



# Knowledge, Attitude, and Practice Regarding COVID-19 among Healthcare Workers in a Tertiary Teaching Hospital

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## Abstract

Healthcare workers are the frontline battling the COVID-19 pandemic and are at a high risk of infection. This paper assesses knowledge, attitude, and practice towards COVID-19 among healthcare workers in Universiti Malaya Medical Centre (UMMC). This cross-sectional study was conducted among healthcare workers in UMMC, Kuala Lumpur. Data collection period was from 1st March to 30th April 2021. A validated 19-item was used to measure knowledge, attitude and practice (KAP) scores. Univariate and multivariate analyses were conducted to identify factors associated with KAP scores, with significance set at  $p < 0.05$ . A total of 162 respondents participated, including nurses (37.7%), allied health professional (24.7%), clinical specialist (6.8%), medical assistant (6.2%), medical doctors (4.9%), pharmacist (1.2%) and others (18.5%). Majority of HCWs (98.8%,  $n=160$ ) had good knowledge, poor attitude (93.2%,  $n=151$ ) and good COVID-19 preventive measure practices (97.5%,  $n=158$ ). Multivariate logistic regression demonstrated that gender (adjusted Odds Ratio, OR 4.41; 95% Confidence Intervals, 95%CI: 1.25, 15.62) and profession (aOR 2.49; 95%CI: 0.68, 9.12) were found to be the significant

factors associated with good attitude towards COVID-19 prevention measures. While healthcare workers demonstrated good overall knowledge and practice, their attitude towards COVID-19 prevention was poor. Behavioural interventions are recommended to improve attitude and strengthen safety culture in healthcare settings.

**Keywords:** COVID-19, Knowledge, Attitude, Practice, Healthcare workers

#### **What was Known**

- Healthcare workers are at higher risk for COVID-19 infection due to occupational exposure.
- Healthcare workers are required to always engage in infection preventive behaviors.

#### **What's New and Next**

- Level of knowledge, attitude and practice towards COVID-19 prevention among healthcare workers.
- Continuous training and education for healthcare workers is needed to ensure preventive practice towards COVID-19.

## Introduction

The COVID-19, has caused a worldwide pandemic of respiratory illness. As of July 2024, there has been over 775 million confirmed cases with over 7 million deaths reported globally<sup>1</sup>. Healthcare workers are a high-risk group in contracting the SARS-CoV-2 virus through their interactions with patients in the healthcare setting as well as out of workplace exposure. The World Health Organization (WHO) estimated the total number of deaths globally among HCWs at 6643 from January 2020 till May 2021<sup>2</sup>. The mortality among HCWs has been reported in hardest-hit countries such as China, Italy and the United Kingdom<sup>3, 5</sup>.

During this ongoing global crisis, HCWs is estimated to constitute more than 7% of all COVID-19 cases globally<sup>5</sup>. High COVID-19 infection rate among HCWs will lead to disruption in healthcare services and could cause deterioration in health of the general population who may not have access for treatment due to other diseases<sup>6</sup>. This has led healthcare organizations to implement a variety of strategies to protect their healthcare workers from infection. Traditional surveillance programs, periodic or intermittent testing, and clinical-based triaging are being used in response to the growing number of HCW infections<sup>7</sup>. However, these approaches come with their own challenges, such as inadequate capacity, untrained laboratory personnel, and inadequate funding. In low- and middle-income countries (LMIC), these challenges are exacerbated by the lack of resources available<sup>8</sup>. In Malaysia, the reported COVID-19 mortality rate among healthcare workers was 0.0079%, reflecting relatively low fatality but still highlighting the need for preventive and protection for frontliners<sup>9</sup>.

Universiti Malaya Medical Centre (UMMC) is a tertiary teaching hospital located in Kuala Lumpur, Malaysia that serves as a training centre for students from the Faculty of Medicine, Universiti Malaya. It has a total working population of over 6000 workers including administrative and non-clinical staff. Since January 2022, there were over 2500 healthcare workers that have contracted COVID-19 infection both from exposure to COVID-19 cases at the workplace as well as the community. The Occupational Safety, Health and Environment (OSHE) and infection control unit of UMMC was responsible for protecting our healthcare workers from COVID-19 infection and preventing workplace transmission through various efforts such as healthcare worker surveillance, development and implementation of standard operating procedures, workplace investigation, return to work, and training and education<sup>10</sup>. In addition to that periodic training on prevention and management of COVID-19 infection was also provided to healthcare workers based on latest evidence regarding COVID-19 and national policies. However, du

Prevention of COVID-19 infection was mainly reliable on public health control measures such as social distancing, hand hygiene, use of appropriate personal protective equipment as well as vaccination<sup>11, 12</sup>. However, the goals of prevention will not be successful without adequate knowledge regarding the diseases, inappropriate attitude or wrong practices that are not in line with the standard operating procedures<sup>13</sup>. In addition to that studies have shown that knowledge is a predictor for positive attitude and good practice towards prevention of COVID-19 infection including vaccine uptake<sup>14, 15</sup>. A wide variety of studies have been conducted looking into levels of knowledge, attitude and practice (KAP) for COVID-19 among healthcare workers.<sup>13, 16-18</sup> These studies found that some of the factors affecting the level of KAP among healthcare workers included age group, underlying medical conditions, access to information sources and urban residence. Adequate knowledge also was found to fuel optimistic attitude that translates into proper practices at work, which helps deter the risk of infection. Another study also reported that poor knowledge regarding COVID-19 disease also contributed to poor practice which could increase the risk of infection among healthcare workers.<sup>19</sup> In Malaysia, there was a study on that reported good KAP scores towards COVID-19 prevention among healthcare workers<sup>19</sup>. However, this study was conducted in a public hospital and may have limitation on generalizing these findings to healthcare workers from other centres such as tertiary teaching hospital and the private sector. Despite continuous training provided to health care workers, there is still misinformation from various sources that may influence their understanding and perception regarding this subject. This may affect their knowledge, attitudes, and practices (KAP) towards COVID-19 which will result in poor adherence to control measures at work. Therefore, it is crucial to understand the knowledge of the medical providers and determine the factors that affect their attitudes and practices to have adequate practices and protection. The purpose of this study is to assess knowledge, attitude, and practice towards COVID-19 among healthcare workers in Universiti Malaya Medical Centre (UMMC).

## Materials and Methods

### *Study Design and Setting*

This cross-sectional study was conducted at a tertiary teaching hospital in Kuala Lumpur, Universiti Malaya Medical Centre (UMMC). The study population consisted of all healthcare workers (permanent and contract) employed under UMMC. A total of 162 participants were selected using convenience sampling method through distribution of an online questionnaire that was emailed to all healthcare workers employed at UMMC. The minimum required sample size

calculated for this study was 361 based on a 95% confidence level, 5% margin of error, and an assumed prevalence of 50%. The questionnaire was distributed to participants using the REDCap (Research Electronic Data Capture) online platform. REDCap is a secure web based platform designed to support data capture for research purposes. REDCap enable real-time data entry, audit trails, and seamless export to statistical software such as SPSS. The platform is subscribed by the University of Malaya and is widely used in research. The online survey was conducted for a period of two months from 1st March to 30th April 2021. Consent was obtained voluntarily from each participant prior to answering the online questionnaire.

### *Instrument*

The instrument used in this study to measure knowledge, attitude and practice towards COVID-19 is a self-administered 19-item validated questionnaire adapted from previous studies conducted among healthcare workers in Malaysia<sup>20</sup>. The instrument was validated with Cronbach's alpha, with values for the KAP sections being 0.61 (knowledge domain), 0.74 (attitude domain), and 0.72 (practice domain)<sup>20</sup>. Content validity was established through expert review by six professionals in infectious disease, infectious control, public health, and occupational safety. Although the Cronbach's alpha for the knowledge domain was 0.61, this is considered acceptable in exploratory research, particularly during emerging public health events where rapid assessment tools are needed<sup>21</sup>. The questionnaire consists of four sections; Section 1 was socio-demographic data of participants, followed by 6 items for knowledge (Section 2), 9 items for attitude (Section 3) and 4 items for practice (Section 4).

### *Measures*

The independent variables in this study were sociodemographic variables and occupation factors, meanwhile the dependent variables outcomes were knowledge, attitude and practice towards COVID-19 prevention.

A cut-off score of 80% is used to differentiate between poor and good KAP level. Each correct response is given 1 point and zero for incorrect answers. The knowledge domain contributes a total of 6 points (1 point is given for every correct answer) and a score of 4 and above indicates good knowledge regarding COVID-19. For the attitude domain, a score of 36 from a five-point Likert scale for agreement (1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree) and above indicates good attitude towards COVID-19 prevention.

Meanwhile, in the practice domain, the responses were recorded on a five-point Likert scale for frequency (1-never; 2-rarely; 3-sometimes; 4-often; 5-always). A score of 16 (out of 20) was designated as good practice towards COVID- 19. A score of 16 and above indicates good practice towards COVID-19 prevention.

### *Statistical Analysis*

Statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) Statistics for Windows Version 27.0. Descriptive analysis was done for the socio-demographic variables. The knowledge, attitude and practice scores were also analysed descriptively first before proceeding with univariate logistic regression using chi square test to examine socio-demographic and occupational factors associated with KAP towards COVID-19 among healthcare workers. Possible determinants of good knowledge, attitude and practice were expressed as odds ratio (OR) and 95% CI. A value of  $p < 0.25$  was taken as the level of significance. Variables significant at  $p < 0.25$  in the univariate analysis will be further analysed in the multivariate logistic regression.

## **Result**

### *1. Socio-demographic characteristics of participants*

A total of 162 participants (Table 1) were included in the final analysis of this study. The mean age is 37.9 years with a standard deviation of 7.9 years with the youngest and oldest participants being 24 years and 55 years respectively. Majority of participants were females (82.1%, n=133) and from the job category of nurses (37.7%, n=61) with more than 10 years (69.8%, n=113) of working experience.

**Table 1** Characteristics of study participants

Characteristic	Frequency N (%)
Gender	
Male	29 (17.9)
Female	133 (82.1)
Age, Years (Mean, Sd)	37.9 ± 7.9
Ethnicity	
Malay	127 (78.4)
Chinese	17 (10.5)
Indian	14 (8.6)
Others	4 (2.5)
Marital Status	
Single	33 (20.3)
Married	123 (75.9)
Divorce	3 (1.9)
Widow	3 (1.9)
Highest Education Level	
SPM	11 (6.7)
Diploma/ STPM	77 (47.5)
Degree	46 (28.5)
Masters	26 (16.1)
PhD	2 (1.2)
Designation	
Clinical Specialist	11 (6.7)
Medical Officer	8 (5.0)
Nurse	61 (37.7)
Medical Assistant	10 (6.8)
Pharmacist	2 (1.2)
Allied Health Professional*	40 (24.7)
Others	30 (18.5)
Working Experience	
Less Than 5 Years	11 (6.7)
5 To 10 Years	38 (23.5)
More Than 10 Years	113 (69.8)

*Note: SPM- Sijil Pelajaran Malaysia (Malaysian Certificate of Education); STPM- Sijil Tinggi Persekolahan Malaysia (Malaysian Higher School Certificates)*

### 2. Knowledge, Attitude and Practice Scores

Majority of HCWs (98.8%, n=160) had good knowledge and good practice scores (97.5%, n=158). Meanwhile only a very small proportion reported good attitude scores (6.8%, n=11) (Table 2).

**Table 2** Knowledge, attitude, and practice towards COVID-19 among healthcare workers

	Mean (SD)	Range	Good, N (%)	Poor, N (%)
Knowledge	5.29 (0.79)	3-6	160 (98.8)	2 (1.2)
Attitude	29.0 (4.5)	17-41	11 (6.8)	151 (93.2)
Practice	18.9 (1.4)	14-20	158 (97.5)	4 (2.5)

### 3. Factors associated with knowledge towards COVID-19

The majority of participant demonstrated good knowledge (99%) and good practice (97.5) towards COVID-19 prevention. However despite these positive findings, a large proportion (93%) showed poor attitude. None of the sociodemographic factors were significantly associated with knowledge towards COVID-19 among healthcare workers in the univariate analysis (Table 3).

### 4. Factors associated with attitude towards COVID-19

Gender and designation were found to be associated with attitude towards COVID-19 among healthcare workers in the univariate analysis, however, following multivariate analysis only gender was significantly associated with attitude towards COVID-19 among healthcare workers. Where in males had 3.85 odds of having an optimistic attitude towards COVID-19 compared to females (Table 4).

**Table 3** Factors associated with knowledge towards COVID-19 among healthcare workers

Variable	Univariate logistic regression	
	Crude OR (95% CI)	p-value
Gender		
Male	0.00 (0.00, .)	0.998
Female	1	
Age, years	1.11 (0.89, 1.37)	0.340
Ethnicity		
Malay	1	
Others	0.00 (0.00, .)	0.998
Marital status		
Single	1	
Married/ Divorce/ Widow	0.00 (0.00, .)	0.998
Highest education level		
SPM/ Diploma/STPM	0.00 (0.00, .)	0.997
Degree/ Masters/ PhD	1	
Designation		
Not Allied health professional <sup>#</sup>	1	
Allied health professional	0.429 (0.03,7.03)	0.553
Others	0.00 (0.00, .)	0.998
Working experience		
Less than 10 years	1	
More than 10 years	2.23 (0.14, 38.08)	0.552

Note. OR, Odds ratio; CI, Confidence interval;

\*Variables significant at 0.25 from the univariate analysis with no evidence of multicollinearity and interaction were entered into multivariate analysis.

\*\*Significant set at p-value < 0.05 after multivariate analysis, 1 indicates a reference group.

<sup>#</sup>Not allied refers to Clinical specialist, Medical officer, Medical assistant, Pharmacist.

SPM- Sijil Pelajaran Malaysia (Malaysian Certificate of Education);

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**Table 4** Factors associated with attitude towards COVID-19 among healthcare workers

Variable	Univariate logistic regression		Multivariate logistic regression	
	Crude OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Gender				
Male	4.41 (1.25, 15.62)	0.021*	3.85 (1.05, 14.16)	0.043**
Female	1		1	
Age, years	1.01 (0.93, 1.09)	0.843		
Ethnicity				
Malay	1			
Others	1.40 (0.35, 5.56)	0.637		
Marital status				
Single	1			
Married/ Divorce/ Widow	2.69 (0.33, 21.79)	0.354		
Highest education level				
SPM/ Diploma/STPM	1.01 (0.30, 3.45)	0.998		
Degree/ Masters/ PhD	1			
Designation				
Non-Allied health professional <sup>#</sup>	1		1	
Allied health professional	2.49 (0.68, 9.12)	0.170*	1.91 (0.49, 7.39)	0.350
Others	0.60 (0.07, 5.35)	0.647	0.55 (0.06, 5.04)	0.600
Working experience				
Less than 10 years	1			
More than 10 years	2.03 (0.42, 9.78)	0.376		

Note. OR, Odds ratio; CI, Confidence interval;

\*Variables significant at 0.25 from the univariate analysis with no evidence of multicollinearity and interaction were entered into multivariate analysis.

*\*\*Significant set at p-value < 0.05 after multivariate analysis, 1 indicates a reference group. Hosmer-Lemeshow goodness-of-fit test chi-square = 2.36 (df = 3), p = 0.501. (Using enter method for variable selection); # Not allied refers to Clinical specialist, Medical officer, Medical assistant, Pharmacist*

*SPM- Sijil Pelajaran Malaysia (Malaysian Certificate of Education); STPM- Sijil Tinggi Persekolahan Malaysia (Malaysian Higher School Certificates)*

### 5. Factors associated with practice towards COVID-19

None of the factors were significantly associated with practice towards COVID-19 among healthcare workers in the univariate analysis (Table 5).

**Table 5** Factors associated with practice towards COVID-19

Variable	Univariate logistic regression		Multivariate logistic regression	
	Crude OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Gender				
Male	0.65 (0.065, 6.44)	0.710		
Female	1			
Age, years	0.97 (0.86, 1.10)	0.619		
Ethnicity				
Malay	1			
Others	0.00 (0.00, .)	0.998		
Marital status				
Single	1			
Married/ Divorce/ Widow	1.31 (0.13, 13.04)	0.816		
Highest education level				
SPM/ Diploma/STPM	1.19 (0.16, 8.69)	0.861		
Degree/ Masters/ PhD	1			
Designation				
Not Allied health professional <sup>#</sup>	1			
Allied health professional	0.86 (0.08, 9.84)	0.908		
Others	0.64 (0.06, 7.37)	0.724		
Working experience				
Less than 10 years	1			
More than 10 years	0.76 (0.08, 7.53)	0.818		

*Note. OR, Odds ratio; CI, Confidence interval;*

*\*Variables significant at 0.25 from the univariate analysis with no evidence of multicollinearity and interaction were entered into multivariate analysis.*

*\*\*Significant set at p-value < 0.05 after multivariate analysis, 1 indicates a reference group.*

*# Not allied refers to Clinical specialist, Medical officer, Medical assistant, Pharmacist*

*Note: SPM- Sijil Pelajaran Malaysia (Malaysian Certificate of Education); STPM- Sijil Tinggi Persekolahan Malaysia (Malaysian Higher School Certificates)*

## Discussion

In general, majority of healthcare workers in this study showed good levels of knowledge (99%) and practice (98%) regarding COVID-19. These findings were similar to studies conducted among healthcare workers in other Asian countries such as Thailand<sup>22</sup>, Indonesia<sup>23,24</sup>, Pakistan<sup>25</sup> and India<sup>26</sup>. This could be attributable to similarities in Asian cultural and socio-demographic characteristics of participants in these regions with our study participants from Malaysia. However, a study that was conducted among medical students in Indonesia reported around 50% of students had poor knowledge and practices towards COVID-19. This could be attributable to the lack of medical experience as more than half of the participants involved 1<sup>st</sup> year to 3<sup>rd</sup> year medical students without clinical experience and different educational levels including diploma and bachelors. In addition to that, the participants also were from various institutions with different academic programs and requirements.

However, 93% of participants were found to have poor attitude scores in this study despite being in a tertiary teaching hospital with adequate resources and continuous training. Many studies have also reported that continuous training and knowledge transfer provides reinforcement to workers on knowledge regarding the particular topic and similarly from an occupational health perspective continuous training has been a requirement in legislations globally as well<sup>27,33</sup>. This study finding was not consistent with other studies done in Vietnam and Nepal that reported positive attitudes towards COVID-19 that was influenced by good awareness or knowledge regarding the disease, which eventually translates into good practice<sup>16,26</sup>. Both studies had large sample size with good power of association, the good attitude scores among Vietnamese healthcare workers could be attributable to the effective risk communication by the government ensuring the public are well informed and updated on verified information regarding COVID-19 to prevent unrest. Further analysis into the attitude domain scores of this study revealed that participants scored poorly for fear of being infected with COVID-19 at the workplace and the expected outcome in the future in terms of successfully controlling it which could be attributable to the misinformation regarding emerging new variants of COVID-19 that is responsible for creating new waves of COVID-19. This could influence the attitudes of healthcare workers towards a positive outcome in relation to the COVID-19

pandemic. A scoping review conducted in the sub-Saharan Africa region found that seven studies reported participants to have poor attitude towards COVID-19, mainly on risk of being infected with COVID-19 and recovery outcomes following COVID-19 infection.<sup>34</sup> These findings further strengthen the need to provide verified and true information regarding COVID-19 and risk control measures at the workplace to ensure healthcare workers feel safe at work.

In this study, only gender was found to have significant association with attitude towards COVID-19 following multivariate analysis with males having close to 4 times higher odds of an optimistic or positive attitude towards COVID-19 in comparison to females. These findings were inconsistent with findings from other studies that reported females to have better scores especially for knowledge and practice domains<sup>22,23,35</sup>. This could be attributed to psychosocial factors in which females are at higher risk of experiencing anxiety regarding the pandemic compared to males resulting in more vigilant attitude and behavior towards preventive practices of COVID-19. There were no socio-demographic factors that were found to be associated knowledge regarding COVID-19 among the study participants, this could be mainly due to the small sample size in this study.

This study provides insight into the level of knowledge, attitude and practice towards COVID-19 prevention among healthcare workers and is the first to the authors knowledge that has been conducted in a tertiary teaching hospital. This baseline information is particularly important in order to plan for an effective intervention especially during a time of crisis as many healthcare workers were still getting infected or being in close contact with confirmed cases of COVID-19 resulting in severe shortage of manpower and even disruption of services. The major limitation of this study was the small sample size resulting in lack of significant factors associated with the level of KAP. Secondly, the sampling method used in this study was convenience sampling in which the questionnaire was emailed to all healthcare workers in UMMC and those interested to participate in this study answered the questionnaire voluntarily. This method may introduce selection bias and the study population may not be representative of all job categories of healthcare workers in UMMC as is shown by a poor response from doctors (11.7%) and majority were nurses (37.7%).

## Conclusion

Generally, healthcare workers in Universiti Malaya Medical Centre (UMMC) showed good overall knowledge and practice with regards to COVID-19 infection and its preventive measures. However, their attitude was poor even with better knowledge. The various information regarding

COVID-19 from multiple sources that were readily available during this period may have influenced healthcare workers' understanding and perspective regarding this subject. This includes misinformation that may influence their attitude towards COVID-19. Healthcare workers practice is directly influenced by their attitude. Hence, the need for continuous periodic training with updated verified information regarding COVID-19 is key to improving the attitude of healthcare workers towards COVID-19. Despite being in a tertiary teaching hospital, providing verified information through formal channels such as hospital staff online portals are needed to reassure healthcare workers and avoid misconceptions regarding COVID-19. Prevention was key to ensuring our healthcare workers were safe against COVID-19 infection during this period while minimizing the number of personnel quarantined to ensure delivery of healthcare services. Findings from this study must be generalized with caution due to relatively small sample size.

### **Ethical Approval Statement**

Ethical approval was obtained from the Medical Ethics Committee, Universiti Malaya Medical Centre, Malaysia (MREC ID: 2022116-10930) prior to conducting the study.

### **Author Contributions**

SRK, LYC, VCWH, BMS, AA, WCK and OK designed the study and formulated the concept as well as the study methodology and manuscript preparation. NFO was responsible for preparation and distribution of the online questionnaire using the Redcap online platform, data collection and data cleaning. SS was responsible for statistical analysis. NHHL, TBT, NHHH and SSH were part of the team that helped with proofreading and manuscript editing and finalization prior to submission for publication. All authors read and approved the manuscript prior to submission for publication.

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## Conflicts of Interest

The authors declare that they have no competing interests.

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