STRADA Jurnal Ilmiah Kesehatan
DOI: 10.30994/sjik.v10i1.747
ISSN: 2252-3847 (print); 2614-350X (online) Vol.10 No.1 May 2021 Page. 1213-1224

A Systematic Review of Knowledge, Attitudes and Practices among Healthcare Workers on Personal Protective Equipment against Covid-19

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ABSTRACT
Coronavirus 2019 (COVID-19) is an acute respiratory disease that is emerging and spreading rapidly around the world. The rapid spread of COVID-19 poses new challenges in infection control. A comprehensive understanding of personal protective equipment (PPE) among health workers is essential. This study aims to conduct a systematic review of the knowledge, attitudes and practices of using PPE among health workers to prevent COVID-19 infection. The systematic review searched five electronic databases (Scopus, Pubmed, Science Direct, CINAHL, and Proquest) for previous studies published between 2019 and 2021. We found eleven studies that met the inclusion criteria in the review. Most of the health workers have good knowledge, positive attitudes and bad practices towards using PPE to prevent COVID-19 infection. The most important recommendation for increasing knowledge, attitudes and practices (KAP) is to equip health workers with a periodic training program on the use of PPE to combat COVID-19.

Keywords: COVID-19, Personal Protective Equipment, Health Workers

Received April 17, 2021; Revised April 27, 2021; Accepted May 1, 2021

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BACKGROUND

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is an infectious pathogen that appears and spreads rapidly that causes an acute respiratory disease called coronavirus disease 2019 (COVID-19) (Bazaid et al., 2020). Globally, 4.7 million new cases were reported on 17 January 2021, a decline of 6% from last week. At the same time, the number of new deaths has climbed to a record high at 93 000, a 9% increase from last week. Over 2 million people have now lost their lives to COVID-19. The Americas, Europe, and South-East Asia regions showed declines in new cases, with Europe showing a 15% decline and the Americas and South-East Asia regions showing more moderate declines of 2% and 1% respectively (World Health Organization, 2021). The infectious nature ofthe disease, rising numbers ofcases, daily mortalities and a lack oftherapeutics have led to a healthcare crisis ofepic proportions (Bazaid et al., 2020). The recent rapid spread of Coronavirus disease 2019 and the global pandemic are facing new challenges in the area of infection control (Yeon & Shin, 2020). Adequate personal protective equipment (PPE) is a central component of infection prevention control (IPC) and is of paramount importance in the fight against COVID-19. Consistent and effective use of PPE is essential for protecting patients, healthcare workers and their families (Norton et al., 2020).

In this situation, a comprehensive understanding of infection prevention and control is essential for health workers when seeking to protect themselves, patients, colleagues, and the general public from the transmission of infection (Yeon & Shin, 2020). Among the critical components of infection and prevention control (IPC) during the management of COVID-19 is the mandatory use of PPE by healthcare workers (HCWs) . This component is a safeguard, as HCWs are at greater risk ofcontracting the disease. In Nigeria as on the 1st of May, approxi- mately 113 HCWs have been infected with SARS-CoV-2 during their duties. PPE is a physical barrier worn by HCWs to prevent spreading of a pathogen from either a suspected or con- firmed case or a pathologic specimen. It serves the dual role of preventing disease spread from patients to HCWs and vice versa. These physical barriers include goggles, face shields, fluid-resistant medical or surgical masks, particulate respirators (e.g., powered air-purifying and N95 respirators), gloves, disposable gowns, disposable coveralls, waterproofor heavy duty aprons, waterproof boots, and hoods or head-covers in conjunction with other IPC methods. The best way for HCWs to prevent this infection is through practice and demonstrated competency in donning, doffing, and proper use of personal protective equipment (PPE). Hence, an assessment of the current status of knowledge, attitude, and practice towards PPE among HCWs were duly needed (Hossain et al., 2021).

METHODS

Study Design

A systematic review was conducted as a comprehensive and synthesis of relevant studies about knowledge, attitudes and practices of using personal protective equipment to prevent COVID-19 infection among health workers. The Centre for Review and Dissemination and the Joanna Briggs Institute Guideline guided the assessment of study quality. The evaluation of the systematic review was performed using the PRISMA checklist of items to include while reporting and analyzing a systematic review.

Data Sources and Searches

Five databases were collected by Scopus, CINAHL, PubMed, ProQuest, and Science Direct published between 2016 and 2020. The scope of the article was limited to cross

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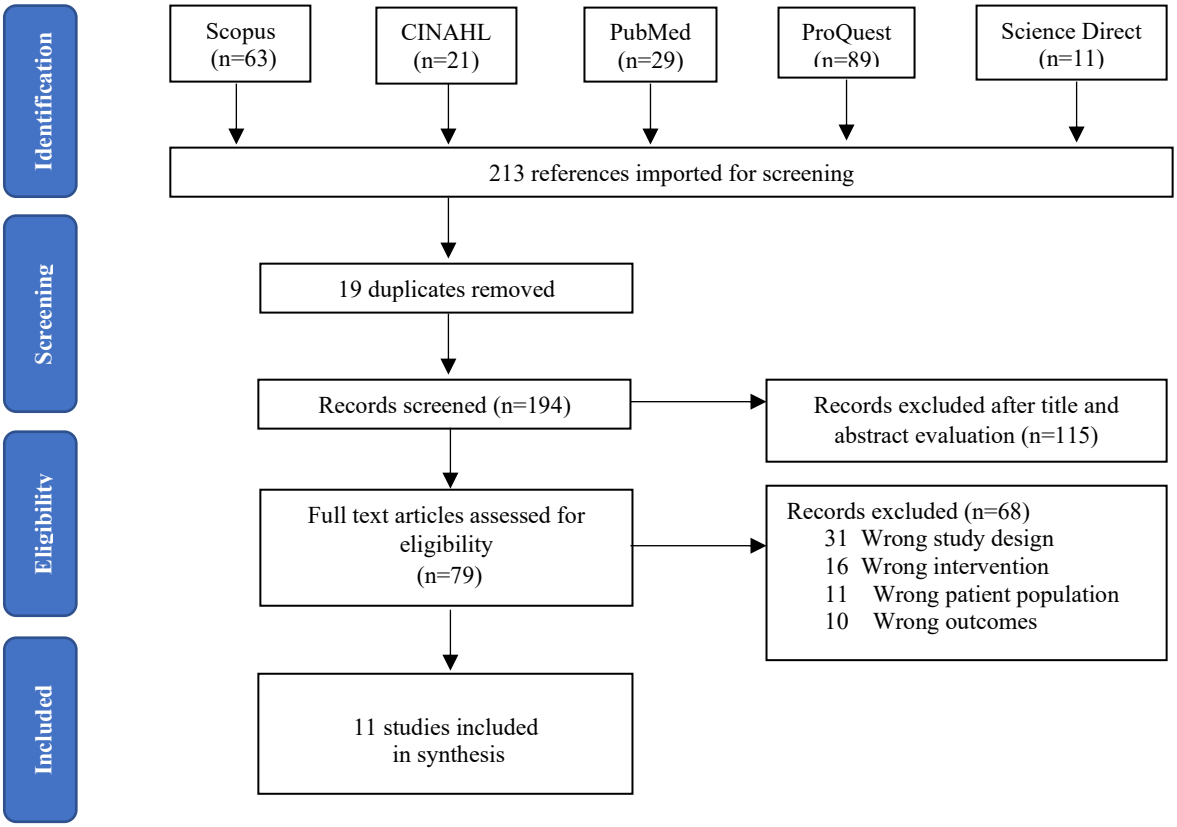
sectional study, human studies, and English publications. The researchers develop search terms to collect articles related to Knowledge, attitudes and practices of using personal protective equipment to prevent COVID-19 infection among health workers. The databases search used the following terms (covid 19 OR corona virus disease) AND (knowledge OR attitude OR practice) AND (personal protective equipment) AND (health workers). A comprehensive search strategy has been shown in figure 1.



Eligibility Criteria

In this systematic review study, cross-sectional studies on various health care workers (HCWs) published in English peer-reviewed journals were included in the study without any time limit. Qualitative, review and non-English studies were excluded. The outcomes measured in the included studies were knowledge, attitude, practice about personal protective equipment of HCWS towards COVID-19.

Data extraction and analysis

After searching databases, the articles were entered into mendeley software. Data from each article was inferentially extracted by researchers. Data were extracted using the narrative analysis to express the data synthesis including id, author, year, study design, target population, instrument and main outcomes (knowledge/ awareness, attitude, practice) about personal protective equipment.

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Assessment of study quality and risk of bias

The JBI Critical Appraisal for Cross-Sectional Studies was used to analyze the quality of methodology in each study. JBI consisted of 8 specific questions for cross sectional design. The checklist for studies suitable had various assessment criteria. Criterion assessment was given a score of 'yes', 'no', 'unclear' or 'not applicable', and every criterion with score 'yes' was given one point and, following this, each study score was calculated. Critical appraisal to assess the eligible studies was performed by researchers. If the score of the study was at least 50% during critical appraisal, which was the predetermined cut-off point agreed by researchers, studies were included into the review. Researchers excluded low quality studies in order to avoid compromising the validity of the results and recommendations of the review

RESULTS

A Total of 213 hits were obtained across the different electronic database, of which 19 were duplicates. After elimination of the duplicates, titles of 194 studies were screened. Of this, 115 studies were excluded, and then 79 studies assesd for full text articles for eligibility, and finally 11 articles enrolled in the study (Table 1) . Table 1 also showed that the articles were published between 2019 and 2021, with the most of articles published in 2020 (63,6 %).

Table 1. Summarize of Selected Studies

ID*	Author (Year)	Study Design	Location	Participants	Mode of survey	Measured Outcome	Conclusion
1	(Piché-Renaud et al., 2020)	Cross sectional	Canada	175 HCWs (35 doctors, 24 residents, 72 nurses, 14 respiratory therapists, 14 administration staff	By email	Knowledge, attitudes, and practices regarding PPE use	Training for health workers focused on doing PPE as appropriate should be carried out
2	(Darr, 2021)	Cross sectional	Inggris	339 nurses	social media, local and national trust-based internal mail	Knowledge and practices	Providing PPE guidance and conducting training can increase awareness, confidence, and knowledge among nursing staff
3	(Ayinde et al., 2020)	Cross-Sectional	Nigeria	350 HCWs (143 nurses, 93 CHO&CHEWs, 83 Doctors and 31 Others(health attendant/ward maid))	On site	Knowledge, attitudes, and practices	Effective infection control measures including regular skills-based training for all health workers can improve infection control practices

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4	(Ogolodo m et al.,2020)	cross-sectional	Nigeria	300 (102 doctors, 38 Lab Scientist ,26 nurse/midwife, 20 Consultant, 18 Technician, 18 Optometrist, 17 House Officer, 16 Radiographer, 14 Physiotherapist, 10 Pharmacy)	Online survey	Knowledge, attitudes	The health care workers in this study are well aware of the etiology of Coronavirus disease, mode of transmission and symptoms.
5	(Alao et al., 2020)	cross-sectional study	Nigeria	272 (medical doctors, nurses and clinical students)	online survey using Google form	Knowledge, attitude abeliefs, and level of PPE skill of each participant	This study showed that HCWs' knowledge about, attitudes towards, hand beliefs on PPE and their PPE skill in practice in Nigeria were remarkably poor. There is an urgent need for nationwide practical training on PPE use to curtail the spread of SARS-CoV-2 infection among HCWs.
6	(Izhar et al., 2021)	cross-sectional study	pakistan	452 maternity care providers	online survey using Google form	Knowledge and practice a	The participants had good knowledge and practices regarding PPE
7	(E.E. Abukhelaif, 2019)	cross sectional	Saudi arabia	185 nurses	-	believe, awareness and practices about PPE	Nurses had excellent knowledge with and appropriate use of PPE as vital in safeguarding HCWs and spread of infection
8	(Samant & Sane, 2020)	cross-sectional	India	48 orthopaedic surgeons and residents	observation al, web-based questionnaire	Knowledge, attitudes, and practices	Overall, KAP regarding prevention of spread of COVID-19 among orthopaedicians were adequate.

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9	(Hossain et al.,2021)	cross sectional	Bangladesh	393 healthcare workers (doctors, nurses, pharmacists, and lab technicians)	Online surveys	knowledge, attitude, and practice	health care workers overall have good knowledge and positive attitudes but poor practice regarding PPE
10	(Yu et al.,2020)	cross sectional	AS	61 otolaryngology physicians	Online surveys	practice	There is a high perception of safety, as well as adequate training of N95 and PPE equipment.
11	(Sethi et al., 2020)	Cross-Sectional	India	60 Health care workers (doctors, nurses and technicians)	onsite	Practice	The study showed inappropriate use and poor usage and practice of PPE among HCWs.

*ID : show the 1st to 11th studies.

Table 2. Main Study Characteristics and Finding

Category	Number of studies		Study ID
	n	%	
Country/setting			
Developed country			
Canada	1	9,09	1
Inggris	1	9,09	2
AS	1	9,09	10
Developing country			
Nigeria	3	27,27	3,4,5
Pakistan	1	9,09	6
Saudi Arabia	1	9,09	7
India	2	18,18	8,11
Bangladesh	1	9,09	9
Type of health workers			
Doctors	6	54,54	1,3,4,5,9,11
Nurse	7	63,63	1,2,3,5,7,9,11
respiratory therapists	1	9,09	1
administrative staff	1	9,09	1
midwives	1	9,09	6
lab scientists	2	18,18	4,9
ophthalmologists	1	9,09	10
radiographers	1	9,09	4,
physiotherapists	1	9,09	4,
pharmacists	2	18,18	4,9
clinical student	1	9,09	5
orthopedic surgeons and residents	1	9,09	8

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Outcome measure			
Knowledge	10	90,9	1,2,3,4,5,6,7,8,9,10,11
Attitude	7	63,63	1,3,4,5,8,9,10
Practice	9	81,81	1,2,3,5,6,8,9,10,11
Study design			
Cross sectional	11	100	1,2,3,4,5,6,7,8,9,10,11
Mode of survey			
Online	8	72,72	1,2,4,5,6,8,9,10,11
Onsite	2	18,18	3
Not mentioned	1	9,09	7

The main findings were presented in table 2. Total of 11 articles obtained from different countries that met the inclusion criteria was reviewed. Among them, 8 studies (72,72 % %) were conducted in developing countries, while 3 studies (27,27 %) were conducted in developed countries. We found that 100% study used cross sectional study design. About the types of health workers who participated as respondents in the study were doctors, nurses, respiratory therapists, administrative staff, midwives, lab scientists, ophthalmologists, radiographers, physiotherapists, pharmacists, clinical students, otolaryngology physicians, orthopedic surgeons and residents. About 72,72 % of the studies used an online questionnaire to collect data, and the most used platforms included Google form, SurveyMonkey, and email.

Table 3. Levels of Knowledge, attitude and practices of the selected articles

ID*	Author (Year)	Knowledge/ Awareness	Attitude	Practice
1	(Piché-Renaud et al., 2020)	Majority had moderate knowledge	Good attitude	Poor practice
2	(Darr, 2021)	Moderate knowledge	-	Poor practice
3	(Ayinde et al., 2020)	78,6 % had good level knowledge	positive attitude was 64% among the respondents	However, use of personal protective equipment (PPE) was low (56.8%)
4	(Ogolodom et al., 2020)	(56%) were highly aware of the pandemic	Majority of the-participants had positif attitude	
5	(Alao et al., 2020)	Poor knowledge - only 70 (25.7%) had adequate knowledge about PPE.	poor attitude	Using the Likert scale, twelve (4.4%) of the study participants always use PPE in the course of attending to patients.
6	(Izhar et al., 2021)	(85%) had adequate knowledge	-	78.8% had good practices regarding

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				PPE use.
7	(E.E. Abukhelaif, 2019)	(93%) had good awareness	-	-
8	(Samant & Sane, 2020)	Majority participants had "good-excellent" level of knowledge	Overall the attitude in this study was positive	majority participants reported good practices.
9	(Hossain et al., 2021)	99.5% (n=391) had good knowledge	88.8% (n=349) had positive attitude	51.7% (n=203) had good practice regarding PPE
10	(Yu et al., 2020)	Good	Good	good
11	(Sethi et al., 2020)	-	-	Poor practices

The level of knowledge, attitudes, and practices of selected articles can be seen in table 3.The majority of studies have good knowledge, positive attitudes, but bad practices regarding the use of PPE to prevent COVID 19 infection.

Table 4. Quality Assessment using JBI Score

ID	Study	JBI Critical Appraisal Number of items								Total (%)	Quality Rating
		1	2	3	4	5	6	7	8		
1	(Piché-Renaud et al., 2020)	Y	Y	Y	Y	Y	Y	Y	Y	100	High
2	(Darr, 2021)	Y	Y	UN	Y	Y	Y	Y	UN	75	High
3	(Ayinde et al., 2020)	Y	Y	Y	Y	Y	Y	Y	Y	100	High
4	(Ogolodom et al., 2020)	Y	Y	Y	Y	Y	Y	Y	Y	100	High
5	(Alao et al., 2020)	Y	Y	Y	Y	N	N	Y	Y	75	High
6	(Izhar et al., 2021)	Y	UN	Y	Y	Y	N	Y	Y	75	High
7	(E.E. Abukhelaif, 2019)	Y	Y	Y	Y	Y	Y	Y	Y	92,3	High
8	(Samant & Sane, 2020)	Y	Y	Y	Y	UN	UN	Y	Y	75	High
9	(Hossain et al., 2021)	Y	Y	UN	Y	NA	NA	Y	Y	62,5	Moderate
10	(Yu et al., 2020)	UN	NA	Y	Y	Y	Y	Y	Y	75	High
11	(Sethi et al., 2020)	Y	Y	Y	NA	NA	NA	Y	Y	62,5	Moderate

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ID	Study	JBI Critical Appraisal Number of items								Total (%)	Quality Rating
		1	2	3	4	5	6	7	8		
The scores : high = > 75%, moderate = 50-74%, low = 50%; N= 0; UN = 0; Y = 1; NA=0 N = no; UN = Unclear; Y = Yes; NA = Not Aplicable											

Table 4 showed that there were several studies ranged from moderate and high quality. JBI tool indicated the most of the studies have good quality (9 studies) and only 2 studies have a moderate bias.

DISCUSSION

Healthcare workers play a pivotal role in COVID-19 management as front-liners. Hence, they are at high risk for severe acute respiratory syndrome from SARS-COV-2 infection. The best way for HCWs to prevent this infection is through practice and demonstrated competency in donning, doffing, and proper use of personal protective equipment (PPE). Hence, an assessment of the current status of knowledge, attitude, and practice towards PPE among HCWs were duly needed. (Hossain et al., 2021).

Knowledge of Health Workers in Using Personal Protective Equipment to Prevent Covid-19 Infection

From the results of systematic reviews that have been carried out, the level of knowledge of health workers about the use of PPE to prevent COVID-19 infection around the world varies. In general, the knowledge level of health workers is good. Seven studies ((Ayinde et al., 2020; E.E. Abukhelaif, 2019; Hossain et al., 2021; Izhar et al., 2021; Ogolodom et al., 2020; Samant & Sane, 2020; Yu et al., 2020) reported satisfactory knowledge, 2 studies ((Darr, 2021; Piché-Renaud et al., 2020) reported a moderate level of knowledge, and 1 study (Alao et al., 2020) showed that the results of knowledge of health workers were at a low level. The results of the research identified that the knowledge of health workers related to PPE included: definition, types, standards for using PPE, level of protection related to the use of PPE, indications for PPE use, knowledge of how to choose the appropriate PPE and knowledge to remove PPE in the correct order. It was also noted that most information about COVID-19 was collected from news, newspapers, the internet and official websites among health workers (Yadav et al., 2020).

The causes of poor knowledge of health workers about PPE include a lack of training for health workers, no retraining of health workers on PPE, and incorrect assumptions about an infectious disease pandemic that are rare. This is in line with the results of research conducted by (Suppan et al., 2020) that health workers who have received education with the e-learning module have increased knowledge and practice about PPE. In the prevention of infectious diseases, disasters from health workers who have poor knowledge have many aspects. The workers are not only at risk of contracting the infection but also the hosts for developing the disease rapidly in a short period of time. Low adherence to the control and prevention of COVID-19 infection among health workers is associated with a high incidence of infection among health workers (Bani-Issa et al., 2021).

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Attitude of Health Workers in Using Personal Protective Equipment to Prevent Covid-19 Infection

From the results of a systematic review analysis, there are only 7 studies that discuss the attitudes of health workers regarding PPE to prevent COVID-19 infection. There are 6 studies (Ayinde et al., 2020; Hossain et al., 2021; Ogolodom et al., 2020; Piché-Renaud et al., 2020; Samant & Sane, 2020; Yu et al., 2020) which report that health workers have a positive attitude, and 1 study (Alao et al., 2020) reports that health workers have a bad attitude towards PPE.

The results of the analysis show a positive attitude, namely the importance of using PPE as personal protection and a means of preventing infection. Attitudes towards the use of PPE among health workers are influenced by perceptions of the dangers and risks, barriers to using PPE, dissatisfaction with the PPE provided and discomfort when wearing it. One study (Hossain et al., 2021) reported that married healthcare workers were significantly more likely to have positive attitudes because they were likely to be strengthened by the responsibility for protection to family members.

Practice of Health Workers in Using Personal Protective Equipment to Prevent Covid-19 Infection

The practice in this review is defined as the use of PPE to prevent COVID-19 infection which includes how to wear and remove PPE properly, discipline in wearing PPE, following appropriate steps are important to avoid self-contamination when using PPE. From the results of the analysis of 9 studies, it was stated that 5 studies (Alao et al., 2020; Ayinde et al., 2020; Darr, 2021; Piché-Renaud et al., 2020; Sethi et al., 2020) showed bad practice of using PPE and 4 studies (Hossain et al., 2021; Izhar et al., 2021; Samant & Sane, 2020; Yu et al., 2020) showed good practice.

The results of a study conducted by (Ogolodom et al., 2020) suggested that the poor skills regarding and practice of wearing and removing PPE may partly explain the high infection rate of health workers in Nigeria during the COVID-19 outbreak. The use of PPE is not in accordance with standard operating procedures is a risk factor for the high incidence of COVID-19 infection in health workers (Malik et al., 2020; Ran et al., 2020).

CONCLUSION

In conclusion, this systematic review found that the level of knowledge of health workers varies across the world and in general the level of knowledge is at a good level. Attitudes of healthcare workers also vary, with more studies reporting more positive attitudes. However, different results show that in the practice of using PPE, the majority of health workers are at a bad level. Appropriate action must be taken at the policy level to ensure adequate infection prevention and control measures. Training sessions on the use of PPE should be organized regularly. Strong monitoring and evaluation needs to be introduced to ensure proper PPE practice.

ACKNOWLEDGMENT

The authors of this study would like to thank the Faculty of Nursing and also the Master of Nursing Study Program, for providing the opportunity to present this study.

CONFLICT OF INTEREST

No conflict of interest was disclosed.

DOI: 10.30994/sjik.v10i1.747
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