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ORIGINAL ARTICLE

COVID-19 KNOWLEDGE, ATTITUDES, AND PRACTICES AMONG HEALTHCARE WORKERS IN URBAN COMMUNITY BANGKOK, THAILAND

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ABSTRACT

Objective. This study examined associations between socio-demographic characteristics and knowledge, attitudes, and practices (KAP) related to COVID-19 among healthcare workers in Bangkok, Thailand.

Materials and methods. A cross-sectional online survey was distributed among healthcare workers in Bangkok, Thailand from July - August 2021.

Results. A total of 637 responses were received. Most participants were clinical workers (68.4%), and nearly half (47.3%) had been at risk of infection with COVID-19 (ever screening test). Binary logistic regression analysis found associations between high knowledge scores and the 26–35-year age group (OR=1.776-1.562, 95%CI 1.021–2.853), having a bachelor's degree or higher (OR=1.672, 95%CI 1.058–2.644), and clinical workers (OR=1.784, 95CI% 1.188–2.678). The 36 year and above age group was associated with higher attitude scores (OR=2.406, 95%CI 1.567–3.695). Higher practice scores were associated with females (OR=1.913, 95%CI 1.057–3.464), and clinical workers (OR=1.903, 95CI% 1.170–3.095). Correlation analysis found a positive correlation between practice scores and knowledge ($r=0.322$, $p<0.001$) and attitudes ($r=0.263$, $p<0.001$).

Conclusion. Although healthcare workers demonstrated overall high knowledge, attitude, and practice scores, this study identified several factors that influence KAP. This study can guide public health strategies regarding healthcare workers during the third wave of the COVID-19 pandemic in Thailand.

Key words: *COVID-19, knowledge, attitudes, practices, healthcare workers, Thailand*

Abbreviations

COVID-19 – Coronavirus disease; KAP – Knowledge, Attitudes, Practices; HCWs – Healthcare workers; ICU – Intensive Care Unit; OR – Odds Ratio; CI – Confidence Interval; r – correlation coefficient.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has emerged as a serious threat to human societies worldwide. An increasing proportion of the populations most at risk of serious illness or death are becoming infected [1]. Healthcare workers (HCWs) are at the forefront in the containment of COVID-19, and they are at increased risk of exposure to the virus [2]. Understanding the factors contributing to the increased rates of infection among HCWs can mitigate virus transmission among HCWs and patients alike [3, 4].

Although direct transmission in hospitals cannot be ruled out as a cause of infection among HCWs, the data do not indicate widespread nosocomial transmission among either patients or HCWs [5]. Nonetheless, COVID-19 represents an occupational health risk among HCWs due to their frequent exposure to

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infected individuals [6]. However, studies on factors influencing infection rates among HCWs are scarce and have methodological limitations that include poor control of the amount and intensity of exposure as well a lack of control of confounding factors [7].

People's adherence to infection control measures will largely be affected by their knowledge, attitude, and practices (KAP). Among existing studies, hospital environmental contamination and lack of isolation room facilities that lead to transmission between HCWs have been associated with overcrowding [8]. Another study reported that compared with non-HCWs, HCWs with COVID-19 were younger, had less severe illness, and were less likely to be admitted to hospitals [9]. These findings suggest the possibility of socio-demographic and facility-based factors in COVID-19 transmission among HCWs, which could indicate that some HCWs have inadequate knowledge and practices related to infection prevention. Although several studies have found adequate and good knowledge among HCWs during the COVID-19 pandemic [2, 3, 6, 10, 11, 12, 13], others have reported poor knowledge and improper practices [14, 15, 16]. Insufficient knowledge related to COVID-19 could lead HCWs to engage in inappropriate practices, increase their stress and anxiety, and undermine the adequacy of their medical judgments [6]. The public must routinely practice precautionary behaviors to control the spread of COVID-19, and requiring people to adhere to social distancing and appropriate preventative practices can help prevent or contain outbreaks [17, 18]; however, effective pandemic management requires an adequate understanding of the factors that influence behavioral changes [19], including the ways that KAP affect individuals' adherence to government measures [20].

Multiple waves of COVID-19 outbreaks in Thailand have impacted many provinces, with the largest outbreaks being associated with sites that attracted crowding, extended interactions, and high turnover [21, 22, 23]. It is important that HCWs adhere to the recommended COVID-19 prevention measures in order to support efforts to mitigate the impacts of this disease. Findings of a few previous studies on gaps in KAP regarding COVID-19 transmission in Thailand have been used to produce targeted educational videos that have contributed to with subsequent improvements on retesting [24]; however, such research has largely been focused on the general public, and few have specifically focused on HCWs.

This study aimed to help address the above-mentioned research gap by conducting a cross-sectional survey study among HCWs in Bangkok, Thailand. Specifically, this study aimed to: 1) collect information on HCWs' baseline knowledge, attitudes, and practices related to COVID-19; 2) examine potential associations between socio-demographic characteristics and COVID-19-related knowledge, attitudes, and practices; 3) compare clinical and non-clinical KAP; and 4) investigate possible correlations between knowledge, attitude, and practice dimensions. In so doing, this study can help identify various characteristics of HCWs who are more likely to be vulnerable to the effects of COVID-19. In addition, understanding how the virus spreads reinforces the importance of prevention measures. Knowing how COVID-19 has impacted people of all ages may reinforce the need for everyone to adopt health-promoting behaviors.

MATERIAL AND METHODS

Study design

This study conducted a cross-sectional survey study of HCWs working at the Faculty of Medicine Vajira Hospital, Bangkok, Thailand. Data collection occurred from July – August 2021. This study was approved by the Ethics Committee of Faculty of Medicine, Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand (Approval no. COA 116/2564).

Participants

HCWs aged 18 years and above agreed to participate in the study. All participants were of Thai nationality and living in the urban community of Bangkok, Thailand. The sample size was calculated using G*Power based on the estimated population of HCWs in the city.

Data collection

Questionnaires were completed using an online survey (Google forms). Participants were recruited on social media using a snowball technique based on social distancing during the COVID-19 pandemic. The invitation requested voluntary participation of HCWs and provided instructions for filling in the questionnaire.

Questionnaire

The questionnaire was designed based on a previous KAP study on COVID-19 [25] and adapted to the situation in Thailand by a team of experts. The questionnaire takes about 10 minutes to complete and is divided into four sections. The first part collected socio-demographic information, including gender, age, education, occupation, income, marital status, residence type, and risk of contracting COVID-19 (Table 1). The remaining three sections were dedicated to KAP items (Table 2), including: 1) ten knowledge items (K1-K10) rated No=0 and Yes=1 for a total score ranging from 0 to 10 and a cut-off point of 60% (≥8 points) indicating adequate knowledge; 2) nine

attitudes items (A1-A9) rated on scale comprised of Agree=2; Not Sure=1; Disagree=0 for a total score ranging 0 to 18 and a cut-off point of 13 points denoting favorable attitudes; and 3) seven practice items (P1-P7) rated as Practice=2; Not sure=1; Not practice=0 for a total score ranging from 0 to 14 and a cut-off point of 13 points demonstrating proper practices. Several attitude, and practice items were based on participants' perspectives of whether the country could win the fight against the COVID-19 pandemic (see Table 2 for details).

Statistical analysis

We summarized the descriptive statistics and compared sociodemographic characteristics using binary logistic regression to test the association between socio-demographic characteristics with COVID-19 related knowledge, attitudes, and practices and investigate differences between clinical and non-clinical workers. We used *Spearman's* correlation analysis to examine relationships between knowledge, attitudes, and practices scores. The level of significance was set at $p<0.05$. The statistical analysis was performed using the Statistical Package for the Social Sciences Program (SPSS), version 22.

RESULTS

The original number of participants was 758; however, applying inclusion and exclusion criteria resulted in 715 responses. Among these, we obtained a total of 637 valid responses. Sociodemographic characteristics are presented in Table 1. Among the included HCWs, the majority (88.5%) were female, and the mean age was 37.86±11.70. Most participants had attained bachelor's degree or above (79.4%), were clinical workers (68.4%), earned an income of at least 25,000 Thai Baht (54.0%), and were single (61.5%) The largest group were living in homes (37.7%). Nearly half reported having been at risk of contracting COVID-19 (ever had a screening test; 47.3%). These characteristics are representative of the social demographics of the HCWs living in Bangkok.

Responses on knowledge, attitudes, and practices

The mean knowledge score was 8.53±1.49 (Table 2). Nearly 60% of participants showed good knowledge (n=370) and just over 40% demonstrated poor knowledge (n=267). Most participants understood that wearing two masks can prevent infection better than one layer (68.9%), recognized frequent handwashing as a preventative measure (95.3%), and knew that vaccines prevent severe symptoms (78.6%).

The mean attitudes score was 13.52±2.49 (Table 2). Participants were more or less evenly divided between favorable (50.9%) and unfavorable (49.1%) attitudes. Approximately 70% expressed a favorable attitude toward the idea that wearing two masks is better than one mask, and over 90% agreed that avoiding crowds and public places can protect COVID-19 (n=587). However, fewer than 40% believed that COVID-19 can be controlled (n=236), and most agreed that the pandemic has affected daily life (97.8%) and family (96.7%).

The mean practices score was 13.62±0.89 (Table 2). Approximately 80% of participants reported maintaining proper practices (n=512). The majority reported frequently washing their hands or cleaning them with alcohol (99.1%) and covering their mouths and noses with an elbow or tissue when coughing or sneezing (89.8%). Most reported that they strictly complied with government guidelines (96.9%), and followed news updates about the COVID-19 situation (98.4%).

Table 1. Sociodemographic characteristics of participants (n = 637)

Socio-demographics	n (%)
Gender	
Male	73 (11.5%)
Female	564 (88.5%)
Age (years)	
≤25	126 (20.3%)
26-35	176 (27.6%)
≥36	332 (52.1%)
Education	
Less than a bachelor's degree	131 (20.6%)
bachelor's degree or above	506 (79.4%)
Occupation	
Non-clinical worker	201 (31.6%)
Clinical worker	436 (68.4%)
Income	
<15,000	45 (7.1%)
15,001-20,000	138 (21.7%)
20,001-25,000	110 (17.3%)
>25,000	344 (54.0%)
Status	
Single	392 (61.5%)
Married	223 (35.0%)
Divorced	22 (3.5%)
Residence type	
House	240 (37.7%)
Condominium or apartment	180 (28.3%)
Hospital service	217 (34.1%)
Risk of contracting COVID-19	
Have been infected	13 (2.0%)
Experienced risk (ever screening test)	301 (47.3%)
Never at risk	194 (30.5%)
Not sure	129 (20.3%)

Table 2. Knowledge, attitude, and practice scores

Knowledge		n (%)	
		True	False
K1	COVID-19 is spread through human-to-human transmission.	627 (98.4%)	10 (1.6%)
K2	COVID-19 can be spread by droplets and aerosols.	626 (98.3%)	11 (1.7%)
K3	COVID-19 symptoms include mild fever, tiredness, dry cough, and muscle pain.	604 (94.8%)	33 (5.2%)
K4	Everyone has the same risk of infection COVID-19.	560 (87.90%)	77 (12.1%)
K5	There currently is no treatment for COVID-19.	556 (87.3%)	81 (12.7%)
K6	Wearing two layers of masks can prevent infection from COVID-19 better than one layer.	439 (68.9%)	198 (31.1%)
K7	Washing hands frequently reduces the risk of COVID-19 infection	607 (95.3%)	30 (4.7%)
K8	Anyone who comes in contact with someone infected with COVID-19 should be immediately isolated for 14 days.	583 (91.5%)	54 (8.5%)
K9	Vaccines prevent severe COVID-19 symptoms.	501 (78.6%)	136 (21.4%)
K10	There currently is no information on the efficacy and safety of vaccination against COVID-19.	334 (52.4%)	303 (47.6%)

Knowledge mean±SD = 8.53±1.49; Max score=10
Good knowledge: 370 (58.1%), Poor knowledge: 267 (41.9%)
True=1, Note sure and False=0

Attitudes		n (%)		
		Agree	Not Sure	Disagree
A1	COVID-19 can be controlled	236(37.0%)	297(46.6%)	104(16.3%)
A2	COVID-19 has affected my daily life.	623 (97.8%)	10 (1.6%)	4 (0.6%)
A3	COVID-19 has affected my family.	616 (96.7%)	15 (2.4%)	6 (0.9%)
A4	Cleaning inside households or offices daily can protect against COVID-19	424 (66.6%)	180(28.3%)	33 (5.2%)
A5	Wearing two masks is more effective than one mask	445 (69.9%)	160(25.1%)	32(5.0%)
A6	Avoiding crowds and public places can protect from COVID-19	587 (92.2%)	40 (6.3%)	10 (1.6%)
A7	Vaccination is the best protection against COVID-19.	347 (54.5%)	187(29.4%)	103(16.2%)
A8	The government's clear and accurate information and media will be able to control the spread of COVID-19.	260 (40.8%)	230(36.1%)	147(23.1%)
A9	I have confidence that governmental measures will be able to control the spread of COVID-19.	98 (15.4%)	224(35.2%)	315(49.5%)

Attitudes mean±SD = 13.52±2.49, Max score=18
Favorable attitudes: 324 (50.9%), Unfavorable attitudes: 313 (49.1%)
Agree=2; Not Sure=1; Disagree=0

Practices		n (%)		
		Practice	Not sure	Not practice
P1	I wear a mask every time I leave the house.	633 (99.4%)	2 (0.3%)	2 (0.3%)
P2	I wash my hands or clean them with alcohol often.	631 (99.1%)	5 (0.8%)	1 (0.2%)
P3	I cover my mouth and nose with my elbow or a cloth or tissue. when I cough or sneeze	572 (89.8%)	22 (3.5%)	43 (6.8%)
P4	I maintain at least 1 meter distance from others in public places.	593 (93.1%)	31 (4.9%)	13 (2.0%)
P5	I avoid crowds and public places.	609 (95.6%)	25 (3.9%)	3 (0.5%)
P6	I follow news updates about the COVID-19 situation.	627 (98.4%)	9 (1.4%)	1 (0.2%)
A7	I have strictly complied with government guidelines.	617 (96.9%)	20 (3.1%)	0

Practice mean±SD = 13.62±0.89, Max score=14,
Proper Practices: 512(80.4%), Improper Practices: 125(19.6%)
Practice=2; Not sure=1; Not practice=0.

Association between sociodemographic characteristics and knowledge, attitudes, and practices (KAP)

Table 3 presents the results of the multivariate analysis. The multivariate analysis of knowledge showed that being at least 26 years of age was associated with greater knowledge about COVID-19 ($p < 0.05$; OR=1.776-1.562, 95%CI 1.021–2.853). In addition, having a bachelor's degree or higher ($p = 0.028$; OR=1.672, 95%CI 1.058–2.644) and being a clinical worker ($p = 0.005$; OR = 1.784, 95CI% 1.188–2.678) were associated with greater knowledge about COVID-19.

Being aged 36 or older was associated with more positive attitudes about COVID-19 ($p < 0.001$; OR = 2.406, 95%CI 1.567–3.695). Notably, being a clinical worker was not associated with positive attitudes about COVID-19.

Table 3. Results of binary logistic regression analysis

Association between sociodemographic characteristics, knowledge, attitudes, and practices (KAP)						
Multivariate						
Socio-demographics	Knowledge		Attitudes		Practice	
	OR (95%CI)	*p*-value	OR (95%CI)	*p*-value	OR (95%CI)	*p*-value
Gender						
Male	Ref.		Ref.		Ref.	
Female	1.030 (0.601-1.766)	>0.05	0.860 (0.501–1.474)	>0.05	1.913 (1.057–3.464)	**0.032**
Age (years)						
≤25	Ref.		Ref.		Ref.	
26-35	1.776 (1.109–2.853)	**0.017**	0.942 (0.588–1.509)	>0.05	1.400 (0.789–2.485)	0.250
≥36	1.562 (1.021–2.388)	**0.040**	2.406 (1.567–3.695)	**<0.001**	1.673 (0.989–2.830)	**0.055**
Education (degree)						
< bachelor's degree	Ref.		Ref.		Ref.	
≥bachelor's degree	1.672 (1.058–2.644)	**0.028**	1.099 (0.700–1.725)	>0.05	1.847 (0.855–2.586)	0.160
Occupation						
Non-clinical worker	Ref.		Ref.		Ref.	
Clinical worker	1.784 (1.188–2.678)	**0.005**	1.202 (0.800–1.806)	>0.05	1.903 (1.170–3.095)	**0.009**
Knowledge scores (1 = < 8 scores, 2 = ≥ 8 scores). Attitudes scores (1 = < 13 scores, 2 = ≥ 13 scores). Practice scores (1 = < 13 scores, 2 = ≥ 13 scores). OR, odds ratio; CI, confidence interval. Significant at *p*-value < 0.05.						
Association between KAP question items with occupational variable						
Occupation	KAP-questions items					
	OR (95%CI)	*p*-value	OR (95%CI)	*p*-value	OR (95%CI)	*p*-value
Knowledge(K)	K6		K7		K9	
Non-clinical worker	Ref.		Ref.		Ref.	
Clinical worker	0.640 (0.416–0.984)	**0.042**	2.749 (1.234–6.126)	**0.013**	1.745 (1.132–2.689)	**0.012**
Attitudes(A)	A1		A5		A6	
Non-clinical worker	Ref.		Ref.		Ref.	
Clinical worker	1.458 (0.993–2.141)	0.054	0.675 (0.449–1.013)	0.058	2.133 (1.115–3.940)	**0.015**
Practice(P)	P2		P3		P7	
Non-clinical worker	Ref.		Ref.		Ref.	
Clinical worker	2.139 (0.264–17.376)	0.477	1.629 (0.933–2.844)	0.086	0.628 (0.188–2.095)	0.449
Health care worker is non-clinical worker =0, clinical worker =1. Knowledge(K) is good knowledge = 0, poor knowledge = 1. Attitudes(A) is favorable attitudes = 0, unfavorable attitudes = 1. Practice(P) is proper practices = 0, improper practices = 1. OR, odds ratio; CI, confidence interval. Significant at p-value < 0.05.						

Being female was associated with more proper practices (p = 0.032; OR=1.913, 95%CI 1.057–3.464), as was being 36 years of age or older (p = 0.055; OR=1.673, 95%CI 0.989–2.830) and being a clinical worker (p = 0.009; OR=1.903, 95CI% 1.170–3.095).

Association between KAP items and sociodemographic variables

When examining associations between sociodemographic characteristics and individual items, being a clinical worker was associated with higher scores than non-clinical workers on several knowledge items (Table 3), including the benefits of frequent handwashing and the effectiveness of vaccines for preventing severe symptoms ($p < 0.05$; OR=1.745-2.749, 95CI% 1.234–6.126), that wearing two mask layers can prevent infection better than one layer ($p < 0.05$; OR=0.640, 95CI% 0.416–0.984).

Being a clinical worker was also associated with more favorable attitude item scores related to the effectiveness of avoiding crowds and public places to protect against COVID-19 (p = 0.015; OR= 2.133, 95CI% 1.115–3.940). Differences between clinical and non-clinical workers optimism regarding whether COVID-19 can be controlled and wearing two masks is more effective than only one mask approached the level of significance (p >0.05). Being a clinical worker was not associated with any difference in practices.

Correlations between knowledge, attitude, and practice scores

Table 4 presents the results of the *Spearman's* correlation analysis. There were weak-to-moderate positive correlations between practices and both knowledge and attitudes.

Table 4. Spearman correlation analysis between knowledge, attitudes, and practices scores on healthcare workers

Correlation coefficient (r)		
Variables	Practice	p-value
Knowledge	0.322	<0.001
Attitudes	0.263	<0.001
Practice	1.000	-

Correlation coefficient significant at p-value < 0.05.

DISCUSSION

This study was conducted among HCWs working in an urban community during the third wave of the COVID-19 pandemic in Thailand. The findings show that sociodemographic factors such as gender, age, and education can influence health care workers' knowledge, attitudes, and practices, and practices are positively and significantly correlated with knowledge and attitudes. The findings reinforce the need for COVID-19-related training and education among HCWs as well as adequate supports for front-line workers in order to prevent or mitigate further outbreaks [26].

The finding that nearly half of the participants had experienced sufficient risk of infection that they had obtained a COVID-19 screening highlights HCWs' heightened occupational health risk due to their frequent exposure to infected individuals [6, 27]. One study argued that more robust national surveillance testing methods are needed to accurately monitor HCWs' COVID-19 infections and deaths as a means to improve safety [28]. The risk factors driving high infection rates among both patient-facing and non-patient-facing front-line HCWs require the implementation of special public health interventions and occupational health policies [29].

Association between sociodemographic characteristics and knowledge, attitudes, and practices

The finding that HCWs aged 26 years and above demonstrated a 1.77-fold increase in knowledge scores over those aged 25 below is in agreement with previous studies [30, 31], as is the result that participants with higher education levels showed a 1.67-fold increase in knowledge scores over those with less than a bachelor's degree [10, 32]. In addition, being a clinical worker was associated with a 1.78-fold increase in knowledge scores over non-clinical workers reinforces the results of previous research [30, 32, 33]. However, the high level of knowledge might be due to the advanced information networks of the current modern world and higher education level of the people [34].

The finding that HCWs aged 36 above showed a 2.40-fold increase in favorable attitudes than younger age groups is agreement with a previous study [35]. Notably, although being a clinical worker was not significantly associated with more favorable attitudes about COVID-19, the fact that hi group showed a 1.20-fold increase in attitude scores than non-clinical workers is similar to the results of a previous study [35]. Studies have suggested that HCWs were anxious about their families becoming infected with COVID-19 due to their occupation [36]. Positive attitudes are an important factor in implementing effective healthcare management [37].

The finding that being female was associated with a 1.91-fold increase in proper practices over males could be attributable to the tendency for women to be more directly involved with family responsibilities [38, 39]; however, some researchers have suggested that the reasons for gender and specialty differences require further exploration [40]. The result that clinical workers showed 1.90-fold increase in proper practices over non-clinical workers reinforces the

recommendation of other studies that occupational factors must be addressed [38]. One study found limited prevention practices during the outbreak [33]; however, other research has demonstrated that COVID-19-related practices were significantly related to education [35].

Association between KAP question items and occupation

The finding that clinical workers showed 1.74-fold increase over than non-clinical workers in the knowledge items related to handwashing and the effectiveness of vaccines is in agreement with previous studies that have indicated that clinical workers have greater self-defense awareness than other groups [12, 13]. Like other studies [2, 3, 6, 10–13], we found that HCWs demonstrated overall adequate knowledge of COVID-19 transmission and preventative practices. There is potential utility for HCWs and government authorities to work together to further build vaccine awareness [41]. The current study also found that clinical workers showed a .64-fold reduction than non-clinical workers concerning the utility of wearing two masks rather than one. This result could be interpreted as an indication that clinical workers do not perceive that mask are sufficient protection; rather they may be aware that wearing personal protective equipment (PPE) is more effective at preventing transmission than masks [11]. Studies have reported that N95 face masks offer superior protection than other types [32]. Other studies have indicated that the use of PPE and infection control training are associated with decreased infection risk [7].

Our finding that clinical workers showed 2.13-fold increase over than non-clinical workers concerning the attitude that avoiding crowds and public places could help prevent COVID-19 infection aligns with previous research [13]. Studies have shown that transmission cases have been dominated by superspreading events or contexts, crowded spaces, indoor venues, and unventilated places [42]. We also found that clinical workers had more favorable attitudes than non-clinical workers that COVID-19 can be controlled, which is in agreement with a previous study that showed that this disease can be prevented [43]. Clinical workers' favorable attitudes may be based on a greater awareness of the real situation of COVID-19. Casual attitudes regarding personal safety have been identified as an important barrier to preventative practices [44]. Directing more rigid mask policies toward high-risk rather than low-risk setting or activities is expected to foster mask adherence and acceptance and decrease mask-related discomfort and fatigue [42]. Scientific evidence indicates that mask wearing reduces transmissibility per contact by reducing the transmission of infected respiratory particles in both laboratory and clinical contexts [45]. The current study found that most participants felt that the pandemic had affected their daily lives and families, and a substantial proportion had limited confidence that government measures would be able to control the spread of COVID-19. Hence, we recommend that hospitals and government agencies implement policies to specifically protect the safety of HCWs.

There were no significant differences in COVID-19-related practices between clinical and non-clinical HCWs. Both groups engaged in practices such as frequent handwashing and covering the mouth or nose while sneezing, as experts have recommended [46]. In addition, like HCWs in other studies [13, 47], most participants reported that they had strictly complied with government guidelines are similar to those of other published study and followed news update about the COVID-19 situation. However, other studies have reported poor knowledge and improper practices among HCWs during COVID-19 pandemic [14, 15, 16]. Education and consistent risk communication with the public are critical for an effective pandemic response [42]. One study suggested that close following of such information 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 [47]. Health authorities should further increase publicity to raise public awareness of the disease.

Correlations between knowledge, attitudes, and practices scores

We found modest positive correlations between practices and both knowledge and attitudes, which is in agreement with a previous study [11]. However, another study found that although participants practiced preventive measures, some lacked optimistic attitudes [10]. Like other studies, we found that participants were concerned about dealing with the pandemic long-term [48]. One study suggested that differences between attitudes and practices are likely due to the perception of HCWs of the magnitude of the pandemic [47]. Research has demonstrated that a strong perception of the seriousness of a pandemic and its health consequences is an independent predictor of protective behaviors [49]. Hence, knowledge can play a crucial role in enhancing preventative practices [18].

Limitations

This study was conducted online using self-reported data, which may introduce selection bias. Secondly, this was a cross-sectional study conducted among HCWs in a single hospital, and the responses may not reflect the situation in other regions or at other points

in time. Finally, we did not evaluate the questionnaire's reliability because it was designed based on a previous COVID-19-related KAP study [25] and adapted by a team of experts to reflect the local situation and incorporate participants' perceptions of whether the country could win the fight against the COVID-19 pandemic through implementing social distancing and other restrictive measures for the prevention and control of the COVID-19.

CONCLUSIONS

During the third waves of the COVID-19 pandemic in Thailand, HCWs demonstrated overall good knowledge, favorable attitudes and proper practices. However, this study identified several influencing factors that can guide public health strategies for HCWs. We recommend that health education campaigns target less educated HCWs. It is critical to ensure the continuous provision of PPE and training of all HCWs on proper infection prevention measures. Strategies should also focus on reducing fear and improving attitudes toward the care of COVID-19 patients as well as the promotion of preventive practices.

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Authors' contributions

JK., contributed to study design, data collection, data analysis, interpretation, writing and revision of the manuscript. PY., contributed to data analysis, interpretation, and writing. BS., contributed to study design, data analysis, interpretation. BW., contributed to study design, data analysis, interpretation. CS., contributed to data collection, design, data analysis, interpretation, and writing. All authors read and approved the final manuscript.

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Declaration of competing interest

The authors declare that they have no conflicts of interest.

REFERENCES

1. *Yetmar ZA, Issa M, Munawar S, Burton MC, Pureza V, Sohail MR, Mehmood T.:* Inpatient Care of Patients with COVID-19: A Guide for Hospitalists. Am J Med. 2020 Sep;133(9):1019-1024. doi: 10.1016/j.amjmed.2020.03.041.
2. *Kamacooko O, Kitonsa J, Bahemuka UM, Kibengo FM, Wajja A, Basajja V, Lumala A, Kakande A, Kafeero P, Ssemwanga E, Asaba R, Mugisha J, Pierce BF, Shattock RJ, Kaleebu P, Ruzagira E:.* Knowledge, Attitudes, and Practices Regarding COVID-19 among Healthcare Workers in Uganda: A Cross-Sectional Survey. Int J Environ Res Public Health. 2021 Jun 30;18(13):7004. doi: 10.3390/ijerph18137004.
3. *Al Youha S, Alowaish O, Ibrahim IK, Alghounaim M, Abu-Sheasha GA, Fakhra Z, Al Hendi S, AlQabandi Y, Almazeedi S, Al Asoomi F, Al-Sabah S.*: Factors associated with SARS-CoV-2 infection amongst healthcare workers in a COVID-19 designated hospital. J Infect Public Health. 2021 Sep;14(9):1226-1232. doi: 10.1016/j.jiph.2021.08.012.
4. *El-Gilany AH.*: COVID-19 caseness: An epidemiologic perspective. J Infect Public Health. 2021 Jan;14(1):61-65. doi: 10.1016/j.jiph.2020.11.003.
5. *Sikkema RS, Pas SD, Nieuwenhuijse DF, O'Toole Á, Verweij J, van der Linden A, Chestakova I, Schapendonk C, Pronk M, Lexmond P, Bestebroer T, Overmars RJ, van Nieuwkoop S, van den Bijllaardt W, Bentvelsen RG, van Rijen MML, Buiting AGM, van Oudheusden AJG, Diederen BM, Bergmans AMC, van der Eijk A, Molenkamp R, Rambaut A, Timen A, Kluytmans JAJW, Oude Munnink BB, Kluytmans van den Bergh MFQ, Koopmans MPG.:* COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study. Lancet Infect Dis. 2020 Nov;20(11):1273-1280. doi: 10.1016/S1473-3099(20)30527-2.
6. *Mendoza Millán DL, Carrión-Nessi FS, Mejía Bernard MD, Marcano-Rojas MV, Omaña Ávila ÓD, Doval Fernández JM, Chacón Labrador FR, Quintero Rodríguez A, Gasparini Vega S, Tami A, Maricuto AL, Velásquez VL, Landaeta ME, Figuera M, Chavero M, Figuera L, Camejo-Ávila NA, Forero-Peña DA.*: Knowledge, Attitudes, and Practices Regarding COVID-19 Among Healthcare Workers in Venezuela: An Online Cross-Sectional Survey. Front Public Health. 2021:13(9):633-723. doi: 10.3389/fpubh.2021.633723.
7. *Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM.*: Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers: A Living Rapid Review. Ann Intern Med. 2020 Jul 21;173(2):120-136. doi: 10.7326/M20-1632
8. *Wu, Z. and J.M. McGoogan:* Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA, 2020;323(13): 239-1242.

9. *Kim, R*., et al., Comparison of COVID-19 infections among healthcare workers and non-healthcare workers. PLOS ONE, 2020;15(12):e0241956.
10. *Shrestha, A*., et al., Knowledge and attitude on prevention of COVID-19 among community health workers in Nepal-a cross-sectional study. BMC Public Health, 2021;21(1):1424.
11. *Hussain, I*., et al., Knowledge, Attitude, and Practices Toward COVID-19 in Primary Healthcare Providers: A Cross-Sectional Study from Three Tertiary Care Hospitals of Peshawar, Pakistan. Journal of Community Health, 2021;46(3):441-449.
12. *Elhadi, M*., et al., Knowledge, attitude, and acceptance of healthcare workers and the public regarding the COVID-19 vaccine: a cross-sectional study. BMC Public Health, 2021;21(1):955.
13. *Ejeh, F.E*., et al., Knowledge, attitude, and practice among healthcare workers towards COVID-19 outbreak in Nigeria. Heliyon, 2020;6(11):e05557.
14. *Burki, T.:* COVID-19 in Latin America. The Lancet Infectious Diseases, 2020;20(5):547-548.
15. *Bhagavathula, A.S*., et al., Knowledge and Perceptions of COVID-19 Among Health Care Workers: Cross-Sectional Study. JMIR Public Health Surveill, 2020;6(2):e19160.
16. *aqlain, M.,* et al.: Knowledge, attitude, practice and perceived barriers among healthcare workers regarding COVID-19: a cross-sectional survey from Pakistan. Journal of Hospital Infection, 2020;105(3): 419-423.
17. *Sakr, S*., et al.: Knowledge, attitude and practices related to COVID-19 among young Lebanese population. BMC Public Health, 2021:21(1).
18. *Lee, M., Kang B.A, You M.*:Knowledge, attitudes, and practices (KAP) toward COVID-19: a cross-sectional study in South Korea. BMC Public Health, 2021. 21(1): p. 295.
19. *Al ahdab, S*.: A cross-sectional survey of knowledge, attitude and practice (KAP) towards COVID-19 pandemic among the Syrian residents. BMC Public Health, 2021;21(1).
20. *Hatabu, A.,* et al.: Knowledge, attitudes, and practices toward COVID-19 among university students in Japan and associated factors: An online cross-sectional survey. PLoS ONE, 2021;15(12 December).
21. Thailand, M.P.H., Strategy: Managing the new wave of the Covid-19 Epidemic. 2021, https://ddc.moph.go.th/viralpneumonia/eng/situation.php: Department of Disease Control, https://ddc.moph.go.th/viralpneumonia/eng/situation.php.
22. Thailand, D.D.C., Thailand Situation, (Report) 2021, https://ddc.moph.go.th/viralpneumonia/eng/situation.php: Department of Disease Control, Thailand, https://ddc.moph.go.th/viralpneumonia/eng/situation.php.
23. Thailand, D.D.C., Thailand Situation, (COVID-19). 2021: Department of Disease Control, Thailand, https://ddc.moph.go.th/viralpneumonia/eng/index.php
24. *Maude, R.R*., et al.: Improving knowledge, attitudes and practice to prevent COVID-19 transmission in healthcare workers and the public in Thailand. BMC Public Health, 2021;21(1):749.
25. *Agarwal, A*., et al., Development and validation of a questionnaire for assessing preventive practices and barriers among health care workers in COVID-19 pandemic. Indian Journal of Medical Microbiology, 2021;39(2): 200-211.
26. *Sotomayor-Castillo, C.,* et al., Infection control professionals' and infectious diseases physicians' knowledge, preparedness, and experiences of managing COVID-19 in Australian healthcare settings. Infection, Disease & Health, 2021.
27. *Sabetian, G*., et al., COVID-19 infection among healthcare workers: a cross-sectional study in southwest Iran. Virology Journal, 2021. 18(1): p. 58.
28. *Oda G.,* et al., COVID-19 Infections Among Healthcare Personnel in the United States Veterans Health Administration, March to August, 2020. Journal of Occupational and Environmental Medicine, 2021. 63(4).
29. *Dzinamarira T*., et al., Risk factors for COVID-19 among healthcare workers. A protocol for a systematic review and meta-analysis. PLOS ONE, 2021. 16(5): p. e0250958.
30. *Moodley S.V.,* et al., A health worker knowledge, attitudes and practices survey of SARS-CoV-2 infection prevention and control in South Africa. BMC Infectious Diseases, 2021. 21(1): p. 138.
31. *Shahbaznejad, L.,* et al., Knowledge, attitude and practice of Sari birth cohort members during early weeks of COVID-19 outbreak in Iran. BMC Public Health, 2021. 21(1): p. 982.
32. *Alrubaiee, G.G.,. Al-Qalah T.A.H,. Al-Aawar M.S.A*, Knowledge, attitudes, anxiety, and preventive behaviours towards COVID-19 among health care providers in Yemen: an online cross-sectional survey. BMC Public Health, 2020;20(1):1541.
33. *Asemahagn, M.A*., Factors determining the knowledge and prevention practice of healthcare workers towards COVID-19 in Amhara region, Ethiopia: a cross-sectional survey. Tropical Medicine and Health, 2020;48(1):72.
34. *Gunjawate, D.R*., et al., Impact of coronavirus disease 2019 on professional practices of audiologists and speech-language pathologists in India: A knowledge, attitude and practices survey. Clinical Epidemiology and Global Health, 2021;9:110-115.
35. *Tamang, N.,* et al., COVID-19: a National Survey on perceived level of knowledge, attitude and practice among frontline healthcare Workers in Nepal. BMC Public Health, 2020;20(1):1905.
36. *Ejeh, F.E.,* et al., Factors associated with preventive behaviors, anxiety among healthcare workers and response preparedness against COVID-19 outbreak: A one health approach. Clinical Epidemiology and Global Health, 2021;10:100671.
37. *Mishra, A*., et al., The healthier healthcare management models for COVID-19. Journal of Infection and Public Health, 2021;14(7):927-937.
38. *De Kock, J.H*., et al., A rapid review of the impact of COVID-19 on the mental health of healthcare workers: implications for supporting psychological well-being. BMC Public Health, 2021;21(1):104.

39. *Karlsson, U., Fraenkel, C.-J.,* Covid-19: risks to healthcare workers and their families. BMJ, 2020;371:m3944.
40. *Bandyopadhyay, S.,* et al., Infection and mortality of healthcare workers worldwide from COVID-19: a systematic review. BMJ Global Health, 2020;5(12):e003097. doi: 10.1136/bmjgh-2020-003097.
41. *Kumari A, Ranjan P, Chopra S, Kaur D, Upadhyay AD, Kaur T, Bhattacharyya A, Arora M, Gupta H, Thrinath A, Prakash B, Vikram NK*. Development and validation of a questionnaire to assess knowledge, attitude, practices, and concerns regarding COVID-19 vaccination among the general population. Diabetes Metab Syndr. 2021;15(3):919-925. doi: 10.1016/j.dsx.2021.04.004.
42. *Escandón, K.*, et al., COVID-19 false dichotomies and a comprehensive review of the evidence regarding public health, COVID-19 symptomatology, SARS-CoV-2 transmission, mask wearing, and reinfection. BMC Infectious Diseases, 2021;21(1):710.
43. *Abdel Wahed, W.Y.*, et al., Assessment of Knowledge, Attitudes, and Perception of Health Care Workers Regarding COVID-19, A Cross-Sectional Study from Egypt. J Community Health, 2020;45(6):1242-1251. doi: 10.1007/s10900-020-00882-0
44. *Agarwal, A*., et al., Are health care workers following preventive practices in the COVID-19 pandemic properly? - A cross-sectional survey from India. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2021;15(1):69-75.
45. *Howard, J*., et al., An evidence review of face masks against COVID-19. Proceedings of the National Academy of Sciences, 2021. 118(4): p. e2014564118.
46. *Greenhalgh T, Schmid MB, Czypionka T, Bassler D, Gruer L*. Face masks for the public during the covid-19 crisis. BMJ. 2020;369:m1435. doi: 10.1136/bmj.m1435.
47. *Abolfotouh, M.A., Almutairi, A.F., BaniMustafa, A.A*. et al. Perception and attitude of healthcare workers in Saudi Arabia with regard to Covid-19 pandemic and potential associated predictors. BMC Infect Dis 20, 719 (2020). https://doi.org/10.1186/s12879-020-05443-3
48. *Shahbaznejad, L.,* et al., Knowledge, attitude and practice of Sari birth cohort members during early weeks of COVID-19 outbreak in Iran. BMC Public Health, 2021;21(1).
49. *Bults, M., Beaujean, D.J., de Zwart, O.* et al. Perceived risk, anxiety, and behavioural responses of the general public during the early phase of the Influenza A (H1N1) pandemic in the Netherlands: results of three consecutive online surveys. BMC Public Health 2011;11:2 https://doi.org/10.1186/1471-2458-11-2

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