



Research article

Knowledge of health care workers regarding COVID-19 pandemic response plan; A study from a university affiliated hospital in Jordan

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ABSTRACT

Background: The education and training of healthcare workers (HCWs) about pandemic response plans, infection control protocols (ICP), and precautions are critical for breaking the virus transmission chain. This study aimed to assess the knowledge of HCWs regarding the COVID-19 pandemic response plan and the ICP. Concomitantly, evaluating the effectiveness and impact of institutional measures, policies, and training programs.**Methods:** A cross-sectional study using an electronic questionnaire was used to collect data from 267 HCWs at a University-affiliated-hospital during April 2020.**Results:** In this study, 90.7% of participants were nurses and 66% were females. 60.3% of participants received specific training about caring for COVID-19 patients while at least 94.3% reviewed the pandemic response plan and ICP for COVID-19. 47.5% and 29.2% of participants provided direct care for suspected or confirmed COVID-19 patients, respectively. Between 85.7% and 100% of the participants answered all items correctly regarding the COVID-19 pandemic response plan, measures, and precautions. Furthermore, the correct answers were above 95% for each item.**Conclusion:** HCWs have a high level of knowledge about the COVID-19 pandemic response plan and ICP. Training and disseminating updated plans and protocols in different methods such as an intranet and onsite training in addition to regular methods were very effective.

1. Introduction

The latest novel Corona Virus Disease 2019 (COVID-19) outbreak, which began at Wuhan City capital of Hubei Province of China in December 2019, has brought substantial challenges posing a significant threat to healthcare workers, public health as well as the entire world [1, 2]. By the end of January 2020, the World Health Organization (WHO) declared COVID-19 as a public health emergency of international concern [3]. As of September 9, 2020, more than 27, 417, 497 million confirmed cases across 216 countries around the world, and around 894, 241 deaths have been reported [4]. Health care workers (HCWs) are in close contact with suspected or confirmed COVID-19 cases, and they can

play crucial roles in breaking the chain of virus transmission by adhering to infection control protocols (ICP) and instructions [5].

The COVID-19 transmission mode mainly happened through respiratory droplets when an individual is in close contact with an infected person (less than one meter) or touching contaminated surfaces or contaminated objects and then touching his mouth, nose, or eyes [6]. The incubation period ranges from 2-14 days [4]. Education and training of HCWs regarding patient triaging, proper use of personal protective equipment (PPE), isolation, environment cleaning, and disinfection, handling patient laboratory samples, taking extra precautions for invasive procedures, and hand hygiene are critical for breaking the virus transmission chain. Hospitals should implement proper hygiene

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practices, workplace controls, precautions, and measures including the use of appropriate PPE such as gowns, gloves, eye protection, and face shields to protect workers' health from the risks of COVID-19 infection [7, 8]. Keeping the front-line HCWs safe is a priority in pandemic to defeat the disease. In January 2020, the CDC and WHO have published recommendations for the prevention and control of COVID-19 for HCWs [7, 8].

The United States Center for Disease Control and Prevention (CDC) reported that 9,282 HCWs were infected with COVID-19 between February 12th and April 9th from 315,531 cases reported in the country in the same period [11]. While in Italy and Spain, the reported percentage of infected HCWs from the total confirmed cases was 9% and 14%, respectively [12].

On March 2, 2020, the Jordanian Ministry of Health announced the first confirmed case of COVID-19 for a Jordanian citizen who has a travel history to Italy a few days before. Immediately the government of Jordan has implemented enhanced screening and quarantine measures to reduce the spread of COVID-19. On March 17, 2020, the Government of Jordan suspended all flights to and from Jordan, and on March 20, 2020, announced a nationwide curfew beginning Saturday, March 21.

King Abdullah University Hospital (KAUH) was designated by the Jordanian Ministry of Health as the main center for COVID-19 testing and isolation for the north part of Jordan and one of 7 such centers in the country. KAUH is located in Irbid governorate where two major COVID-19 outbreaks happened in the country. One was related to a wedding party generating more than 80 confirmed tested cases and the second related to a truck driver generating more than 110 confirmed tested cases. Most of those cases were tested and treated at KAUH.

KAUH is accredited by both the Health care accreditation council (HCAC) and Joint Commission International Accreditation (JCIA) as an academic medical center and considered the largest hospital located in the north of Jordan. KAUH has a strong and well-established infection control program that keeps patients, visitors, employees, students, and trainees safe. The pandemic response plan was developed for the previous two years to meet the JCIA standards. This plan was revised by a multidisciplinary expert committee established by the hospital administration to review the pandemic response plan based on the available information and protocols on COVID-19. The committee involves infectious disease specialists, adult and pediatric pulmonary intensive care physicians, head of the emergency department, head of the laboratory department, head of nursing, admission and medical record divisions, health informatics, and other related experts. Available protocols from CDC, WHO [9, 10, 13], MOH, and the latest articles were reviewed and hospital-specific protocol for adult and pediatric patients has been developed including receiving patients in the emergency department, triaging, admission, treatment, and care, isolation, using PPEs, laboratory workup, handling dead body and discharge to home. The revised protocol was disseminated to all hospital departments through the head of the department and posted on the hospital intranet. Besides, extensive onsite training and refreshment have been done by infection control practitioners.

This study investigated the HCWs' knowledge at KAUH about pandemic response plan, measures and precautions used when they contacted suspected or confirmed COVID-19 patients from the first contact in the triage area up to the patient discharge. For this purpose, an electronic survey/questionnaire was developed based on the pandemic response plan and ICP in addition to participants' demographic data.

2. Methods

2.1. Study design and setting

This is a cross-sectional study that was conducted at KAUH during the last week of April 2020. An electronic questionnaire utilizing Google Forms was used to collect data. The Data was collected from HCWs who are on their duties as full-time employees since January 2020. The

Institutional Review Board (IRB) approval was obtained from the affiliated university and the hospital before the commencement of data collection. The participants were informed about their participation rights. The participants were assured about their free will to participate in this study or to refuse to participate without any consequences. The participants were assured of their rights to withdraw from the study at any time, and that all data are treated with confidentiality. After developing the final version of the survey questionnaire on Google Forms, a link was disseminated to all staff through emails and KAUH employee social media groups.

2.2. Study instrument

A 58-item survey instrument was developed using the KAUH pandemic response plan and ICP that was used as training material on the COVID-19 pandemic (see Appendix-A instrument). The survey covered participants characteristics (4 items), if they received training on COVID-19 (2 items), if they provide direct care for confirmed or suspected COVID-19 cases (2 items), and knowledge related to (triaging, transferring, caring, using PPE, environmental safety and isolation, sample collection, invasive procedures precautions and discharge instructions) for COVID-19 patients (50 true/false items). All knowledge-related items/questions were asked as positive sentences except for 3 questions about the ability to visit COVID-19 patients, the need to use PPEs when cleaning the blood and body fluids, and changing the habits of washing clothes, linens, and food dishes. These questions were asked in negative sentences. Instrument readability, clarity, and relevance were assessed by 3 experts.

2.3. Data analysis

Data were exported from google documents forms on an excel sheet then imported to an SPSS software version 22. Participants' mean age and experience periods were reported and descriptive statistics (percentages and frequencies) were calculated to describe sample characteristics and variables. The percent of correct answers were calculated based on the KAUH COVID-19 response plan and ICP.

3. Results

Two hundred and sixty-seven HCWs fully responded to the survey by completing the questionnaire (Table 1). The majority were registered nurses (90.7% n = 235) with a bachelor's degree (79.8%, n = 209). Most of the participants were females (66% n = 171), the majority of participants were married (86.1% n = 223), the age mean for the participants was 33.26 ± 6.04 years while the mean for the participants' experience period was about 9.76 ± 5.92 years.

The majority of the participants (94.3%, n = 249) reported that they read the ICP policy and instructions on how to deal with COVID-19 patients. However, only 60.3% (n = 158) of them declared that they received specific training in dealing with COVID-19 patients. On the other hand, around 47.5% (n = 125) of the participants provided care for suspected COVID-19 patients while 29.2% (n = 77) provided care for confirmed COVID-19 patients.

Regarding the Knowledge of HCWs in triage areas about dealing with the acute respiratory cases suspected or confirmed to have COVID-19, the majority answered correctly with ranging from (n = 258) 98.5% in the emergency department to (n = 226) 86.3% in the Outpatient Department.

Regarding COVID-19 cases admission and caring as suspected or confirmed cases in designated units and wards, the participants answered 15 items as true or false. The percentage of correctly answered items was more than 93.6% except for one item (must designate special medical equipment such as vital signs equipment and stethoscope for each patient) was 85.2%, more details about the HCWs' knowledge about this situation are shown in Table 2.

Table 1. Participants characteristics.

		Frequency	Percent
Gender	Female	175	66.5%
	Male	88	33.5%
Marital Status	Married	230	86.5%
	Single	29	10.9%
	Divorced or widows	7	2.6%
Job title	Registered nurses	235	90.7%
	Associated nurses	14	5.4%
	Physicians	10	3.9%
Education level	Bachelor	209	79.8%
	master	37	14.1%
	Diploma	16	6.1%

Table 2. Participants knowledge and attitude when confirmed or suspected COVID-19 cases admitted to the designated isolation area.

	Frequency	Percent
1. Must admit suspected or confirmed COVID-19 patients to a single well-ventilated isolation room with bathroom and sink	249	94.7%
2. Must admit suspected COVID-19 cases to a special isolation area	247	93.6%
3. Must admit confirmed COVID-19 cases to a special isolation area	252	96.3%
4. Must designate special medical equipment such as vital signs equipment and stethoscope for each patient	224	85.2%
5. Must keep the patient file outside the patient room	250	95.1%
6. Should use the disinfectants and detergents in isolation areas	249	95%
7. Must post a note to comply with precautions on the isolation room entrance	261	99.6%
8. No visitors allowed for COVID-19 patients	253	95.8%
9. There is a restriction to transfer COVID -19 patients between units	257	97%
10. Must clean and disinfect equipment after every use	262	98.9%
11. Must designate portable X-Ray machine and other diagnostic equipment for confirmed COVID-19 isolation areas	250	94.7%
12. If patient transfer necessary must apply precautions to protect HCW, PT, and visitors	254	96.2%
13. If patient transfer necessary must inform the other department in advance to take the necessary precautions	263	99.2%
14. When transfer patients must use appropriate PPE	248	93.9%
15. If patient transfer necessary must use a surgical mask for the patient.	250	94.7%

Regarding using the PPE and precautions when entering the patient room, the percentage of correctly answered items was ranging from 92.5% about using the N95 mask and face shield to 100% about use hand hygiene and using hand disinfectant before and after patient contact and after removing the PPEs. As well, all the seven items related to staff knowledge about environmental safety, cleanliness, and isolation area disinfection were correctly answered with a percentage of more than 90.9%. More details are shown in [Table 3](#).

The percentage of correctly answered items (7 items) related to applying precautions when doing for example one or more of the following procedures: endotracheal intubation, suctioning, tracheostomy, nebulizer, and respiratory therapy were more than 92.7% except for one item (Perform the procedure in a well-ventilated room) was 85.7%. More details are shown in [Table 4](#).

The 4 items related to applying standard precaution and using PPEs during sample collection, transporting, and complying with biohazard

precautions when handling and processing samples were answered correctly with a percentage of more than 98.1% for all items ([Table 5](#)). As well, the 8 items that were related to patient discharge education and instructions were correctly answered with percentages ranging from 90.8% to 98.9% ([Table 6](#)). Of worth mentioning, the analysis of the data unexpectedly didn't show any important differences in the percentage of correct answers among different subgroups. These percentages were high and close to each other in all subgroups.

4. Discussion

The safety of HCWs in pandemic time is a major concern for health care leaders, stakeholders, and communities. Compliance with pandemic response plans and precautions when contacting suspected or confirmed COVID-19 cases can keep them safe. Hence, this study attempted to evaluate the knowledge of HCWs at a university-affiliated hospital

Table 3. Environmental cleanliness and isolation area disinfection.

	Frequency	Percent
Must clean and disinfect all surfaces, equipment, and furniture in the patient room daily	259	98.1%
When cleaning must start from the less contaminated and clean surfaces from above to down	250	95.4%
Must use gloves and face shield when cleaning	259	98.1%
Must use the approved concentration of disinfectants and apply the wet time	260	99.2%
When cleaning the blood and body fluids no need to use PPEs	240	90.9%
Must place linens and clothes used in the isolation room in red bags before sending them to the laundry	248	94.3%
Must provide food and drinks for patient and HCW in isolation areas with isolation trays	253	95.8%

Table 4. Precautions when doing aerosolizing procedures such as endotracheal intubation, suctioning, tracheostomy, nebulizer, and respiratory therapy.

	Frequency	Percent
Use N 95 mask	241	92.7
Use face shield	258	98.5
Use long sleeves gown and gloves	256	98.5
Use a waterproof gown when procedure on patients might produce fluids from patients	260	99.2
Perform the procedure in a well-ventilated room	221	85.7
Do the procedure with the minimum number of HCWs	259	98.9
Clean hand with disinfectant before and after the procedure and after removing the PPEs	256	99.2

Table 5. Lab sample collection and transport.

	Frequency	Percent
Must consider all lab samples as a potential source for infection and HCW must apply standard precaution during sample collection and transporting	258	98.9%
Must use PPEs during samples collection	259	98.9%
Must use sample box and sealed plastic bag labeled with biohazard for transporting samples	257	98.1
Lab workers must comply with biohazard precautions when handling and processing samples	258	98.5

regarding COVID-19 precautions and pandemic response plans. This is critical as the staff of those types of hospitals are also responsible for medical and nursing training programs.

In the present study, the HCWs showed excellent knowledge about the COVID-19 pandemic response plan and measures. Those results were congruent with other reported findings worldwide where knowledge levels among HCWs ranged from 85.6% to 98.6% [14, 15, 16, 17]. The vast majority of the participants in the study stated that they received training or read the hospital measures against COVID-19.

Of worth mentioning, the majority of responses in this study came from nurses although the number of physicians at our educational hospital is high. This could be attributed to the method of data collection as an online survey, or it may reflect the willingness of nurses to participate more in such studies due to their long working hours in direct contact with confirmed or suspected COVID-19 patients and therefore they may be more motivated to complete the survey. Herein, we emphasize that several reminders were sent to HCWs from different disciplines at the hospital. Saying that, these results were in the line with previous studies in that nurses have a decisive role in infection control [18]. As well, given that the majority of participants were nurses and most of the nurses in our hospital are females, therefore, most of the responses are expected to come from females.

This study reflects the HCWs' willingness to know more about COVID-19 infection and the prevention precautions giving that most of the participants, who didn't take the mandatory specific training, electively reviewed the pandemic response plans and the infection control protocols (ICP) which were announced, distributed, and encouraged to be reviewed by the hospital intranet. This may be due to their anxiety and

fear to get infected or transmitting the disease to their families, so they attend training sessions and read the ICP policy. This finding is in line with a multinational survey about perceived challenges of COVID-19 infection prevention and control response in that 66.6% of participants were aware of the existing guidelines for COVID-19 prevention [19]. Furthermore, the infection control practitioners in KAUH provided onsite training for all staff involved in triaging and caring for suspected and confirmed COVID-19 patients. Moreover, more than half of the participants involved directly with suspected or confirmed COVID-19 patients and expected to be aware of the proper guidelines for infection control.

HCWs knowledge about triaging suspected or confirmed COVID-19 patients in the emergency department were higher than in outpatient departments and this could be due to the serious nature of cases in the emergency department where they see all kind of cases and diseases and the staff were trained on the triage process before the pandemic started. This finding is in line with a study conducted to investigate awareness, perceptions, and attitudes regarding COVID-19 among ophthalmologists in Jordan in that participants reported good compliance with international guidelines regarding triaging patients who are attending their clinics [20].

Regarding caring for suspected or confirmed COVID-19 patients, the HCWs showed a high level of knowledge about patients' isolation instructions and requirements, designating special medical equipment, proper use of disinfectants, and detergents in isolation areas, and patient transfer. This finding is congruent with the findings from another Jordanian study indicating that physicians are highly knowledgeable about COVID-19 clinical presentation, routes of transmission, and protective measures [21].

Table 6. Instruction for patients when discharged to home.

	Frequency	Percent
Isolate the patient in a separate well-ventilated room	249	94.7%
Stay home and do not leave home if you have symptoms unless informing your physician and prohibit and visitation or contact with the patients	254	96.6%
Clean hand very well with water and soap or alcohol 70% after any contact with the patients	238	90.8%
For patients and anyone who help the patient in the home must use a face mask and use coughing Etiquette and dispose of paper tissue immediately and wash hands	258	98.1%
Must avoid touching patients secretions and must use gloves and face shield when handling patients secretions	260	98.9%
Should not wash clothes, linens, and food dishes at home as usual	240	91.1%
Must daily clean and disinfect room surfaces with detergents and disinfectants	238	90.8%
Monitor all patient contacts for any symptoms and inform physicians if they have any	259	98.1%

Regarding the COVID-19 cases admission and caring as suspected or confirmed cases in designated units and wards, the participants showed a high level of knowledge which reflects the HCWs commitment to seek more information about patients' isolation and placement, designating special medical equipment, handling patients' records, disinfecting and decontamination of surfaces and equipment, restrictions for visitation and patients transfer PPE and precautions. These findings were congruent with measures and practices applied in other countries as Turkey regarding moving patients from one area to another and designating portable diagnostic equipment as X-ray for COVID-19 patients unless it is necessary [22]. Furthermore, our findings indicated excellent knowledge and attitudes that in pandemic time's HCWs sacrifice their individual needs and benefits to maximize benefits for the community which is congruent with results from previous studies [23].

Regarding using the PPEs and precautions when HCWs are in close contact with patients in their rooms, the participants showed a very high level of knowledge regarding using PPEs and hand hygiene when they entered the patient's room and in closed contact with patients. This finding is in line with reported results from a cross-sectional study that investigated the Jordanian dentists' awareness, perception, and attitude regarding the COVID-19 pandemic and infection control. Their results showed that participants have a high level of awareness regarding hand hygiene, using PPEs properly, transporting patients, and routinely clean and disinfect surfaces in contact with known or suspected patients [24].

Furthermore, the results of the current study showed a high level of participant's knowledge about environmental safety, cleanliness, and isolation area disinfection. This study findings reflect that HCWs are fully aware of proper cleaning and disinfecting surfaces, equipment, and furniture in patients' rooms, proper handling for linens, and medical wastes, using the proper type of disinfectant material and concentration, and using the proper PPE. This finding is in line with the HCWs' routinely measured compliance to standard precautions and infection control policies at KAUH.

Regarding applying precautions when conducting aerosolizing procedures such as endotracheal intubation, suctioning, tracheostomy, nebulizer, and respiratory therapy, the participants showed a high level of knowledge. This result indicates that HCWs were oriented about minimizing the risk of virus transmission by using proper PPEs and precautions in high-risk procedures. As well, the participants showed a very high level about applying standard precautions and using PPEs during sample collection, transporting, and complying with biohazard precautions when handling and processing samples. This finding is congruent with previous evidence-based recommendations where every sample in pandemic situations from confirmed or suspected cases should undergo a proper and well-designed process including the collection, dispatching, processing, reporting, and discarding of biohazard samples to protect the HCWs involved in this process [25]. Furthermore, those finding is congruent with the results from previous studies that stated that the standard precautions should be used based on risk assessment and only by trained personnel to maintain a barrier between the specimen and personnel during all handling process [25, 26]. Regarding HCWs knowledge about patient discharge education and instructions, the findings of this study showed that HCWs were fully aware of the hospital and MOH protocols for discharging COVID-19 patients, for instance, staying alone in a separate and well-ventilated room at home, hand hygiene, cleaning and disinfecting surfaces, using a face mask and monitoring for symptoms that necessitate to come back to the hospital or seek medical attention.

Finally, our results indicated that the majority of the HCWs were knowledgeable regarding the COVID-19 pandemic response plan and the ICPs. This can be attributed to the fact that most of the COVID-19 patients are asymptomatic and it is very challenging to recognize them. Therefore, HCWs always assume that they are in contact with COVID-19 patients even if they were not confirmed or suspected cases. Consequently, they keep updating their knowledge from any possible resources. As well, even if the HCWs were not currently working with the COVID-19

patients, it is expected that they will work with them at any time giving the nature of working in the health care systems during the COVID-19 pandemic. Moreover, the fear and the seriousness of the pandemic keep driving the HCWs to enhance their knowledge about the pandemic response plan and the ICPs.

5. Conclusion

Safety and protection of HCWs who are in the front line and directly involved in the diagnosis, treatment, and care for patients with COVID-19 are important and critical measures in pandemic times. Developing and updating infection control policies and response plans that enhance the understanding and having enough Knowledge regarding infection control precautions, proper use of PPEs, transmission modes, and preventive measures among HCWs can play a pivotal role and can help in controlling this pandemic. Training and disseminating updated plans and protocols in different methods such as an intranet and onsite training in addition to regular methods were very effective.

6. Limitations

This study has several limitations. The study was an online survey in one hospital, and this creates limitations of the generalization of our findings to other health care settings. As well, considering that the majority of participants were nurses and a low proportion of other HCWs participated in our study, it is seen that further research studies needed to include other HCWs. Moreover, although the survey was distributed to all HCWs at KAUH, however, the response rate cannot be accurately calculated since there is no guarantee that all of them previewed it.

Declarations

Author contribution statement

Ibrahim Ghaleb Al Faouri: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Nabil A. Al-zoubi: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Wail A. Hayajneh, Dawood Yusef, Mohammad A. Al-Ghazo, Basil R. Obeidat, Ali Banni Issa and Nasr Alrabadi: Conceived and designed the experiments.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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