Original Research

Knowledge and attitude regarding coronavirus disease 2019 (COVID-19) among hospital pharmacists in Qatar

Lama Madi, Doua Alsaad, Raja Al Khawaja, Wessam El Kassem, Moza Al Hail

Abstract

Background: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) gained global attention because of its high transmissibility and the devastating impact on both clinical and economic outcomes. Pharmacists are among the front-line healthcare workers who contributed widely to COVID-19 pandemic control. We aim to evaluate knowledge and attitude of hospital pharmacists in Qatar about COVID-19. **Methods:** A descriptive cross-sectional web-based survey was distributed over a 2-months period. The study included pharmacists who are working in 10 different hospitals under Hamad Medical Corporation (HMC). The survey was developed based on information available at World Health Organization (WHO) website, Qatar Ministry of Health, and COVID-19 guideline created by HMC. The study was approved by HMC's institutional review board (MRC-01-20-1009). Data analysis was done using SPSS version 22. **Results:** A total of 187 pharmacists were included (response rate 33%). The overall level of knowledge was not affected by the participants' demographics (p-value ≥0.05). Pharmacists provided more correct answers to questions related to general knowledge about COVID-19 compared to questions specificto treatment aspects of the disease. More than 50% of pharmacists were using national resources as main source of information related to COVID-19. Good health practices and attitudes regarding disease control was reported by pharmacists, including preventive measures implementation and self-isolation when needed. Around 80% of pharmacists are in favor of taking influenza vaccine and COVID-19 vaccine. **Conclusion:** Overall, hospital pharmacists' knowledge about COVID-19 is good in relation to the disease nature and transmission. Knowledge about treatment aspects including medications needs further enhancement. Providing continuing professional development activities regarding latest information about COVID-19 and its management, and serial newsletters updates, and encouraging journal club activities for recently published research can help improve hospital pharmacist knowledge.

Keywords: hospital pharmacists; coronavirus disease 2019 (COVID-19); knowledge; attitude; treatment

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) gained global attention because of its high transmissibility and the devastating impact on both clinical and economic outcomes. COVID-19 caused an on-going pandemic, affecting most countries and territories around the world. As of 9 March 2022, more than 448 million cases have been reported, with more than 6 million deaths.[1,2] On 30 January 2020, the World Health Organization (WHO) declared the COVID-19 outbreak as a public health emergency of international concern and a pandemic on 11 March 2020.[1]

Lama MADI*. Department of Pharmacy, Qatar Rehabilitation Institute, Hamad Medical Corporation, Doha, Qatar. LMadi@hamad.qa

Doua ALSAAD. Department of Pharmacy, Women's Wellness and Research Center, Hamad Medical Corporation, Doha, Qatar. dalsaad@hamad.qa

Raja AL KHAWAJA. Department of Pharmacy, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar. Ralkhawaja@hamad.qa

Wessam EL KASSEM. Department of Pharmacy, Women's Wellness and Research Center, Hamad Medical Corporation, Doha, Qatar. WElKassem@hamad.qa

Moza AL HAIL. Department of Pharmacy, Women's Wellness and Research Center, Hamad Medical Corporation, Doha, Qatar. malhail2@hamad.qa

The healthcare system worldwide was overwhelmed with the pandemic; resource allocation and priority setting, and decisions about access to hospitals, ventilators, vaccines, and medicines were the main concerns.[1] Inadequate information about COVID-19 transmission, management, and control posed additional challenges to health organizations and healthcare systems worldwide.[3] The global economic growth was estimated to be trimmed by 3% - 6% in 2020 due to COVID-19, in addition to the high number of unemployment.[3]

The front-line healthcare workers are at an increased risk for COVID-19 infection. They are in close contact with patients who might be infected by COVID-19, as well as, healthcare workers might be spreading the infection unwarily to patients. Accordingly, healthcare workers play a crucial role in the control of transmission chain during the outbreak of COVID-19. Understanding the practices of healthcare providers is part of the disease control.[4,5]

M Saqlain, M Zhang and Priyanka A. Parikh et al found that healthcare workers have good knowledge, but there are some factors that influence their knowledge and attitude, in addition to some misunderstandings and malpractices not found in the current study. Thus, health education is an important approach to effectively combating COVID-19.[6-11] Pharmacists are among the front-line healthcare workers who contributed widely to COVID-10 crisis management. In February 2020, the International Pharmaceutical Federation (FIP) issued a guideline for pharmacists and pharmacy workforce to provide relevant information on the coronavirus outbreak. Since then,

the guideline has been updated frequently according to the informs received about COVID-19.[12] In fact, pharmacists have an important multifaceted role in disaster preparedness and disaster response. The American Pharmacists Association (APhA) mentioned in its policy manual disaster preparedness section published in 2015 that the APhA "encourages pharmacist involvement in surveillance, mitigation, preparedness, planning, response, and recovery related to bioterrorism and emerging infectious diseases".[13] Pharmacists, being the medication experts, should take the lead in managing medication supply chains and distribution systems such as procurement, storage, compounding, and dispensing in emergencies.[14,15]

The knowledge and attitude of both community and hospital pharmacists about COVID-19 were reviewed at different practice settings.[16-20] Tesfaye et al conducted a study to assess COVID-19-related knowledge, attitude, and practice among hospital and community pharmacists, which revealed that half of the participants had adequate knowledge about the disease.[16] On the other hand, Zeeny et al described adequate knowledge about COVID-19 in more than 90% of hospital pharmacists.[17] Another study published in Turkey showed that media affect the attitudes of both the public and health professionals.[16,18]

The first case of COVID-19 in Qatar was reported on 27 February 2020. As of 16 March 2021; a total of 359361 people were infected. During the initial pandemic, Qatar has reached the highest number of confirmed cases worldwide, relative to its population size. However; the death rate in Qatar was very low due to the high-quality healthcare system in the country as well as to the fact that Qatar population is young.[1,21] Qatar's economy is kept healthy by the government by providing an $824 million fund as financial support to businesses.[22] Pharmacists in Qatar play a vital role in healthcare system. Actively, they contribute to patient care outcomes, public health awareness, and disease control.

The goal of the current study is to understand the readiness of hospital pharmacists in public health emergencies in Qatar. We aim to evaluate knowledge and attitude about COVID-19 to identify areas of misconceptions, misunderstandings, and malpractices, and accordingly develop practice improvement strategies. This study may assist health regulatory authorities to take necessary steps to increase pharmacist safety and their ability to deliver best care in Qatar.

Aims of the study

This study aimed to explore the knowledge and attitude of pharmacists working in Hamad Medical Corporation hospitals about Coronavirus Disease 2019 (COVID-19).

To examine the correlation between hospital pharmacist's knowledge and attitude about Coronavirus Disease 2019 and their demographic characteristics (i.e.experience duration, job position , or level of education).

Ethical approval

The study was approved by Institutional Review Boards of HMC (reference number: MRC-01-20-1009).

METHOD

Study design

A descriptive cross-sectional web-based survey was distributed over a 2-month period between February and March 2021. It was approved by Hamad Medical Corporation's institutional review board (MRC-01-20-1009).

Pharmacists working at different hospitals of Hamad Medical Corporation (HMC) in Qatar were included in the study. HMC manages 12 hospitals, two of which are specialized in treating Covid-19 patients. Repeated reminders were used to approach pharmacists from all facilities.

Survey development

The questionnaire was developed by the research investigators based on the WHO website, Qatar Ministry of Health website, and COVID-19 guidelines created by - HMC.[21,23,24] The survey was developed in English language using survey monkey® website. It consisted of 31 questions divided into three main sections: (i) Demographic information, (ii) Knowledge about COVID-19, (iii) Attitude of participants toward COVID-19. The demographic section included questions related to gender, age, level of education, years in practice, job position, and hospital. The second section consisted of 19 questions; eight questions about COVID-19 general knowledge, including symptoms, risk factors, and transmission, and the remaining eleven questions assessed COVID-19 treatment knowledge, including approved treatments by FDA, current management, antiviral (remdesivir, lopinavir–ritonavir), tocilizumab, hydrocortisone, convalescent plasma, hydroxychloroquine, thromboprophylaxis and non-steroidal anti-inflammatory drugs (NSAIDs). Finally, the attitude of participants section consisted of six questions: their approach when they had COVID-19 like symptoms, or when they are in close contact with COVID-19 patients, sources of information used, effective ways in preventing COVID-19, and practice toward flu and COVID-19 vaccines.

A scoring tool was made to help assess knowledge. Every correct answer earns one point, while every incorrect answer earns zero. Answering 80% of the questions correctly was considered "good" knowledge, while answering less than 80% of the questions correctly was considered "poor "knowledge.

The WHO website, Qatar Ministry of Health website, and HMC guidelines were used as answer guide. The content validity of the survey was established by reviewing the official website and previous studies. The questionnaire was checked for accuracy and relevance of the questions to study objectives by all the authors independently. To further validate this questionnaire, a pilot study was conducted on 15 pharmacists working in HMC who had characteristics similar to those of study subjects who were not included in the sample. Data collected from the pilot study were analyzed using SPSS (Statistical Package for Social Sciences, by IBM incorporated). The reliability coefficient (alpha) was 0.74.

Data collection procedure

An email invitation was sent to the potential participants through HMC emails. The email contained the web link to the survey with a request to fill it up and submit it voluntarily. The first page of the survey includes a consent form that sufficiently explains the research project overview. No names or personal identifiers were recorded.

The response rate was tracked. In addition, a reminder email was sent every two weeks to increase the survey response rate until the target sample size was achieved.

Sample size

The sample size was calculated based on total number of pharmacists which is 564 . Given that the number of pharmacists working at HMC hospital is 564, with a margin error of 5% and a design effect equivalent to 2 for cluster design. From the above formula, the calculated sample size to achieve 95% CI was 289 and the desired sample size to achieve 90% CI around 180.

Data analysis

Data analysis and presentation were primarily descriptive. Percentage and frequencies were used with a comprehensive reporting of hospital pharmacists' knowledge and attitude about COVID-19. Associations between the dependent (knowledge and attitude) and independent variables (demographic characteristics of the participants) were assessed using the chi-square test. For attitude section, frequencies and percentages were used to report data. All P-values presented were two-tailed, and P-values <0.05 were considered statistically significant. All statistical analyses were done using SPSS version 22 (SPSS Inc., Chicago, IL, USA).

RESULTS

Demographic characteristics

A total of 187 pharmacists were involved in this web-based survey Among respondents, 43.3 % were aged 30 to 39 years, and 58.82% were female. The higher proportion of the participants were staff pharmacists (45.45%%) and had more than ten years of work experience (44.39%). The majority of participants were from Hamad Bin Khalifa Medical City (39.04%) and Hamad General Hospital (29.41%), two of the largest hospitals (Table 1).

Knowledge assessment about COVID-19

Good knowledge, 80% or more correct answers, was found in 42.7 % of participants. Figures 1 and 2 present the percentage of correct answers for questions assessing COVID-19 general knowledge and questions assessing COVID-19 treatment knowledge, respectively. All demographic characteristics, including gender, age, level of education, years in practice, job position, and hospital, showed no significant association with overall level of knowledge (p-value > 0.05), table 2. However; some demographic characteristics showed an association with knowledge about individual questions:

Table 1. Characteristics of the participants	
Characteristic	**N (%)**
Gender	
Female	110(58.82%)
Male	77(41.18%)
Age	
Less than 30 years	46(24.6%)
30 – 39 years	81(43.32%)
40 – 49 years	50(26.74%)
50 years or more	10(5.35%)
Level of education	
Bachelors	103(55.08%)
Masters / Pharm D	81(43.32%)
PHD	3(1.6%)
Years in practice	
Less than 1 year	16(8.56%)
1 – 5 years	44(23.53%)
6 – 10 years	44(23.53%)
More than 10 years	83(44.39%)
Job position	
Staff pharmacist	85(45.45%)
Clinical pharmacist	49(26.2%)
Senior pharmacist	30(16.04%)
Specialist clinical pharmacist	7(3.74%)
Other (please specify)	16(8.56%)
Hospital	
Hamad Bin Khalifa Medical City (HBKMC)	73(39.04%)
Hamad General Hospital (HGH)	55(29.41%)
Al Wakra Hospital (AWH)	12(6.42%)
Heart Hospital (HH)	6(3.21%)
National Center of Cancer Care and Research (NCCCR)	11(5.88%)
Rumailah Hospital (RH)	10(5.35%)
Al-Khor Hospital (AKH)	9(4.81%)
Hazm Mebaireek General Hospital (HMGH)	6(3.21%)
Heart Hospital (HH)	6(3.21%)
Cuban Hospital (CH)	3(1.6%)
Communicable Disease Center (CDC)	2(1.07%)

Participants knowledge regarding the difference between COVID-19 and flu was associated with gender. Male have higher correct response (P = 0.042).

There was a strong association between level of education and job position with COVID -19 knowledge. All specialist clinical pharmacists gave the correct answer (P = 0.008).

Knowledge about COVID-19 survival on surfaces showed a significant association with gender and level of education. Males have higher correct responses (P = 0.022) and PhD staff

Table 2. Chi-square test results of demographic variables VS knowledge			
Variables	Adequate knowledge > 80 % (n, %) good	Inadequate Knowledge < 80 % (n, %) Poor	P-value
Gender			
Male	25 (32.5%)	52(67.5%)	0.443
Female	42(38.2%)	68(61.8%)	
Age			
Less than 30 years	19(41.3%)	27 (58.7%)	0.254
30 – 39 years	27 (33.3%)	54 (66.6 %)	
40 – 49 years	15 (30 %)	35 (70%)	
50 years or more	6 (60 %)	4 (40 %)	
Level of education			
Bachelors	33 (32%)	70 (68%)	0.261
Masters / Pharm D	32 (33.3%)	49 (66.6%)	
PHD	2 (66.6%)	1 (33.3%)	
Years in practice			
Less than 1 year	4 (25%)	12 (75 %)	0.495
1 – 5 years	19 (43.2%)	25 (56.8%)	
6 – 10 years	17 (38.6%)	27 (61.4%)	
More than 10 years	27 (32.5 %)	56 (67.5%)	
Job position			
Staff pharmacist	25 (29.4%)	60 (70.6%)	0.216
Senior pharmacist	11 (36.7%)	19 (63.3%)	
Clinical pharmacist	20 (40.8%)	29 (59.2%)	
Specialist clinical pharmacist	5 (71.4%)	2 (28.6%)	
Other (please specify)	6 (37.5%)	10 962.5 %)	
Hospital			
Hamad Bin Khalifa Medical City (HBKMC)	30 (41.1%)	43 (58.9%)	0.513
Hamad General Hospital (HGH)	13 (23.6%)	42 (76.4%)	
Heart Hospital (HH)	2 (33.3%)	4 (66.6 %)	
National Center of Cancer Care and Research (NCCCR)	3 (27.3%)	8 (72.7%)	
Rumailah Hospital (RH)	4(40 %)	6 (60%)	
Communicable Disease Center (CDC)	1 (50 %)	1 (50%)	
Hazm Mebaireek General Hospital (HMGH)	3(50%)	3(50%)	
Al-Khor Hospital (AKH)	4 (44.4%)	5 (55.6 %)	
Al Wakra Hospital (AWH)	5 (41.7%)	7 (58.3%)	
Cuban Hospital (CH)	2 (66.7 %)	1 (33.3 %)	

have higher correct responses too (P = 0.038)

The association between Tocilizumab knowledge and demographics showed a significant association with age. The age group 50 and above had a higher correct response (P = 0.009).

Pharmacist knowledge regarding hydroxychloroquine if helps to reduce mortality of hospitalized patients due to COVID-19 was associated significantly with years in practice. The staff experience of 6 to 10 years had a higher correct response (P = 0.009).

The participant's general knowledge assessment towards COVID-19 included eight questions (Figure 1). Generally, many questions were answered correctly by participants. Almost all participants were aware of COVID-19 symptoms, risk factors for severe disease, and method of transmission with following percentage respectively 98%, 96%, and 98%. However, 26% of pharmacists were unaware of the duration needed to develop the disease after exposure to COVID-19. Additionally, 31% only were aware of the duration that COVID-19 can survive on surfaces. Finally, 66% knew the correct answer about COVID-19
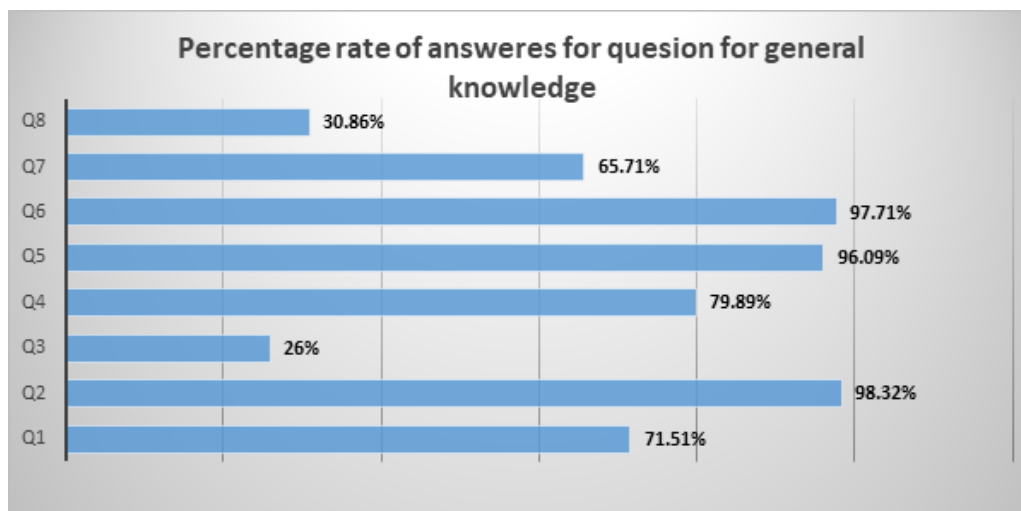
Figure 1. General knowledge assessment about COVID-19. Q1. COVID-19, Q2. Common symptoms of COVID-19 Q3. COVID-19 symptoms Q4. COVID-19 compared to flu / common cold, Q5. Risk factors to severe features of COVID-19 include, Q6. COVID-19 is transmitted, Q7. COVID-19 transition from person to person, Q8. COVID-19 can survive on surfaces up to.

transition from person to person.

Assessment of participants' treatment knowledge towards COVID-19 included 11 questions (Figure 2). Majority of the questions were answered incorrectly by pharmacists. Most of the participants (87%) know the current management in COVID-19 patients. In addition, more than 80 % identify the suitable antipyretic inpatient with COVID-19 and correct information about the role of blood plasma that is got from patient who has recovered from COVID-19 to use in COVID-19 patients. However, only 31 % of participants answered correctly the question related to Remdesivir, and 35 % answered correctly the question related to Lopinavir–Ritonavir. About 55 % knew the correct answer about the role of hydroxychloroquine and hydrocortisone in COVID-19 patients.

Attitude about COVID-19

The hospital pharmacist's attitude toward COVID-19 pandemic is summarized in table 3. About half of the hospital pharmacists (54%) used national resources of information during COVID-19 outbreak. More importantly, 95.4% of hospital pharmacists have the attitude of notifying their department and seeking medical advice if they have COVID-19 like symptoms. About half of them would isolate themselves for seven days if they contact someone who has COVID -19 even if no symptoms developed and believe that wearing the mask in the public area is the most effective in preventing COVID-19. Around 79 % of hospital pharmacists consider getting the flu vaccine during the current COVID-19 pandemic. Similarly, 81% of hospital pharmacists favor taking the COVID-19 vaccine.
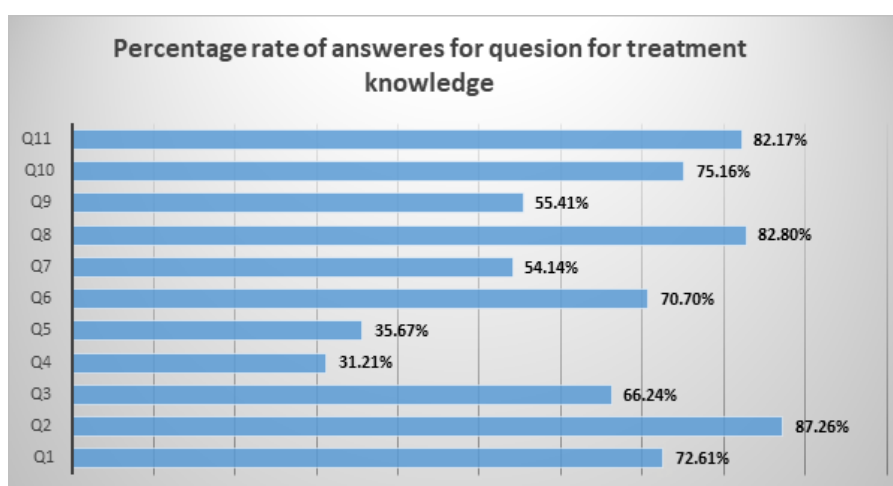

Figure 2. Treatment knowledge assessment about COVID-19. Q1. Currently there is no treatment approved by Food and Drug Administration (FDA) for COVID-19, Q2. Current management of patients with COVID-19 includes, Q3. An antiviral is used in, Q4. Remdesivir, Q5. A recently published study found that Lopinavir–Ritonavir decrease the time to clinical improvement compared with standard care alone, Q6. Tocilizumab is used, Q7. Hydrocortisone is the preferred glucocorticoid agent in COVID-19 patients, Q8. Convalescent plasma, Q9. Hydroxychloroquine helps reduce mortality of hospitalized patients due to COVID-19, Q10. Thromboprophylaxis is indicated in all hospitalized patients with COVID-19, Q11. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are the preferred antipyretic agents rather than paracetamol in patients with COVID-19.

Table 3. Attitude toward COVID-19 among hospital pharmacists	
Variable	**N (%)**
Sources of information you found MOST useful during COVID-19 outbreak	
National resources	83 (54.25%)
International resources	50 (32.68%)
Media	9 (5.88%)
Published research	9 (5.88%)
Should you do if you have COVID-19 like symptoms	
Notify department and seek medical advice	146 (95.42%)
Seek medical advice without notifying department	1 (0.65%)
Stay home, self-isolate without seeking medical care	5 (3.27%)
Come to work and wearing mask without seeking medical care	1 (0.65%)
What should you do if you have come in close contact with someone who has COVID-19	
Self-isolate for 7 days, even if no symptoms developed	75 (49.02%0
Self-isolate for 14 days, even if no symptoms developed	53 (34.64%)
Self-isolate for 7 days, only if mild symptoms developed	17(11.11%)
Self-isolate for 14 days, only if mild symptoms developed	8(5.23%)
Which of the following do you believe is MOST effective in preventing COVID-19	
To cover nose and mouth when sneezing	17 (11.11%)
To take vitamins and supplements	4 (2.61%)
To wash hands frequently	15 (9.80%)
To wear medical/ surgical mask in public areas	82(53.59%)
To perform social distancing	35 (22.88%)
Considering the current COVID-19 pandemic; are you in favor of taking the flu vaccine	
Yes	121 (79.08%)
No	32 (20.92%)
Considering the current COVID-19 pandemic; are you in favor of taking the COVID-19 vaccine	
Yes	124 (81.05%)
No	29 (18.95%)
The COVID-19 vaccines are being developed and tested very quickly; will they be safe	
Yes	118 (77.12%)
No	35 (22.88%)

DISCUSSION

Hospital pharmacists are an integral part of the healthcare system in the prevention of the spread of COVID-19. FIP emphasized their vital role in providing the essential services to both patients and healthcare teams through the supply of medicines and pharmaceutical care.[25]

Overall, hospital pharmacists in Qatar have poor knowledge about COVID-19; which is not consistent with other countries.[17,26] It has been noticed in our study that the level of knowledge regarding the treatment aspects of COVID-19 is not sufficient, as reflected by the low percentage of correct responses to treatment-related questions. Many pharmacists did not answer correctly the questions related to antiviral medications, hydroxychloroquine, and corticosteroid use in COVID-19 management. Insufficient knowledge of pharmacists

about treatment can be attributed to the fact that there is no current treatment for COVID-19. As such, it is difficult for pharmacists to remain aware of the latest evidence-based recommendations regarding COVID-19 treatment as the current COVID-19 management and treatment are being evaluated in clinical trials, consequently the treatment protocols frequently change based on the latest research results.[27] On the other hand, pharmacists had better knowledge about the general aspects of the disease, which may reflect pharmacists' interest in having sufficient information about disease control and prevention strategies to protect themselves, their family, and society. Global websites such as WHO have been reported to be the primary resource of COVID-19 related information used by pharmacists, followed by the country local official resources.[28] In Qatar, hospital pharmacists described those official national resources such as: Qatar Ministry of Public

Health/ Hamad Medical Corporation Guidelines to be the most useful resources during COVID-19 pandemic. This reflects the trust hospital pharmacists have regarding Qatar health authorities' preparedness to control the pandemic.

In Qatar, hospital pharmacists' attitude regarding preventive measures showed healthy practices such as self-isolation when needed. Similar healthy attitudes have been reported by pharmacists in other regions.[16] Large proportions of hospital pharmacists are in favor of taking flu vaccine (79%), and COVID-19 vaccine (81%) this year. Such an attitude may reflect hospital pharmacists' consciousness about their health and the community health, and their willingness to contribute to disease control. Similar acceptance level for COVID-19 vaccine was reported by pharmacists in Kuwait (80%) as well as in United States of America for both COVID-19 and influenza vaccines (78% and 95%, respectively).[29,30]

The current work is advantaged by including pharmacists working at different 10 large governmental hospitals in Qatar, with a response rate reaching more than 30% and 90% confidence interval. On the other hand; the results of this study are limited by the novel nature of the disease. Knowledge about different clinical aspects related to COVID-19 is still to be built, and the available information is changing overtime according to the new research and investigations. Moreover, new variants of SARS-CoV-2 were detected by the end of 2020, and further assessment of its transmissibility, severity, risk of reinfection, and antibody response is needed.[1] The generalizability of our results is restricted to hospital pharmacists, assessment of knowledge and attitude of community pharmacists would be encouraged in future research.

For further enhancement of hospital pharmacists' knowledge about COVID-19, we would recommend providing continuous education regarding the updates about COVID-19 and the new research results, with a focus on treatment aspects, as pharmacists are the medication experts and the source of medication-related information for other healthcare providers and patients. Furthermore, serial newsletters, and journal club activities for recently published research are all encouraged. Such educational activities need to be tailored according to current gathering restrictions related to COVID-19, where webinars and online applications can be utilized to encourage participation in a safe environment.

CONCLUSION

Overall, hospital pharmacist's knowledge about COVID-19 is good in relation to the disease nature and transmission. However; knowledge about treatment aspects, including medications, needs further enhancement, especially, that pharmacists are the medication experts in the medical field. Providing continuing professional development activities regarding the updates in COVID-19 and its management, serial newsletters updates, and encouraging journal club activities for recently published researches can help improving hospital pharmacist knowledge.

ACKNOWLEDGEMENTS

FUNDING

CONFLICTS OF INTEREST

No conflicts of interest to declare.

References

1. Coronavirus disease (covid-19). World Health Organization. World Health Organization; [cited 2021 Dec21]. Available from: http://www.who.int/emergencies/diseases/novel-coronavirus-2019

2. Coronavirus disease 2019 (covid-19). Centers for Disease Control and Prevention. Centers for Disease Control and Prevention; [cited 2021 Dec21]. Available from: http://www.cdc.gov/coronavirus/2019-ncov/index.html

3. Global economic effects of covid-19. [cited 2021 Dec21]. Available from: https://sgp.fas.org/crs/row/R46270.pdf

4. Nguyen LH, Drew DA, Joshi AD, et al. Risk of COVID-19 among frontline healthcare workers. MedRxiv. 2020;1-23.

5. Mhango M, Dzobo M, Chitungo I, et al. Covid-19 risk factors among health workers: A rapid review. Safety and Health at Work. 2020;11(3):262-265. https://doi.org/10.1016/j.shaw.2020.06.001

6. Saqlain M, Munir MM, Rehman SU, 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. https://doi.org/10.1016/j.jhin.2020.05.007

7. Zhang M, Zhou M, Tang F, et al. Knowledge, attitude, and practice regarding covid-19 among healthcare workers in Henan, China. Journal of Hospital Infection. 2020;105(2):183-187. https://doi.org/10.1016/j.jhin.2020.04.012

8. Parikh PA, Shah BV, Phatak AG, et al. Covid-19 pandemic: Knowledge and perceptions of the public and healthcare professionals. Cureus. 2020;12(5):e8144. https://doi.org/10.7759/cureus.8144

9. Kassie BA, Adane A, Tilahun YT, et al. Knowledge and attitude towards covid-19 and associated factors among health care

providers in northwest Ethiopia. PLOS ONE. 2020;15(8):e0238415. https://doi.org/10.1371/journal.pone.0238415

10. Salman M, Mustafa Z, Asif N, et al. Knowledge, attitude and preventive practices related to COVID-19 among health professionals of Punjab Province of Pakistan. The Journal of Infection in Developing Countries. 2020;14(7):707-712. https://doi.org/10.3855/jidc.12878

11. Bhagavathula AS, Aldhaleei WA, Rahmani J, et al. Knowledge and perceptions of covid-19 among health care workers: Cross-sectional study. JMIR Public Health and Surveillance. 2020;6(2):e19160. https://doi.org/10.2196/19160

12. Covid-19 hub. fip. [cited 2021 Dec21]. Available from: https://www.fip.org/coronavirus

13. Report of the 2015 APhA House of Delegates. American Pharmacists Association. [cited 2021Dec21]. Available from: https://www.japha.org/article/S1544-3191(15)30079-0/fulltext

14. Jorgenson D, Muller A, Whelan AM. Pharmacist educators in Family Medicine Residency Programs: A qualitative analysis. BMC Medical Education. 2012;12:74. https://doi.org/10.1186/1472-6920-12-74

15. Woodard LJ, Bray BS, Williams D, et al. Call to action: Integrating student pharmacists, faculty, and pharmacy practitioners into emergency preparedness and response. Journal of the American Pharmacists Association. 2010;50(2):158-164. https://doi.org/10.1331/JAPhA.2010.09187

16. Tesfaye ZT, Yismaw MB, Negash Z, et al. Covid-19-related knowledge, attitude and practice among hospital and community pharmacists in Addis Ababa, ethiopia. Integrated Pharmacy Research and Practice. 2020;9:105-112. https://doi.org/10.2147/IPRP.S261275

17. Zeenny RM, Ramia E, Akiki Y, et al. Assessing knowledge, attitude, practice, and preparedness of hospital pharmacists in Lebanon towards covid-19 pandemic: A cross-sectional study. Journal of Pharmaceutical Policy and Practice. 2020;13(1):54. https://doi.org/10.1186/s40545-020-00266-8

18. Kara E, Demirkan K, Ünal S. Knowledge and attitudes among hospital pharmacists about COVID-19. Turkish Journal of Pharmaceutical Sciences. 2020;17(3):242-248. https://doi.org/10.4274/tjps.galenos.2020.72325

19. Karasneh R, Al-Azzam S, Muflih S, et al. Media's effect on shaping knowledge, awareness risk perceptions and communication practices of pandemic COVID-19 among pharmacists. Research in Social and Administrative Pharmacy. 2021;17(1):1897-1902. https://doi.org/10.1016/j.sapharm.2020.04.027

20. Jarab AS, Al-Qerem W, Mukattash TL, et al. Pharmacy and pharm. D students' knowledge and information needs about COVID-19. International Journal of Clinical Practice. 2021;75(3):e13696. https://doi.org/10.1111/ijcp.13696

21. Ministry of Public Health. Ministry of Public Health - الصحة الرئيسية. [cited 2021 Dec21]. Available from: http://www.moph.gov.qa/english/Pages/default.aspx

22. Tadros A. Coronavirus spreads "exponentially" in Qatar's labor camps. Cbsnews.com. 2020 [cited 17 March 2022]. Available from: https://www.cbsnews.com/news/coronavirus-in-qatar-spreads-exponentially-in-migrant-worker-labor-camps/

23. Coronavirus disease (covid-19). World Health Organization. World Health Organization; [cited 2021 Dec21]. Available from: http://www.who.int/news-room/q-a-detail/q-a-coronaviruses

24. Coronavirus disease (covid-19). https://hamad.qa/EN/Pages/default.aspx/. Accessed 21 Nov 2021

25. Covid-19 guidelines for pharmacists and the pharmacy workforce [Internet]. [cited 2021Dec21]. Available from: https://www.fip.org/files/content/priority-areas/coronavirus/COVID-19-Guidelines-for-pharmacists-and-the-pharmacy-workforce.pdf

26. Hussain I, Majeed A, Saeed H, et al. A national study to assess pharmacists' preparedness against covid-19 during its rapid rise period in Pakistan. PLOS ONE. 2020;15(11):e0241467. https://doi.org/10.1371/journal.pone.0241467

27. Al-Quteimat OM, Amer AM. SARS-COV-2 outbreak: How can pharmacists help? Research in Social and Administrative Pharmacy. 2021;17(2):480-482. https://doi.org/10.1016/j.sapharm.2020.03.018

28. Abdel Jalil M, Alsous MM, Abu Hammour K, et al. Role of pharmacists in covid-19 disease: A Jordanian perspective. Disaster Medicine and Public Health Preparedness. 2020;14(6):782-788. https://doi.org/10.1017/dmp.2020.186

29. Al-Sanafi M, Sallam M. Psychological determinants of covid-19 vaccine acceptance among healthcare workers in Kuwait: A cross-sectional study using the 5c and vaccine conspiracy beliefs scales. Vaccines. 2021;9(7):701. https://doi.org/10.3390/vaccines9070701

30. Pharmacists ready to receive and administer COVID-19 vaccines. Newsroom. [cited 2021Dec21]. Available from: https://pharmacist.com/About/Newsroom/pharmacists-ready-to-receive-and-administer-covid-19-vaccines-according-to-apha-survey