, nationality, marital status, educational level and direct patient contact.

Discussion

The present study was to assess the level of concern among hospital-based HCWs, about Covid-19 crisis. An overall average concern score of 48.5 ± 12.8 out of a maximum possible score of 96 points was observed, with a negative range of attitude, indicating a moderate level of concern. In comparison with the results of a previous survey in the same settings using the same data collection tool, to assess the concern of HCWs about MERS outbreak in Saudi Arabia,¹⁶ HCWs reported significantly higher mean concern scores about Covid-19 pandemic. These were observed for; overall concern, self-satisfaction-related concern, social status-related concern and government-related concern. These findings reflect the higher concern about Covid-19 than MERS-CoV among HCWs in the same setting with a previous MERS-CoV outbreak.¹⁶ This may reflect the impact and role of mass media and social media marketing on the way we perceive our world and our everyday lives on individual, social and societal levels, during these critical times. However, the finding of a significantly lower mean score reported for infection control-
related concern about Covid-19 infection may be attributed to the previous experiences of HCWs, and the institutions they work for, with MERS-outbreak of how to deal with such outbreaks. A study was carried out on 582 HCWs at King Khalid University Hospital (KKUH), Riyadh, Saudi Arabia, showed that the majority of HCWs had mild anxiety from Covid-19. However, the survey was conducted before registering any case of Covid-19 in Saudi Arabia.

An important finding in the present study was that a high level of concern about Covid-19 pandemic was prevalent across the different concern domains. The highest level of concern was observed in the HCWs’ responses to questions regarding fears of infection of a family member, fears of being in public places that may result in infection, the closure of schools and workplaces in the event of an epidemic and risks associated with dealing with a febrile patient, obligation of care provision for patients infected with Covid-19 and government’s action to implement the curfew and the movement restriction periods. It was interesting that in the present study, 85% agreed that school and shopping markets need to be closed, while only 19% during the previous MERS outbreak. This finding may reflect the perception of HCWs in our study of the magnitude of Covid-19 pandemic. However, it is important to note that this perception of fear might differ from country to another. For example in Japan with the absence for an epidemic during the SARS-COV outbreak, more than 50% reported having a high level of fear and an anxiety of infection, while in Thai study, nearly all HCWs reported acceptance to take the risk of caring for H5N1 patients.

In line with the WHO recommendations for institutional preparedness to reduce the impact of potential outbreaks, MNG-HA has developed a comprehensive plan of medical and public health response for Covid-19 epidemic. This plan aimed at the protection of HCWs through the implementation of strict infection control measures and personal protection practices. Despite these efforts, HCWs in our study did not feel safe at the workplace and felt at risk of contracting the infection. This finding is similar to a study in the UK in which 66% of the HCWs did not feel confident in the healthcare system’s ability to cope with bird flu epidemic. The exact reasons of such high concern among HCWs, despite the existence of a preparedness plan, cannot be determined from the current study and further studies are needed.

Our study shows that HCWs who were in direct contact with patients had significantly higher concern scores than those who were not in direct contact. This finding was in agreement with the results of a study in China to compare the average values of fear, anxiety and depression due to Covid-19 pandemic between medical and admin staff, where medical staff reported greater fear, anxiety and depression than administrative staff. This finding is not surprising given the higher perceived risk by those HCW due to the condition of the work environment. However it is important to pay special attention to those HCWs to manage their perception of risk by ensuring that they have access to proper personal protective equipment (PPE) and safe patients’ handling procedures.

Saudi HCWs, in the present study, reported higher concern to Covid-19 pandemic as compared to non-Saudis. This can be explained by the culture norms and the difference in living conditions between Saudis and non Saudi HCW. The majority of non saudi HCW are expats who are likely to live alone with their family members living in their home countries. Therfore expats are less likely to worry about the risk
of infecting their family members and loved one compared to Saudi HCW who live with their families and tend to have a very active social life.\textsuperscript{25} The present study also showed that living with others was an independent predictor of high level of concern about Covid-19 infection, most likely due to their fear of transmitting the infection to others if they get infected.

An interesting but a little counterintuitive finding of our study is the fact that older HCWs were less concerned about covid-19 than the younger ones. This is especially true given that risk factors for severe disease and death in Covid-19 include older age among many other factors.\textsuperscript{26} Further, there was a significant association between higher concern score and lower education level. In a survey on the undergraduate medical students in 3 medical institutes of Karachi, the majority of students found worrisome of getting infected with Covid-19 during medical rotations, dreaded insufficient care and inappropriate treatment if they acquire infection and thought their institute-associated hospital won't be able to handle the situation in case of an uncontrolled outbreak.\textsuperscript{27} One possible explanation can be inferred from the theory of reasoned action of a causal relationship between knowledge and experience and the subsequent positive perception and intention to change behavior.\textsuperscript{28} attitudes and behavioral intent.

In the current study HCWs of western region had significantly higher concern score compared to other regions. This was different than the study during MERS where the HCWs of central region had higher concern than other regions.\textsuperscript{16} We believe that these differences are likely due to the perception of HCWs of the magnitude of the pandemic in the different regions. During Covid-19, the western region had shown much rapid increase of confirmed cases compared to the other regions.\textsuperscript{6} Additionally, the government has implemented complete lockdown of the western region prior to other regions. However during MERS, the largest outbreak has taken place in the central region. The large magnitude of the epidemic the western region compared to other regions in the country could have contributed to the observed level of concern of HCWs in this region.

**Limitations**

Our study is not without limitation. Our survey was based on self-reported information which might suffer from a recall bias. Moreover, all study participants were HCWs in tertiary hospitals, and therefore could limit the generalizability of the findings to other settings. Finally, all identified predictors of concerns cannot be interpreted beyond general association. Despite these limitations, our study addresses a major problem faced by HCWs in many countries around the world during this pandemic.

**Conclusions**

The current study highlights the high concern among healthcare workers about Covid-19 and identifies the predictors of those with the highest level of concern. High level of concern could lead to suboptimal healthcare service as well as less effective management of COVID-19 cases. This could be mitigated by implementing strategies designed to minimize perceived risk of infection by HCWs. These strategies
should be part of the early planning for a response to an epidemic and it should cover a wide range of programs that focus on financial incentives, education, personal counseling and education.

**List Of 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, HCWs—Health care workers, WHO—World Health Organization, PHEIC—Public Health Emergency of International Concern, IHR—International Health Regulation, CFR—case fatality rate, ER—emergency department, ICU—intensive care unit, IRB—Institutional Review Board,

**Declarations**

**Ethics approval and consent to participate**

This study was approved by the institutional review board of the MNG-HA in Riyadh, Saudi Arabia (April 15, 2020; RC 20/173/R). Participation in this study was voluntary. HCWs were assured in a written informed consent that their responses would remain anonymous and would not affect their performance evaluations, work status or compensations.

**Consent for publication**

Not applicable

**Availability of data and materials**

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

**Competing interest**

The authors declare that they have no competing interests.

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None

**Author contributions**

MAA contributed to concept development, manuscript preparation and final writing, AFA and AAB contributed to concept development and data collection, MAH contributed to concept development statistical analysis and manuscript finalization, and AFA and AAB contributed to research proposal
writing, data collection, analysis and interpretation, and manuscript drafting. All authors read and approved the final manuscript.

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