ORIGINAL ARTICLE

Coronavirus Disease-2019: Knowledge and Practices Behaviour of Healthcare Workers at a University Teaching Hospital in Malaysia

Kai Wei Lee[1], Abdul Hanif Khan Yusof Khan[2,3], Siew Mooi Ching[1,3], Navin Kumar Devaraj[1,3], Janudin Baharin[2], Peck Kee Chia[2], Wei Chao Loh[2], Anna Misya'il Abdul Rashid[2], Liyana Najwa Inche Mat[2], Wan Aliaa Wan Sulaiman[2,3], Mohd Tawfeq Mohd Noor[2], Dhashani Sivaratnam[4], Fan Kee Hoo[2], Hamidon Basri[2]

[1] Department of Family Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Serdang, Selangor, Malaysia.
[2] Department of Neurology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Serdang, Selangor, Malaysia.
[3] Malaysian Research Institute on Ageing, Universiti Putra Malaysia, 43400, Serdang, Selangor, Malaysia.
[4] Department of Ophthalmology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Serdang, Selangor, Malaysia.

ABSTRACT

Introduction: Coronavirus disease-2019 (COVID-19) was declared a global pandemic in March 2020, with 15 million people have been infected worldwide, and this number is increasing. Our study sought to assess the knowledge and practice of healthcare workers (HCWs) in a teaching hospital in Malaysia. **Methods:** This cross-sectional study was undertaken using online Google form links among HCWs. Knowledge and practice were assessed using a validated questionnaire. The analysis was performed with SPSS version 26. Factors associated with poor knowledge were analysed using multivariate analysis. **Results:** A total of 193 HCW responded to our online survey. Majority of our HCWs were female (74.1%) with a mean age of 32.5 years. We found 53 (27.5%) and 134 (69.4%) of our HCWs had good knowledge and good practice on COVID-19, respectively. Knowledge gap was identified in the symptomatology, investigation methods and management. Based on multiple logistic regression, determinants of poor knowledge scores were those work as medical attendants (aOR = 3.626; 95% CI = 1.489, 8.834) and nurses (aOR = 4.107; 95% CI = 1.175, 14.358). **Conclusion:** Around one-third and 70% of our HCWs have good knowledge and practice of COVID-19 infection respectively. Continuous, specifically targeted and updated medical education, need to be carried out to improve the knowledge and practice among our HCWs in order to keep abreast of the fast-moving pace of COVID-19 knowledge development.

Keywords: SARS-CoV-2, COVID-19, Knowledge, Practice behavior, University Teaching Hospitals

Corresponding Author:
Abdul Hanif Khan Yusof Khan, MMed
Email: ahanifkhan@upm.edu.my
Tel: +603-9769 2569

INTRODUCTION

The outbreak of COVID-19 in early December 2019 was first identified in Wuhan; China. Following the exponential rise of cases globally, this mysterious and rapidly spreading pneumonia was collectively termed; coronavirus disease 2019 (COVID-19). On 11th March 2020, the World Health Organization (WHO) declared a public health emergency of international concern caused by a novel virus SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) (1). As of 24th July 2020, around fifteen million patients infected with more than half a million death reported worldwide (2). In Malaysia, 8840 confirmed COVID-19 cases recorded with 123 deaths associated with the disease.

The knowledge on COVID-19 is rapidly expanding, with accumulating evidence being reported with regards to the pathophysiology, clinical presentation, and management. Transmission of SARS-CoV-2 occurs primarily between people through the aerosol form in infected patients with an incubation period of 14-days (1). The clinical presentation can be heterogeneous, ranging from completely asymptomatic, typical upper respiratory tract infection and in a small subset of patients presented with an unusual presentation, e.g., a thromboembolic phenomenon (3–5). Patients with pre-existing co-morbidities and an elderly are considered at higher risk to develop severe disease and mortality (3,6). Currently, during this study being done, there is no specific cure, and effective vaccine developments are still in the early clinical trial stage. In view of this, the WHO recommends measures to prevent spreading of SAR-

CoV-2 among human and provides recommendations to reduce risk of transmission by adopting strict hygiene practices, including frequent hand hygiene as part of our day-to-day practices, avoiding close contact with other people (social distancing) to limit disease spread (7).

Healthcare workers (HCWs), especially medical front-liners fighting this raging disease, are a vulnerable group exposed to dangers of the pathogen itself but may also be susceptible to psychological stress. This manifests from longer work hours, exhaustion due to excessive workload, and even physical violence from the public panic response (8). Therefore, HCWs need to keep abreast of the fast-moving knowledge of COVID-19 to prevent delays in identifying and treating infected individuals to prevent the rapid spread of the illness. Guidelines had been developed by both international organisations, e.g., WHO and the Center of Control Disease, coupled with local guidelines around the world preaching community to adapt with the new socio-behavioural norms (e.g. reduced outing and shopping for non-essential activities) and a series of preventive measures (e.g. physical distancing) from public health perspective had been routinely broadcasted to remind us in hope what we know and what we do can be consistent, then we can successfully fight the pandemic.

Although community have been educated for public health measures, studies showed that people's motivation to comply with these restrictions and preventive measures during lockdown differed across people, particularly among those with distinct opinions and attitudes (9,10). Some studies reported that age, gender, education, health literacy, pre-pandemic factors, antisocial potential, moral disengagement from COVID-19 rules and trust in national/local authorities was associated with motivation to comply with public health advice and preventive measures (11–17). For example, younger adults showed higher compliance rate with COVID-19 preventive measures than older adults (17). Men are more likely not compliance compared to females because men have a perception that they are less likely to contract COVID-19 and they have a stronger immunity to fight against the virus and less likely to suffer from serious health problem even if they were infected those with lower education were more likely to have non-compliance behaviour and this could be correlated with their health literacy) (12,16,17).

Nonetheless, less is known about knowledge on COVID-19 among HCWs, and so far, however, no study has been published to assess knowledge of HCWs on the COVID-19 pandemic in Malaysia. To fill in this vacuum, we conducted a study with objectives to assess baseline knowledge and practice among various groups of HCWs in a public university hospital and their associated factors. This study has important implications for public health policies and communication on COVID-19, as HCWs are expected to be more knowledgeable and able to educate the public, particularly on preventative and management of COVID-19. However, due to the heterogeneity of our HCWs, they may have different competency to acquaintance with knowledge and different practice in preventing COVID-19 which our study aimed to investigate.

MATERIALS AND METHODS

Study design

This was a cross-sectional study was conducted in Universiti Putra Malaysia Teaching Hospital from 1st May 2020 till 31st May 2020. We used a pre-validated questionnaire distributed online using a google form link. Our hospital is a 400-bedded hospital with approximately 250 HCWs and is currently a non-treating COVID-19 hospital.

Ethics approval

Ethics approval was obtained from the Universiti Putra Malaysia ethic committee for research involving human subject prior to data collection (JKEUPM-2020-246). This research was conducted in accordance to the principles of the declaration of Helsinki. Informed consent was obtained from respondents prior to data collection.

Study population

HCWs refered to all persons working in a healthcare setting to improve health and manage diseases, such as specialists, medical officers, nurses, medical assistants, medical attendants, and allied health) practising as front liners in our hospital who are aged 18 years and above.

Sample size calculation and sampling method

The sample size was calculated based on Epi Info 7.0, using the prevalence of good knowledge and practice towards COVID-19 of 69-74 per cent reported in a study (18). The estimated sample size was 141, with 80 per cent power, 95 per cent confidence interval (CI), and a statistically significant level (α) at 5 per cent. The total number of respondents needed was 176, after taking into account a non-respondent rate of 20 per cent. Convenient snowballing sampling method was used to recruit study samples.

Study Variables

Independent Variables

Independent variables in this study were demographic characteristics, i.e. age, highest academic qualification, duration of experience as HCWs and current speciality attached to, i.e. medical based and surgical based.

Dependent variables

A new set of questionnaires was modified based on the literature. Knowledge was assessed by using a 45-item questionnaire that was pre-validated and modified to suit our HCWs based on WHO (Question and Answer webpage) and a study by Olum et al. in

Uganda (18,19). The questions were designed to address knowledge on the causative agent, incubation period, symptomatology, diagnostic methods, criteria of screening, and management. The response was; 'yes' or 'no'; each is weighing one and zero points respectively. The minimum score is 0, and the maximum score is 42.

Practice was assessed with an eight-item questionnaire that will assess the practice in preventing COVID-19 developed from WHO and Ministry of Health Malaysia, i.e. frequent hand washing, wearing a mask and personal protective equipment, avoiding crowded places, social distancing and avoid travelling to a high-risk area (19,20). The response was; yes or no; each is weighing one and zero points respectively. The minimum score is 0, and the maximum score is 8.

Data collection instruments

Pilot study was conducted to look at the feasibility and suitability of the methodology.
Subsequently, the questionnaire was distributed to the participants via Google Forms link along with the consent form. Results from the questionnaire were downloaded in Microsoft Excel format for cleaning and coding.

Operational definition

To classify of those with good and poor knowledge or practice, we refered to Bloom (1956) which suggested cut-off of 80% for classification (21,22). We used cut-off of 80% for good knowledge (≥33) and good practice (≥8).

Statistical analysis

We used Statistical Package for Social Sciences (SPSS) version 26.0 for data analysis. Data on socio-demographical characteristics were presented either in frequency and percentage or mean ± standard deviation, or median (interquartile range). Data of knowledge and practice among HCWs in Universiti Putra Malaysia Teaching Hospital were expressed in mean ± standard deviation. Knowledge and practice total scores were further categorised into good and poor based on the median score. Median knowledge score in percentage was calculated with formula: median score of knowledge divided by total score of knowledge (which was 42) and multiple by 100. Median practice score in percentage was calculated with formula: median score of practice divided by total score of practice (which was 8) and multiple by 100. Univariate analysis was performed to identify factors associated with poor knowledge and practice behaviour on COVID-19. The predictors for the poor knowledge and practice of COVID-19 were determined using multiple logistic regression.

RESULTS

Of 250 HCWs approached, a total of 193 HCWs responded to our online survey (response rate = 77.2%). Socio-demographic characteristics of the respondents were presented in Table I. Majority of them were female (74.1%), with a mean age of 32.5 (SD = 5.1) years and more than half were in age ranged from 31 to 40 (57%). Majority responders were nurses (40.9%), followed by medical officers (18.7%), specialists (16.1%), medical attendants (14%), assistant medical officers (7.3%) and allied health (3.1%). Half of the respondents obtained at least a diploma (45.1%), followed by a bachelor degree (24.9%), a postgraduate degree (16.1%) and 14% of responders with only school equivalent qualifications. More than half of the HCWs had less than five years of working experience (50.3%). Majority of them were serving in medical-based departments (79.8%), and 20.2% were in surgical-based departments.

Table 1: Socio-demographic characteristics of the participants (*n* = 193)

Variables		Frequency, *n (%)*	Mean ± S.D.
Gender	Male	50 (25.9)	Not relevant
	Female	143 (74.1)	
Age, years	20 to 30	66 (34.2)	32.49 ± 5.06
	31 to 40	110 (57.0)	
	More than 40	17 (8.8)	
Occupation	Allied health	6 (3.1)	Not relevant
	Medical attendant	27 (14.0)	
	Nurse	79 (40.9)	
	Assistant medical officers	14 (7.3)	
	Medical officers	36 (18.7)	
	Specialist	31 (16.1)	
Highest education level obtained	Secondary school	27 (14.0)	Not relevant
	Diploma	87 (45.1)	
	Bachelor degree	48 (24.9)	
	Postgraduate degree	31 (16.1)	
Working experience, years	Less than 5 years	97 (50.3)	Not relevant
	5 to 10 years	68 (35.2)	
	More than 10 years	28 (14.5)	
Specialties	Medical-Based[1]	154 (79.8)	Not relevant
	Surgical Based[2]	39 (20.2)	

Data are presented in n (%) or mean ± SD. [1] Medical based specialities include; Internal Medicine, Pediatrics, Family Medicine, Anaesthesiology, Emergency Department, Psychiatric, Radiology, Rehabilitation. [2] Surgical based specialities include; General Surgery, Orthopedics, Obstetrics and Gynaecology, Ophthalmology, Otolaryngology (ENT).

From our study, we found 53 (27.5%) and 134 (69.4%) of our HCWs had good knowledge and good practice on COVID-19, respectively. Median knowledge score was 30 (Interquartile range=6) or median knowledge percentage was 71.4%; In term of practice score, the median was and 8 (interquartile range=1) or median knowledge percentage was 100%. We performed subgroup analysis (Table II) on knowledge and practice behaviour of COVID-19 between medical doctors and non-medical doctors to look for kinds of information relating to COVID-19 which were lacking among these specific samples in hope for strengthening the educational program on COVID-19 among HCWs. Based on the analysis, we found that there were

Table II: Subgroup analysis of knowledge and practice behaviour between medical doctors and non-medical doctors in a university teaching hospital on COVID-19 infection (*n* = 193)

Parameters			Medical doctor	Non-medical doctor	p-values
Knowledge on the causative viral agent of COVID-19	SARS-COV-2	Correct	60 (89.6)	67 (53.2)	<0.001
	DEN-2	Incorrect	0 (0.0)	4 (3.2)	
	MERS-COV-2	Incorrect	7 (10.4)	34 (27.0)	
	H1N1	Incorrect	0 (0)	0 (0)	
	I am not sure	Incorrect	0 (0)	21 (16.7)	
Knowledge of the COVID-19 incubation period	3, 7 or 10 days	Incorrect	4 (6.0)	1 (0.8)	0.050[a]
	14 days	Correct	63 (94.0)	125 (99.2)	
Knowledge of the method of COVID-19 transmission	Air droplets/airborne	Incorrect	1 (1.5)	21 (16.7)	0.002
		Correct	66 (98.5)	105 (83.3)	
	Touch	Incorrect	19 (28.4)	30 (23.8)	0.489
		Correct	48 (71.6))	96 (76.2)	
	Blood	Incorrect	6 (9.0)	16 (12.7)	0.436
		Correct	61 (91.0)	110 (87.3)	
	Faecal oral	Incorrect	11 (16.4)	6 (4.8)	0.007
		Correct	56 (83.6)	120 (85.2)	
	Unknown, and need more research	Incorrect	54 (80.6)	110 (87.3)	0.215
		Correct	13 (19.4)	16 (12.7)	
Knowledge of the symptoms of COVID-19	Asymptomatic	Incorrect	20 (29.9)	82 (65.1)	<0.001
		Correct	47 (70.1)	44 (34.9)	
	Fever	Incorrect	5 (7.5)	19 (15.1)	0.127
		Correct	62 (92.5)	107 (84.9)	
	Respiratory symptoms	Incorrect	0 (0.0)	2 (1.6)	0.544[a]
		Correct	67 (100.0)	124 (98.4)	
	G.I. symptoms	Incorrect	29 (43.3)	83 (65.9)	0.002
		Correct	38 (56.7)	43 (34.1)	
	Fatigue and anorexia	Incorrect	32 (47.8)	105 (83.3)	<0.001
		Correct	35 (52.2)	21 (16.7)	
	Thromboembolic symptoms	Incorrect	46 (68.7)	121 (96.0)	<0.001
		Correct	21 (31.3)	5 (4.0)	
Knowledge of high-risk groups to be infected with COVID-19	Elderly	Incorrect	0 (0.0)	0 (0.0)	N/A
		Correct	67 (100.0)	126 (100.0)	
	Children	Incorrect	25 (37.3)	23 (18.3)	0.004
		Correct	42 (62.7)	103 (81.7)	
	Chronic kidney disease patients	Incorrect	9 (13.4)	41 (32.5)	0.004
		Correct	58 (86.6)	85 (67.5)	
	Type 2 diabetes mellitus	Incorrect	4 (6.0)	22 (17.5)	0.026
		Correct	63 (94.0)	104 (82.5)	
	Hypertension	Incorrect	10 (14.9)	21 (16.7)	0.754
		Correct	57 (85.1)	105 (83.3)	
	Previous stroke	Incorrect	21 (31.3)	66 (52.4)	0.005
		Correct	46 (68.7)	60 (47.6)	
	Previous Ischemic heart disease	Incorrect	14 (20.9)	41 (32.5)	0.088
		Correct	53 (79.1)	85 (67.5)	
	Chronic lung disease	Incorrect	1 (1.5)	17 (13.5)	0.006
		Correct	66 (98.5)	109 (86.5)	
	Cancer patients	Incorrect	6 (9.0)	54 (42.9)	<0.001
		Correct	61 (91.0)	72 (57.1)	
	Smoking	Incorrect	0 (0.0)	27 (21.4)	<0.001
		Correct	67 (100.0)	99 (78.6)	

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Table II: Subgroup analysis of knowledge and practice behaviour between medical doctors and non-medical doctors in a university teaching hospital on COVID-19 infection (*n* = 193) (continued)

Parameters			Medical doctor	Non-medical doctor	p-values
Knowledge on criteria for screening patient for COVID-19	Symptomatic	Incorrect	2 (3.0)	7 (5.6)	0.501[a]
		Correct	65 (97.0)	119 (94.4)	
	Close contact	Incorrect	0 (0.0)	2 (1.6)	0.544[a]
		Correct	67 (100.0)	124 (98.4)	
	Travel history within 14 days to high risk area	Incorrect	0 (0.0)	4 (3.2)	0.300[a]
		Correct	67 (100.0)	122 (96.8)	
Knowledge on methods in diagnosing COVID-19	Rapid antigen test	Incorrect	31 (46.3)	32 (25.4)	0.003
		Correct	36 (53.7)	94 (74.6)	
	Nasopharyngeal swab	Incorrect	1 (1.5)	6 (4.8)	0.425[a]
		Correct	66 (98.5)	120 (95.2)	
	Sputum culture	Incorrect	12 (17.9)	14 (11.1)	0.188
		Correct	55 (82.1)	112 (88.9)	
	Chest X-ray	Incorrect	22 (32.8)	38 (30.2)	0.702
		Correct	45 (67.2)	88 (69.8)	
	Full blood count	Incorrect	8 (11.9)	12 (9.5)	0.600
		Correct	59 (88.1)	114 (90.5)	
Knowledge on treatment of COVID-19	Symptomatic treatment	Incorrect	7 (10.4)	40 (31.7)	<0.001
		Correct	60 (89.6)	86 (68.3)	
	Antibiotics	Incorrect	3 (4.5)	23 (18.3)	0.008
		Correct	64 (95.5)	103 (81.7)	
	HCQ	Incorrect	44 (65.7)	47 (37.3)	<0.001
		Correct	23 (34.3)	79 (62.7)	
		Correct	48 (71.6)	107 (84.9)	
	Antiviral	Incorrect	28 (41.8)	100 (79.4)	<0.001
		Correct	39 (58.2)	26 (20.6)	
	Steroids	Incorrect	5 (7.5)	2 (1.6)	0.050[a]
		Correct	62 (92.5)	124 (98.4)	
	Immune-modulatory agents	Incorrect	54 (80.6)	115 (91.3)	0.032
		Correct	13 (19.4)	11 (8.7)	
	Vaccine	Incorrect	2 (3.0)	13 (10.3)	0.070
		Correct	65 (97.0)	113 (89.7)	
Practices of COVID-19 prevention	Frequent hand-washing	Incorrect	0 (0.0)	3 (2.4)	0.553[a]
		Correct	67 (100.0)	123 (97.6)	
	Wearing mask and PPE	Incorrect	2 (3.0)	5 (4.0)	1.000[a]
		Correct	65 (97.0)	121 (96.0)	
	Avoid crowded places	Incorrect	0 (0.0)	1 (0.8)	1.000[a]
		Correct	67 (100.0)	125 (99.2)	
	Social distancing	Incorrect	0 (0.0)	2 (1.6)	0.544[a]
		Correct	67 (100.0)	124 (98.4)	
	Avoid travel to high risk area	Incorrect	0 (0.0)	0 (0.0)	N/A
		Correct	67 (100.0)	126 (100.0)	
	Health seeking behaviour if symptomatic	Incorrect	7 (10.4)	11 (8.7)	0.696
		Correct	60 (89.6)	115 (91.3)	
	Wearing gloves in public places	Incorrect	17 (25.4)	21 (16.7)	0.148
		Correct	50 (74.6)	105 (83.3)	
	Taking traditional medicine	Incorrect	0 (0.0)	0 (0.0)	N/A
		Correct	67 (100)	126 (100.0)	

Note: Data are presented in n (%); N/A: Not available; [a] Fisher's exact test

statistically significant differences between medical doctors and non-medical doctors in the following knowledge domain: causative agent of COVID-19 infection, incubation period, methods of transmission, symptoms of infection, high-risk groups for suffering from complication due to COVID-19 infection, diagnosing methods and treatments available. There was no statistically significant association between screening criteria for COVID-19 and practice for prevention of this infection.

Univariate analysis for good and poor knowledge and practice behaviour of COVID-19 among HCWs were presented in Table III. Among the variables, we found that good and poor knowledge in COVID-19 among HCWs were statistically significant in association with gender (p-values = 0.021), occupation (p-values = 0.004) and highest education level obtained (p-values = 0.002); From the univariate analysis, years of working experience (p-values = 0.034) was the only important independent factor associated with practice behaviour.

In multiple logistic regression analysis, medical attendants were at higher odds of having poor knowledge in COVID-19 (adjusted odd ratio = 3.626, 95% CI = 1.489, 8.834, p-values = .005) and nurses (adjusted odd ratio = 4.107, 95% CI = 1.175, 14.358, p-values = 0.027) as compared to medical officers (Table IV).

DISCUSSION

To date, there are no signs that COVID-19 pandemic will dissipate and may continuously impose new challenges in all sectors, particularly the healthcare system. HCWs

Table III: Association between knowledge and practice behaviour of COVID-19 among healthcare workers in a university teaching hospital using univariate analysis (*n* = 193)

Variables	Knowledge		Pearson chi-square	p-value	Practice behaviour		Pearson chi-square	p-value
	Good, n (%)	Poor, n (%)			Good, n (%)	Poor, n (%)		
Gender			5.326	**0.021***			0.010	0.919
Male	20 (40.0)	30 (60.0)			35 (70.0)	15 (30.0)		
Female	33 (23.1)	110 (76.9)			99 (69.2)	44 (30.8)		
Age, years			0.036	0.982			0.341	0.843
20 to 30	19 (27.3)	48 (72.7)			45 (68.2)	21 (31.8)		
31 to 40	30 (27.3)	80 (72.7)			78 (70.9)	32 (29.1)		
More than 40	5 (29.4)	12 (70.6)			11 (64.7)	6 (35.3)		
Occupation			17.545	**0.004***			2.737	0.741
Allied health	2 (33.3)	4 (66.7)			4 (66.7)	2 (33.3)		
Medical Attendant	4 (14.8)	23 (85.2)			20 (74.1)	7 (25.9)		
Assistant medical Officers	4 (28.6)	10 (71.4)			10 (71.4)	4 (28.6)		
Nurse	13 (16.5)	66 (83.5)			55 (69.6)	24 (30.4)		
Medical officers	15 (41.7)	21 (58.3)			27 (75.0)	9 (25.0)		
Specialist	15 (48.4)	16 (51.6)			18 (58.1)	13 (41.9)		
Highest education level obtained			15.004	**0.002***			2.343	0.504
Secondary education	4 (14.8)	23 (85.2)			20 (74.1)	7 (25.9)		
Diploma	16 (18.4)	71 (81.6)			62 (71.3)	25 (28.7)		
Bachelor degree	18 (37.5)	30 (62.5)			34 (70.8)	14 (29.2)		
Postgraduate degree	15 (48.4)	16 (51.6)			18 (58.1)	13 (41.9)		
Years of working experience			1.519	0.468			6.777	**0.034***
Less than 5 years	23 (23.7)	74 (76.3)			65 (67.0)	32 (33.0)		
5 to 10 years	8 (28.6)	20 (71.4)			55 (80.9)	13 (19.1)		
More than 10 years	22 (32.4)	46 (67.6)			54 (79.4))	14 (20.6)		
Specialties			1.185	0.276			0.129	0.720
Medical-based[1]	45 (29.2)	109 (70.8)			106 (68.8)	48 (31.2)		
Surgical based[2]	8 (20.5)	31 (79.5)			28 (71.8)	11 (28.2)		

Note: *Factor with p value <0.25 to be included in multiple logistic regression.

Table IV: Predictors of poor knowledge in COVID-19 among healthcare workers in a university teaching hospital using multivariate analysis (*n* = 193)

Factors		Adjusted Odd ratio	95% confidence interval	p-value
Gender	Male	Reference	Reference	Reference
	Female	1.671	0.769, 3.630	0.195
Occupation	Medical officers	Reference	Reference	Reference
	Specialists	1.429	0.231, 8.836	0.701
	Nurse	4.107	1.175, 14.358	0.027
	Assistant medical officers	1.786	0.470, 6.789	0.395
	Medical attendant	3.626	1.489, 8.834	0.005
	Allied health	0.762	0.290, 2.004	0.582
Education level	Bachelor and above	Reference	Reference	Reference
	Diploma and below	1.068	0.114, 9.995	0.954

who are the forefront liners of this pandemic must equip themselves in dealing with this contagious novel to prevent and manage the spread among the community. Therefore, it is essential for authorities in COVID-19 management to identify sufficient knowledge and accurate practice behaviours among their HCWs. Appropriate actions must be taken to fill all the missing gaps in order to improve the overall care and chance in tackling this pandemic.

To the best of our knowledge, this is the first study published in assessing knowledge and practice among HCWs in Malaysia dealing with COVID-19. In Malaysia, a task force was created to manage COVID-19 patients at dedicated care hospitals which usually involve either public tertiary hospitals. Our hospital is a university teaching hospital, which does not gazette as a COVID-19 reference care hospital, but continuously exposed to the possibility of COVID-19 cases through 24hours emergency services available. This study was conducted during the first wave in early May 2020 of COVID-19 infection in Malaysia. In our study, the overall level of knowledge among our HCWs was moderate, with 27.5% responders displayed good knowledge. Nonetheless, the level of practice was higher, with 69.4% showed good practice towards COVID-19. The median knowledge and practice score in percentage was 71.4% and 100%, respectively. The level of knowledge among our HCWs was relatively lower compared to the previous study being done. Our studies found that good knowledge was seen among medical officers and specialist with 41.7% and 48.4% shown to have good knowledge. The lowest seen among the medical attendants, with only 14.8% have good knowledge of COVID-19 followed by the nurses at 16.5%. A study done among HCWs in Uganda showed that the mean knowledge score in percentage was 82.4, with 69% of HCWs reported with good knowledge (18). Other studies also showed a higher number of HCWs with good knowledge. A study done both in Vietnam and China showed more than 80% of HCWs had sufficient knowledge of COVID-19 infection (23,24). Possible explanation for the lower knowledge in our cohort is due to non-familiarity of our HCWs to COVID-19 infections as during the study being done, the infection is still in the early stages in Malaysia with our hospital not managing COVID-19 infection. Nonetheless, medical doctors had good overall knowledge as compared to non-medical personnel. Furthermore, the lower knowledge among our HCWs can also be attributed to the lower number of non-medical doctors in our study, i.e. 34.8% (18.7% medical doctors; 16.1% specialists) compared to the study done in Uganda with the majority of participants were doctors (62%) (18). However, a study done in Vietnam with a significant number of nurses, at around 71%, provided us with another unique perspective that good knowledge does not necessarily belong to doctors alone (24).

We have identified key critical areas of knowledge lacking among our HCWs, particularly among non-medical doctors. In terms of basic knowledge of COVID-19, 30% of non-medical doctors answered incorrectly on the causative viral agent of COVID-19 with 16% unaware of respiratory droplets' role as a method of transmission. Moreover, around 30% of doctors and almost two-third of non-medical doctors answered incorrectly that COVID-19 patients could be asymptomatic of the infection. Awareness of atypical presentation among COVID-19 patients, e.g. gastrointestinal (G.I.) manifestation or thromboembolic phenomenon was also lacking among our cohort, particularly among non-medical doctors. This is an essential area of knowledge to address as studies shown up to 40% of COVID-19 infection could be asymptomatic, and 18% presented with G.I. symptoms (25–27). In terms of investigation knowledge, we found that there were mixed answers on the method of diagnosing, particularly using rapid serology antigen testing, maybe because during this study conducted there was mixed evidence on the effectiveness of serology testing in COVID-19 (28). Nonetheless, good knowledge was found among our cohort on method on diagnosis and screening criteria for COVID-19. The current management for COVID-19 is still heavily investigated, and this was reflected in the management knowledge section among our HCWs. Our results showed mixed results amongst medical and non-medical doctors with more non-medical doctors answered incorrectly at newer approved treatments, e.g. antivirals and immunomodulatory agents. We also found that our medical doctors chose hydroxychloroquine (HCQ) as one of the main treatment arsenals, which during when the survey was done, showed promising results, but which is currently not supported by the latest trials (29). This section of the knowledge assessment shows the importance of continuous medical eduction especially towards a novel infection such as COVID-19.

With the risk of COVID-19 emerges, HCWs should improve infection prevention and control behaviours. In terms of overall practice behaviour, our HCWs showed good practice behaviour among both doctors and non-medical doctors. This study found that lesser working experience (less than 5 years) was associated with poor practice behaviours as compared to those with working experience of more than 10 years among HCWs in HPUPM. According to a review reported by Bavel et al., large scale behavior change could be achieved through several methods, which these methods arised from understanding the human behaviours and by considering psychological burden on individual which influence the motivation to comply with those public health recommendations (30). Bavel et al., summarized important topics from the social and behavioural sciences perspective, which covered threat percention (eg. threat, emotion and risk perception, prejudice and discrimination, and disaster and panic); leadership (eg. trust and compliance, identity leadership and ingroup

elevation); individual and collective interests (eg. Zero-sum thinking, moral decision-making, and cooperation); Science communication (eg. Conspiracy theories, fake news, and persuasion); stress and coping (social isolation and connetion, intimate relationship, and healthy mind-sets) and social context (eg. Social norms, social inequality, culture, and politic polarization) (30). Amid social and behaviours topics, lesser working experience was associated with poor practice behavior in response to the pandemic maybe better explained with culture in social context. Those with more working experience in clinical setting are generally more obliging to personal hygience as this is already the culture in medical setting in which it is very close to the personal practice of hygience norms that we are doing now to prevent infection. This is the reason why those with more working experience in clinical setting are more commited to practice preventive behavior as compared to those with lesser working experience. To improve the practice behavior to prevent infection among those with lesser working experience in clinical setting, it could be achieved through identity leadership model (topic leadership), which prefer localized leaders or senior HCWs in clinical setting to create a sence of personal and social hygience among colleagues and subordinates, to promote practice of hygience as the shared culture among HCWs, as such leadership gives juniors HCWs a sense of collective self-efficacy and hope and in shared culture among HCWs, it provides a psychological platform for HCWs to coordinate efforts to tackle stressors arising from practising preventive measures.

Findings of the associated factors for good knowledge and practice is essential as we may target this particular group of HCWs in a specific educational and programme. More efforts should be directed towards nurses and the medical attendants who are the important front-liners in dealing with potential COVID-19 patients. Attempts should also be made to target non-medical speciality personnel as COVID-19 may not only present as typical upper respiratory symptoms but strangely as G.I., which could be mistaken as surgical cases. Moreover, the planned education programme should focus not only on infection symptomology but also on the latest updates on the evidence-based investigations and managements of COVID-19, which is fast evolving day by day.

Our study had some limitations; firstly, there is no available standardised tool for assessing knowledge and practice among HCWs. Therefore, the comparison between different study cohorts may not be precise. Nonetheless, our questionnaire was pre-validated and was modified according to our HCWs. Secondly, our results would only reflect the knowledge and practice among HCWs in our hospital, a non-COVID-19 treating hospital that could not be generalised across all HCWs in Malaysia. Further larger-scale studies should be conducted, especially among HCWs in COVID-19 treating hospitals nationwide in order to design appropriate interventions on a national level. We used a convenient snowballing sampling method to recruit participants; and we aware that this method can have a potential sampling bias and margin of error however due to mobility restriction order, this sampling technique was used to solve the challenges of locating potential participants.

CONCLUSION

Our study found that around one-third of our HCW had good knowledge of COVID-19 infection. Determinants for poorer knowledge found in medical attendants and nurses. Our HCWs have overall good practice, with around 70% found to have good practice with significant-good practice behaviour seen associated with a longer working experience. Continuous, specifically targeted and updated medical education, need to be carried out to improve the knowledge and practice among our HCWs in order to keep abreast of the fast-moving pace of COVID-19 knowledge development. Further studies need to be carried out among HCWs, especially those working in COVID-19 treating hospitals, to identify knowledge gaps that are likely to exist among Malaysian's HCWs.

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