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Healthcare workers knowledge and perception of the preventive measures amid current Covid-19 pandemic: An experience from central Saudi Arabian district

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ABSTRACT

Aim: Study knowledge and perception of COVID-19 prevention and control (IPC) measures of healthcare workers (HCWs) of Armed Forced Hospital, Wadi Al Dawasir (AFHWD), Saudi Arabia. *Methods*: All HCWs were invited June, 2020; a pre-validated questionnaire used. *Results*: Out of 103 participants, 40 (38.9%) were physicians, 33 (32.0%) nurses, 30 (29.1%) other HCWs; mean age 39.4±9.5y. The mean score for COVID-19 knowledge surpassed the cutoff (25.1 vs. 22.4, p<0.001); contrary to COVID-19 IPC measures' (33.4 vs. 36.4; p=0.01). COVID-19 "all-knowledge" mean score (58.5) equated the cutoff (58.8) (p=0.89); same as IPC measures perception mean score's (80.8 vs. 81.2, p = 0.8). An overall mean score (139.5) achieved equated the cutoff (140), (p = 0.83). Physicians and nurses achieved mean COVID-19 IPC knowledge scores (35.8, 34.9) higher than other professions' (p<0.001). Physicians referred to reliable COVID-19 sources more frequently (aOR 4.1, 95%CI 2.1 – 11.7). *Conclusion*: The HCW levels of knowledge and perception toward COVID-19 measures were satisfactory. Awareness of some specific COVID-19 IPC measures needs to be enhanced. Findings help update COVID-19 preventive policy; raising the HCWs' COVID-19 nosocomial transmission preventive skills.

Keywords: Healthcare workers, knowledge, COVID-19, Central Saudi Arabia

1. INTRODUCTION

The coronavirus disease (COVID-19) is a newly discovered viral infection that started in Wuhan, city in China as a cluster of pneumonia cases of unknown cause was first reported to the World Health Organization (WHO) Country Office in China on 31 December 2019. Ever since, the outbreak showed a swift spread to the rest of the world. Seemingly, the rapidly spreading virus is more contagious than the previously experienced severe respiratory acute syndrome SARS-CoV-1 and Middle East respiratory syndrome-MERS-CoV caused by coronavirus strains (Meng et al., 2019). By March 11 2020, COVID-19 had been declared as a pandemic (WHOa, 2020). The currently circulating COVID-19 (also known as SARS-CoV-2) seems to have originated from bats, suggesting an animal-to-person spread from a live animal market. A suggested route of human-to-human transmission is through airborne droplets, touching or coming into contact with an infected person or a contaminated surface. Although other routes such as blood or saliva have not been explored, these routes of transmission increase the concern about a similar route of transmission for COVID-19 in the healthcare settings (Ibrahim et al., 2017; Langade et al., 2020). That in mind, assuring effective measures to control COVID-19 spread among HCWs on the job is a priority. To date, some antiviral agents, such as remdesivir (GS-5734) and newer antiviral drugs, as well as immunomodulators, monoclonal antibodies showed some success, superior to placebo, in shortening the time to recovery in adults who were hospitalized and had evidence of SARS CoV-2 (Beigel et al., 2020; Robinson, 2020). Toward the first year of the pandemic, some national regulatory authorities have been reviewing some COVID-19 vaccines, some of which have already been granted emergency approvals in the manufacturing countries (WHO, 2020b). Despite the encouraging results of some of these experiments, no enough evidence is yet available for the safety and efficacy of such remedies in the general population settings. For this reason, vigilance and strict adherence to IPC measures to prevent healthcare acquired infection (HCAI) with COVID-19 is crucial. A misunderstanding of the HCWs of IPC theoretical and clinical information in an era of sudden outbreaks jeopardizes prompt treatment opportunity and worsens spread of the infection in the healthcare facilities' environment, putting patients' lives at risk (McCloskey and Heymann, 2020). Until the commencement of this research, no enough evidence-based information has yet been known about many COVID-19 epidemiological and risk profile, nor was it about the underlying pathophysiology and immunogenicity. The HCWs and policy makers were left uncertain and in a state of wide variability-and often - contradiction about the most optimum practices to control COVID-19. The present work aimed to investigate the knowledge and the perception patterns of the HCWs of AFHWD to COVID-19 epidemiological and preventive measures. Correlates of this inquiry would also be investigated.

2. SUBJECTS AND METHODS

Study design and setting

The study was conducted in the healthcare setting of AFHWD. A cross-sectional approach was utilized.

Study population

All HCWs were invited to the study, including those who deliver direct care of patients, i.e., medical staff, clinical therapists, allied health practitioners, paramedics; and those indirectly involved in patient care, such as pharmaceutical staff, aides, helpers, laboratory technicians, central sterilization, laundry, kitchen, and medical waste staff. According to the study design, the hospital's administrative and maintenance staffs were not included in the study. Otherwise, no HCW was excluded based on socio-demographic, professional or other traits.

Data collection

A self-administered questionnaire was designed with the outlines derived from updated official Saudi publications on COVID-19 diagnosis and HCWs' safety guidelines (Safety Guide, 2020; SCDCP, 2020), as well as WHO guidelines on occupational safety of HCWs amid COVID-19 pandemic (WHO, 2020c ; WHO, 2020d); Centers for Disease control and Prevention (CDC) infection control guidance about COVID-19 for health professionals (NPCM, 2020a); and international best practice sources of hand hygiene and personal protective equipment (PPE) for healthcare personnel (CDC, 2020; WHO, 2020e ; NPCM, 2020b). Principal questionnaire scales include the following: *1)* Demographic and professional information, including age, gender, nationality, marital status, children, department, education/qualifications, specialty, job/position. *2)* Health and safety risks perception amid COVID-19 crisis, (16 questions), e.g., questions addressing work place safety; time pressures; workload; injury; exposure to disinfectants; training of HCWs on health and safety issues; policies toward incident reporting; PPE utilization; regular medical check-up of HCWs. *3)* General IPC procedures perception scale, (13 questions), e.g., rating of current IPC training, updated IPC regulations, adherence to IPC regulations; preparedness of IPC facilities; sanitation; exposure to needle-stick, biological body fluids, and immunization of HCWs. *4)* Specific COVID 19 knowledge scale, (8 questions), e.g., mode of COVID-19 transmission; incubation period; symptoms; treatment

guidelines, sources of knowledge about COVID-19 (medical/authentic, governmental, social media, colleagues, family/friends); current COVID-19 control regulations; attendance of COVID-19 updates. *5)* COVID-19 IPC and personal protection measures knowledge scale, (13questions), which includes questions on hand hygiene (HH), proper hand washing (HW), alcohol-based hand-rub (ABHR) techniques; specific IPC guidelines caring for suspected COVID-19 cases [e.g., PPE usage techniques, droplet precautions, confirmed case isolation measures; precautions for aerosol-generating procedures (AGP) (e.g., endotracheal intubation, non-invasive ventilation, tracheotomy, cardio-pulmonary resuscitation), proper facial mask, N95 (or powered air-purifying respirators- PAPRs) and other respirators usage].

A questionnaire draft was delivered to three scholars in the field, an epidemiology researcher with IPC experience; infectious diseases and virology expert, and a respiratory medicine consultant, who were humbly asked to review and comprehensively evaluate in terms of construct and content validity. Refinements were done in response to the reviewers' suggestions. The questionnaire mostly contains closed-ended questions (yes/ no; or true/ false/ don't know). Most of these items represent certain risk exposures, knowledge level and quality of experiences, the influences of which upon knowledge level, perception tendency and the HCW's adherence to IPC measures for COVID-19 would be analyzed. The instrument's reliability indices were further assessed. A sample of 20 HCWs from AFHWD was piloted to complete the questionnaire ("response-a"). The same group was given the questionnaire a week later ("response-b"). The pilot revealed reliability as that of a Pearson's correlation coefficient "*r*" ranging between 0.84 and 92. Likewise, an overall Cronobach's alpha of 0.89 was achieved, indicating a questionnaire's high internal consistency. (The piloted questionnaires were not placed in the study). The questionnaire's items, where appropriate, were scored; e.g., each given a minimum score of one, and a maximum score of four. Summing up scores on all items yields a total score for each completed questionnaire ranging from 40 – to - 200. Based on this scoring method, a cutoff point to discriminate "inadequate" and "adequate" knowledge or "favorable" (good) and "unfavorable" perception for individual scales would be set at 70% of each scale's maximum score, i.e., 45/ 64, scale 2 [(16 questions*4)(0.7)]; 36.5/52 for scale 3 [(13 questions*4)(0.7)]; 22.5/ 32 for scale 4 [(8 questions*4)(0.7)]; and 36.5/ 52 for scale 5 [(13 questions*4)(0.7)]. Likewise, the cutoff for the total questionnaire's score would be 140 (=200*0.7).

The questionnaire starts with a preamble, explaining its aim and importance in supporting our efforts to maintain highest health and safety standards amid the pandemic. Invited HCWs were assured of voluntary nature of their participation and the confidentiality of the collected information. The final questionnaire form was distributed through June 2020 online using a Google application form which was made accessible through a link, and it takes around 15 minutes to complete. Returned questionnaires were coded and entered to a Microsoft program with adequate backups until analyzed. Only questionnaires with valid responses on ≥80% of items were included in the analysis.

Study variables

The study risk variables are represented by items such as those mentioned in the questionnaire scales, most of which are qualitative data, the responses to which is offered as a binary level, e.g., yes/no or three or more levels. Often multi-level variables, such as those expressing the participants' sources of information about COVID-19 may be recoded into binary ones, e.g., "reliable"/"non-reliable" responses. Likewise, AGP precautions variable may be recoded as "adequate"/ "inadequate". The principal outcome variable involves the "overall score" of knowledge level and perception pattern toward COVID-19. The latter may be binned as an "adequate" / "inadequate variable. Intermediate outcomes involve adequacy of specific COVID-19 knowledge (scale 4), and specific COVID-19 IPC/PPE measures (scale 5), as well as the perception levels regarding the applied health and safety measures (scale 2) and that regarding pertinent IPC/PPE measures (scale 3). "All-knowledge" score (sum scales 4, 5) and "all-perception" score (sum scales 2, 3) are other intermediate outcomes to analyze.

Statistical analysis

First, qualitative data, such as the socio-demographic characteristics were summarized as numbers (%); and quantitative data, e.g., scores as the mean score ± standard deviation (SD) [or the median, interquartile range, where appropriate. Second, inferential statistical tests, such as one-way analysis of variance (ANOVA) may be calculated for the influence of a multi-level variable, such as profession, upon the participants' mean scores. Also one-sample t-test may be calculated to measure the difference between the mean score and the corresponding cutoff. Applying such parametric techniques (PMTs), normality distribution of the examined quantitative outcome would first be assured, e.g., using Kolmogorov-Smirnov test. Measuring the strength of association, e.g., between the professions binned (physicians / other HCWs combined) and awareness of the proper application of airborne measures during AGP binary (adequate / inadequate), NPMT tests such as χ^2 test may be used. [The odds ratio (OR), or adjusted Odds ratio (aOR) with its 95% confidence interval (CI) could be used]. The "Statistical Package for Social Sciences" (SPSS) software for MS-

+version-20 (Armonk, NY: IBM Corp.) was used in the analysis. All tests were conducted at α=0.05 for rejecting a true null hypothesis, and results with p-values <0.05 would be considered statistically significant.

Ethical considerations

The study has been preapproval by AFHWD Research Ethics Committee. A permission to collect data was also granted by AFHWD's higher authority.

3. RESULTS

The HCWs averaged 39.4± 9.5years old; with a male: female ratio 1.2, (table 1). Otherwise, the majority (78.6%) were non-Saudi. Most (62.1%) participants were married, 37.9% were single, and 2.9% were divorced. Physicians constituted 38.8% of the study population, followed by nurses (32.0%), health technicians (10.7%), pharmacists (7.8%), "other" professions (6.8%), and therapists (3.9%). In table 1, too, an ANOVA analysis revealed that the HCWs varied in their overall levels of knowledge and perception combined to studied COVID-19 queries [mean score 139.5 (69.8%), (out of maximum overall score 200)], [F (df 97, 5) =9.5, p<0.0001], (table 1). A post hoc test (LSD) showed that the physicians mean score was significantly different from all individual profession scores (p<0.05) but not the therapists'. Nurses' mean score was also significantly higher than the technicians' (p=0.03) and "other" (p=0.01). The HCWs mean overall score (139.5) was as equal to, and not significantly < cutoff score (140) [t (df 102) = -0.22, p=0.83] (table 1 footnote).

Table 1 The HCWs' overall performance regarding knowledge and perception of COVID-19 preventive measures studied stratified by profession (N=103)

Profession	N	Mean	SD	% (of 200)	Min.	Max.	Statistic	Sig.
Physician				75.5	110.0	183.0		
Nurse	33	138.9	16.9	69.5	97.5	181.5		
Therapist	4	139.4	15.3	69.7	127.0	161.0		
Technician	8	120.3	15.5	60.2	89.0	140.5		
Pharmacist	9	128.4	20.2	64.2	99.0	155.0	F (df 97, 5) = 9.5	<0.001
Other	7	121.1	12.5	60.6	107.5	142.5		
Total	103	139.5*	19.4	69.8	89.0	183.0		
Post hoc test	p-value		Profession	Nurse	Therapist	Technician	Pharmacist	Other
			Physician	0.02	0.18	<0.001	0.01	<0.001
			Nurse	-----	0.9	0.03	0.1	0.01

* One-sample t-test (one-tailed): Mean overall performance score vs. cutoff 140 (70%): t (df 102) =-0.22, p=0.83.

Table 2 Participants' level of knowledge of COVID-19 information stratified by profession (N=103)*

Profession	Scale 4: COVID-19 epidemiology, clinical knowledge							Scale 5: Specific COVID-19 IPC/ PPE knowledge					
	N	Mean	SD	Range	% (of 32)	Statistic	Sig.	Mean	SD	Range	% (of 52)	Statistic	Sig.
Physician	40	27.1	3.2	21.0-31.0	84.7			35.8	7.5	12.0-50.0	68.8		
Nurse	33	24.2	4.6	12.0-32.0	75.6			34.9	7.5	21.5-45.0	67.1		
Therapist	4	25.5	3.3	20.0-29.0	75.5			31.4	9.7	20.0-41.0	60.3		
Technician	11	22.1	6.2	13.0-32.0	69.0	F (97,5)		25.3	9.5	12.5-41.0	48.6	F (97,5)	
Pharmacist	8	24.6	5.4	18.0-30.0	76.8	=3.4	0.006	25.7	7.7	13.0-40.0	49.4	=4.9	<0.001
Other	7	23.0	4.3	18.0-31.0	71.8			34.7	8.0	26.0-50.0	66,7		
Total	103	25.1 ŧ	4.5	12.0-32.0	78.4			33.4 ╞	8.6	12.0-50.0	64.2		

* "All-knowledge" score (scales 4,5 combined) 58.5/84= 69.6% (Range 25-79); v. cutoff (58.8/84=70%): 1-sample t-test: t(102)= 0.13, p=0.89

ŧ1-sample t-test (one-tailed): Scale-4 mean score= 25.1 vs. cutoff= 22.4 (70%): t (df 10.2) = 6.0, p<0.001

╞1-sample t-test (one-tailed): S+cale-5 mean score= 33.4 vs. cutoff 36.4 (70%): t (df 102) =–3.5, p=0.01

The level of COVID-19 epidemiological and clinical knowledge (scale 4) differed between professions [F (df 97, 5) = 3.4, p=0.006], (table 2). In the post hoc, the mean score for the physicians (27.1) was significantly higher than those for nurses (24.2), technicians

(22.1), and "other" (23.0), (p = 0.005, p=0.001, p=0.02, respectively). However, nurses did not perform likewise (p<0.05 all comparisons). The ANOVA for specific COVID-19 IPC/PPE knowledge (scale 5) showed a mean score variation between professions [F (df 97, 5) = 4.9, p<0.001]. In the post hoc, physicians' mean score (35.8) was significantly different from technicians' (25.3) and not the nurses' (34.9), (p=0.63). The group's mean sore (25.1, scale-4) was significantly higher than the cutoff (22.4)[t (df102) =6.1, p=0<0.001], (table 2 footnote). However, the mean score (33.4) of scale 5 was lower than scale cutoff (36.4) [t (df102) = –3.5, p=0.01], (table 3 footnote).Collectively, the sum of mean scores of the two scales (58.5) was not statistically smaller than the set cutoff (58.8) [t (df 102) = 0.13, p=0.89], (table 2 footnote).

Table 3 Participants' perception level of the examined preventive measures amidst COVID-19 pandemic, stratified by profession (N=103)*

Profession	Scale 2: Health/safety measures amidst COVOD-19							Scale 3: IPC measures amidst COVOD-19					
	N	Mean	SD	Range	% (of 64)	Statistic	Sig.	Mean	SD	Range	% (of 52)	Statistic	Sig.
Physician	40	46.5	8.5	26.0-60.0	72.8			41.0	7.4	22.0-52.0	78.8		
Nurse	33	44.1	9.7	26.5-60.0	67.3			36.5	6.2	20.0-50.0	70.2		
Therapist	4	45.0	6.5	42-5-60.5	76.5			33.5	12.3	26.0-52.0	64.4		
Technician	11	41.7	8.3	32.5-54.0	65.2	F(97, 5)		30.9	9.4	17.0-42.0	59.4	F(97, 5)	0.03
Pharmacist	8	42.2	10.3	28.5-64.0	66.0	= 4.5	0.02	36.2	10.7	22.0-52.0	69.7	= 4.1	
Other	7	30.8	7.1	24.5-42.0	48.2			32.4	6.3	20.0-38.0	62.36		
Total	103	43.6ǂ	9.6	24.5-84.0	68.2			37.2ǂǂ	8.3	17.0-52.0	71.6		

* "All-perception" mean score (scales 2, 3 combined) = 80.8/116= 69.7; (Range 50-112) vs. cutoff (81.2/116=70%) : t(102) =–0.22, p=0.8

ǂ1-sample t-test (one-tailed): Scale-2 mean score 43.6 vs. cutoff 44.8 (70%): t (df 102) = 0.03, p = 0.9

ǂǂ1-sample t-test (one-tailed): Scale-3 mean score 37.2 with cutoff 36.4 (70%): t (df 102) = 1.03, p = 0.8

Table 4 The relation between the levels of all-knowledge and all-perception (N = 103)*

Knowledge	Perception						Total	% (row)	% (total)	Statistic**	95%CI
	Favorable			Unfavorable							
	N	% (row)	% (total)	N	% (row)	% (total)					
Adequate	31	54.4	30.1	26	45.6	25.2	57	100.0	55.3	aRO =2.04	0.91-4.5
Inadequate	17	37.0	16.5	29	63.0	28.2	46	100.0	44.7		
Total	48	46.6	46.6	55	53.4	53.4	103	100.0	100.0		

* Correlation: Mean "all- knowledge" (58.5/84=69.4%) vs. mean all-perception (80.8/116=69.6%: r=0.2, p=0.08

** χ^2 (1) = 3.1, p=0.09

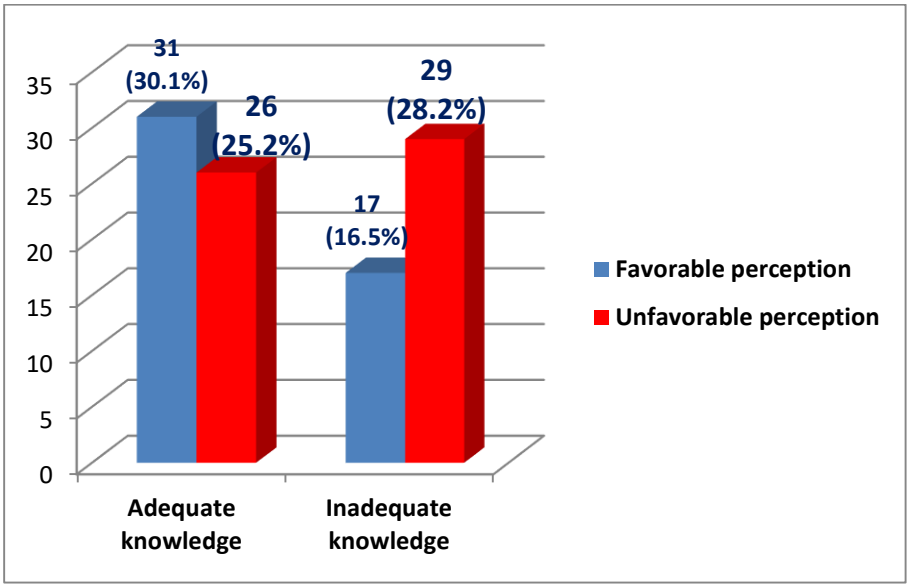

Figure 1 Participants' perception trend in relation to quality of COVID-19 knowledge

In table 3, the participants' mean attitudinal and commitment scores to the health and safety measures amidst the pandemic (scale 2) was different [F (df 97, 5) = 4.5, p=0.02]. In the post hoc analysis, physicians achieved a higher score (46.5) than "other" (30.8), (p<0.001). Likewise, the mean scores for nurses (44.1), therapists (45.0), and technicians (41.7) were different from "other: (p<0.05). The group's average score (43.6) was not significantly smaller than the cutoff (44.8) set for the scale [t (df 102) = 0.03, p= 0.9], (table 3 footnote). Physicians tended to perceived the IPC measures more vigilantly than peer healthcare professionals; (mean score 41.0± 7.4) [F (df97, 5) = 4.1, p=0.03]. Unlike scale 2, physicians mean score (41.0) in the post hoc test was significantly greater than those achieved by nurses (36.5), (p=0.016), technicians (30.9), (p<0.001), and "other" (32.4), (p=0.008). Nurses also were significantly more perceptive to the IPC measures than the technicians (36.5 vs. 30.9, p=0.04). Ultimately, the sum of mean scores for scales about perception (80.8) (69.7%, range 50-112) was not significantly smaller than sum scale cutoff (81.2) [t (102) =–0.22, p = 0.8], (table 3 footnote).

A cross tabulation showed that the odds of having an adequate knowledge in association with an adequate perception of the COVID-19 measures accounted as an aOR=2.04 (table 4); however this association was not significant (95%CI 0.9-4), (table 4, figure 1). [In parallel, Pearson's correlation technique, the mean all-knowledge score (58.5) and mean "all-perception" score (80.8) were weakly-not significantly correlated (r = 0.2, p = 0.08), (table 4 footnote)].

Table 5 shows that around half (52.4%) of HCWs were adequately aware of the protective measures to be taken during performing AGP while caring for suspected COVID-19 cases (aOR = 4.5, 95% CI 2.1-11.7), (table 5), thanks to physicians' tendency to possess this trait (30/45 = 75.0%) more frequently than all other HCWs combined (24/43 = 38.1%). The physicians' tendency for using reliable sources for obtaining information about COVID-19 (67.5% of all physicians), such as medical and authentic sources was significantly greater than that for other HCWs combined (44.4%), (aOR=2.6, 95% CI 1.1-5.6), (table 5, figure 2).

Table 5 Knowledge analysis by physicians/other HCWs: Awareness of specific COVID-19 measures and sources preference of COVID-19 information (N = 103)

Awareness of AGP protective measures											
Profession	Adequate			Inadequate			Total	% (row)	% (total)	Statistic*	95%CI
	N	% (row)	% (total)	N	% (row)	% (total)					
Physician	30	75.5	29.1	10	25.5	9.7	40	100.0	38.8	aOR = 4.9	2.1-11.7
Other HCWs	24	38.1	23.3	39	61.9	37.9	63	100.0	61.2		
Total	54	52.4	52.4	49	47.6	47.6	103	100.0	100.0		
Preference of sources of information about COVID019											
Profession	Reliable			Unreliable			Total	% (row)	% (total)	Statistic**	95%CI
	N	% (row)	% (total)	N	% (row)	% (total)					
Physician	27	67.5	26.2	13	32.5	12.6	40	100.0	38.8	aOR = 2.6	1.1-5.6
Other HCWs	28	44.4	27.1	35	55.6	33.9	63	100.0	61.2		
Total	55	53.3	51.3	48	46.7	46.7	103	100.0	100.0		

* χ^2 (1) = 13.4, p=0.02 ** χ^2 (1) = 13.4, p=0.02

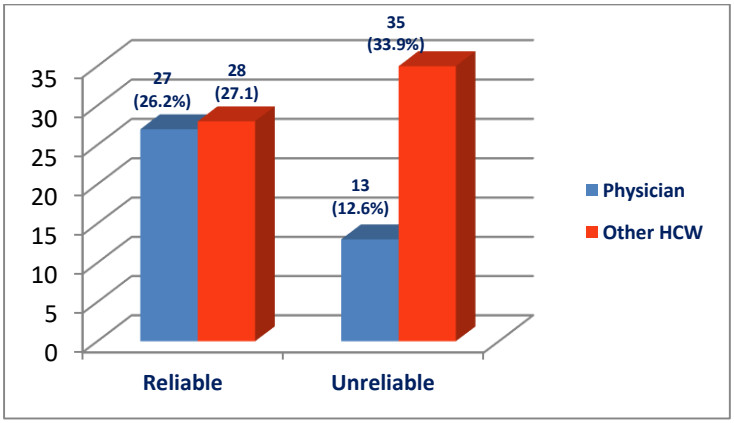

Figure 2 Participants' preferences of COVID-19 sources of knowledge

4. DISCUSSION

This study started June 2020; time when scientists, regulators, and the whole international community have been in an overwhelming conflict with the dreadful virus. The study focused on those preventive measures, such as the IPC procedures, PPE, AGP, patient isolation, and other safety measures in place the time of the study. Specific epidemiological and clinical knowledge aspects of the disease were explored. After all, the perception with the commitment of the HCWs to examined COVID-19 domains was evaluated. The predominant participation of physicians over the nurses' and other health professionals may well reflect the physicians' keenness to resorts to evidence-based experimental sources, such as this research to be updated about SARS Cov-2 combat potentials.

Overall response to COVOD-19 knowledge and perception query

Given the overall targeted score regarding the questionnaire inquiries, those HCWs in direct clinical contact with patients, namely doctors, nurses, health therapists, equitably shared a satisfactorily good level of performance concerning the studied COVID-19 knowledge and perception domains (mean scores 69.8%). In a Vietnamese survey (Huynh et al., 2020), an overall response to the HCWs' knowledge and attitude towards COVID-19 was "good", where 88.4% - 90% of the HCWs exhibited sufficient knowledge and perception levels (all HCW professions counted; target overall score not given). Otherwise, most surveys exploring the HCWs' responses to COVID-19 pandemic assessed the knowledge and attitude segments of the survey separately; not as an overall domain (Huynh et al., 2020; Bhagavathula et al., 2020; Papagiannis et al., 2020; Ejeh et al., 2020). In Saudi Arabia (Abolfotouh et al., 2020), HCWs some tertiary care hospitals recorded a mean score of 48.5 (50.5%) on some COVID-19 items studied. However, the study's questionnaire was only focused on the HCWs concerns about their subjectivity to nosocomial COVID-19, knowledge was not addressed in the study.

COVID-19 knowledge response patterns

Assessing their HCWs' knowledge and attitudes levels towards COVID-19 preventive measures, Papagiannis and collaborates (2020) in Greece found that the majority of the surveyed HCWs (88.3%) had a good level of COVID-19 knowledge (score 80.0%) (Papagiannis et al., 2020). In our survey, 55.4% of the HCWs achieved an adequate knowledge level [score 58.5 (69.7%), and with a range between 48.6% – 84.7%)]. For instance, in UAE, 36.4% - 39.0% of surveyed HCW colleagues reflected a good level on the assessed COVID-19 knowledge items (Bhagavathula et al., 2020). Our HCWs' awareness of the specific measures, such as COVID-19 IPC and PPE procedures was yet to meet the prospected level. In a study lastly conducted in Japan, there was also lack of knowledge about IPC measures for COVID-19, including patient isolation, PPE utilization; a trend that was more evident among non-physician HCWs (Kadoya et al., 2020). Further, our survey was conducted the time when there was still a high degree of uncertainty regarding SARS Cov-2 behavior and exact preventive measures to prioritize (Ejeh et al., 2020).

Responses to specific COVID-19 IPC precautions

The participants showed a good level of awareness of important IPC respiratory precautions during caring for suspected COVID-19 cases, such as how to prevent infection during AGP, thanks to physicians who were the major contributor to such performance. In the Japanese study (Kadoya et al., 2020), the awareness of AGP measures dealing with COVID-19 cases was inadequate, particularly among non-physician HCWs. Otherwise; there was a scarcity of addressing AGP as one of the most important risks for the exposure to COVID-19 infection among HCWs in the studies analyzing their performance on COVID-19 knowledge and behavioral inquiry (Huynh et al., 2020; Bhagavathula et al., 2020; Papagiannis et al., 2020; Ejeh et al., 2020).

Perception of COVID-19 preventive measures

Regarding IPC, including PPE utilization, there were likely a significant satisfaction and adherence with the applied policies. Both the physicians and the nurses were in favor of the recommended measures more than the health technicians and other staff. Pharmacists were almost as frequently committed to these measures as nurses. The behavioral study of Vietnam (Huynh et al., 2020) also agrees that the pharmacists, especially the more knowledgeable about COVID-19 measures, were more positive toward the COVI-19 preventive measures compared to employed physicians, nurses and technical staff.

Knowledge sources preferences

Our physicians tended to refer to medical and authentic sources more frequently (67.5%) than other health professionals to keep themselves up to date about COVID-19 preventive and clinical information. In the Vietnamese study (Huynh et al., 2020), HCWs, including physicians, predominately used social media (91.1%); and 61.0% of the HCWs surveyed in UAE also used these media to

obtain information on COVID-19. Likewise, 70.0% of screened Nigerian HCW population (Ejeh et al., 2020) derived their COVID-19 information from the social media and the television.

Knowledge level and perception trend relationship

The frequency of having an adequate level of COVID-19 knowledge (88.3%) and a favorable perception toward the disease's measures (84.8%) were significantly correlated in some COVID-19 and the HCWs studies (Huynh et al., 2020; Ejeh et al., 2020); the higher the knowledge level the more positive perception exerted. Although such an association was true in our study it was not significant. The Greek study (Huynh et al., 2020) was a multicenter one with 461 HCWs surveyed, generating a high study power able to enhance the probability of having such a significant relationship. The Nigerian study (Ejeh et al., 2020), used separate knowledge – and attitude – questionnaires with two different scoring methods.

In early reports of COVID-19, escalating numbers of SARS Cov-2 cases, e.g., in China and USA were recorded in healthcare settings (Wang et al., 2020; McMichael et al., 2020). The reluctance in taking specific IPC measures aggravated the spread of infection among considerable numbers of people both in the health facilities and the community. Conversely, in circumstances where the prescribed IPC measures were strictly watched, reports of new HCAI of COVID-19 were least (Rhee et al., 2020). That in mind, and the fact that the COVID-19 virus is still circulating, and the recent reports on mutated faster-spreading COVID-19 strains in UK and Europe (ECDC, 2020), the need for continued vigilance to sustain community protection against the pandemic is mandatory.

The study provides an insight on the awareness and perception of AFHWD health professionals regarding the preventive and clinical care measures congruent with COVID-19. Probably, the rather small number of participants may limit the study's power and generalizability beyond those healthcare organizations with more or less similar HCWs' demographic and professional criteria. Honesty responding to the questionnaire may often be a concern, e.g., due to job security thoughts; however, the survey's anonymity limits this problem; ensuring receiving the largest number of valid responses. Comparing responses on some medical procedures, (e.g., negative pressure room isolation, respirator characteristics; COVID-19 clinical training) the level of experience to which HCWs vary by profession was also considered as a probable confounding. Therefore, methods to control for this confounding, such as stratification of most analyzed data by profession, and the use of aOR, where appropriate, were used to remove this concern.

5. CONCLUSION

The study provides an important database for our HCWs' experience regarding COVID-19, where their awareness and utilization of relevant epidemiological and preventive measures have been thoroughly explored. Getting there, areas of deficiency in the current COVID-19 mitigation procedures, such as specific IPC and PPE procedures can be improved. Maintaining a successful COVID-19 prevention tactics, especially in the early era of COVID-19 vaccine release integrates with the extensive national efforts to combat the pandemic.

Findings from this research help evaluate and update COVID-19 management policies; organize appropriate education and training program in order to deliver the best practices to prevent COVID-19 spread in the hospital's environment. That said, testing the HCWs before – and after - these educational activities to assess the level to which the target learning outcome was achieved would rather be considered. A follow up survey recruiting a large number of HCWs, probably inviting other health facilities which share a professional and logistics profile comparable to AFHWD's, additionally endorsing the HCWs' attitude toward the newly licensed COVID-19 viral vector vaccines is recommended.

Authors' contributions

Author A.S. shared in setting the study design, research objectives, preparing study instrument, pilot administration, data collection, and reviewing the results. Author A.W.A. set the infection prevention and control guidelines, literature review write up; shared in data entry. Author H.M.A. held study approvals, supervised study phases and data collection; study instrument validation, final write up review, and recommendations plan. Author H.M.A.F. shared in preparing study proposal, logistics plan, data collection plan, supervised data entry, and reviewed study result. Author B.I. shared in data collection, data entry, ethical approvals, preliminary proposal preparation, and results display reviewing. Author M. Kh. A. held referencing plan, shared in statistical analysis, final write up, and data display. Author R.M.A. prepared the study design, study instruments; conducted the statistical analysis, data display, discussion guidelines, and final write up. All authors read and approved the final manuscript.

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Informed consent

Written and oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval

The study was approved by the Research Ethics Committee of Armed Forces Hospital Wadi Al Dawasir (Ethical approval #: 009/1/13 - 24/12/2020).

Conflict of interests

The authors declare that they have no conflicts of interest.

Data and materials availability

All data associated with this study are present in the paper.

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