Hosted by

Impacts of Personal Protective Equipment Utilisation on Prevention of Coronavirus Among Healthcare Workers in Kwara State, Nigeria

Kperogi Ismaila Ibrahim, Baba Dare Abubakar, Jamiu Abdulqudus Tosin, Ologele Ibrahim, Abdulrasaq Qazeem Onaolapo, Abdullahi Muhammed Bukola

Department of Health Promotion and Environmental Health Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria *Baba, Dare Abubakar (PhD)

***Corresponding author:**

abubakaroni@gmail.com or babadare2010@yahoo.com +2348062346210

DOI 10.53974/unza.jabs.6.4.1034

ABSTRACT

This study examined the impact of personal protective equipment (PPE) utilisation on the prevention of the coronavirus (COVID-19) among healthcare workers (HCWs) in Kwara State, Nigeria. Personal protective equipment (PPE) means personal protective equipment, which are devices designed to protect healthcare workers from contracting infectious diseases during the treatment of patients with the threaded pandemic COVID-19 infection. These instruments can be hand gloves, nose masks, and protective footwear, among others. However, the effect of the non-utilisation of these devices can be devastating, particularly among HCWs treating coronavirus patients because of its volatile nature of transmission through airborne and contacts. This study aims at determining if HCWs perceive that utilisation of PPE has effects on the prevention of Coronavirus (COVID-19) in Kwara State, Nigeria.

A descriptive research design of the survey type was used for this study. The instrument used was a researchers' structured questionnaire, which was validated by three experts in health education. A multistage sampling procedure to sample 230 HCWs from Kwara State government-owned hospitals was used for this study. The instrument was then subjected to a test re-test reliability method and analysed by Pearson Product Moment Correlation Coefficient (PPMC), which yielded 0.81r, showing that the instrument was reliable enough for the study. The data collected was analysed using descriptive statistics of frequency count, simple percentage and inferential statistics of Chi-square ($\chi 2$) at 0.05 alpha level.

Results revealed that HCWs significantly perceived that utilisation of PPE has an impact on the prevention of COVID-19 in Kwara State, Nigeria, with a calculated $\chi 2$ value of 146.174, which is greater than the critical table value of 43.773.

It was concluded that HCWs perceived that the utilisation of PPE has an impact on the prevention of COVID-19 in Kwara State, Nigeria. It was, however, recommended that the government should increase the training of HCWs through seminars and workshops. More so, the government should provide and enforce the adequate use of PPE to be used by HCWs against COVID-19 infection in Kwara State, Nigeria.

Keywords: Attitude, Corona Virus, Impacts, Healthcare Workers

INTRODUCTION

Coronavirus disease 2019, also known as COVID-19, is a rapidly expanding pandemic caused by a novel human coronavirus, particularly, the Severe Acute Respiratory Syndrome (SARS-COV-2), known as 2019-nCov. COVID-19 was first reported in December 2019 among patients with viral pneumonia symptoms, in Wuhan, China. They were found to be related to the Huanan seafood market in Wuhan, in the Hubei Province of China, where other non-aquatic animals were also being sold before the outbreak. As of 20 April 2020, over 2.4 million cases and 165,000 deaths have been reported globally. Europe is the most affected, with over 50% of the cases and 60% of the deaths reported in this region. The United States of America has the highest number of cases globally (695,350 cases) and the highest number of deaths (32,427 deaths). The African region is the least affected, with 13,892 cases and 628 deaths, but the numbers are increasing (Olum, Chekwech, Wekha, Nassozi and Bomgomin, 2020). Healthcare workers (HCWs) have been disproportionally affected by the COVID-19 pandemic, caused by the novel coronavirus, SARS-CoV-2. Given their high frequency of exposure, HCWs who treat adult patients with COVID-19 illness in emergency rooms and hospitals may be particularly susceptible to contracting the infection. Despite the widespread implementation of personal protective equipment (PPE) during the COVID-19 pandemic, there are surprisingly few studies on its impact (Kim, Hegde, LaFiura, Raghavan, Sun, Cheng, Rebholz, and Seidelmann, 2021). COVID-19 infection (morbidity) and death (mortality) rate among Nigerian healthcare workers appear to be on the increase. Coronaviruses are enveloped RNA viruses that are distributed broadly among humans, other mammals, and birds and cause respiratory, enteric, hepatic, and neurologic diseases. Six coronavirus species are known to cause human disease. Four viruses, 229E, OC43, NL63, and HKU1, are prevalent and typically cause common cold symptoms in immune-compromised individuals. The two other strains, Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome (MERS) coronavirus (MERS-CoV), are zoonotic in origin and have been linked to sometimes, fatal illnesses. Coronavirus disease 2019 (COVID-19) is an infectious respiratory disease, which is caused by newly recognised coronavirus (Shrestha, Thapa, Giri, Kumar, Dhobi, Thapa, Dhami, Shahi, Ghimire and Rathaur, 2021).

Old age and patients with pre-existing illnesses (like hypertension, cardiac disease, lung disease, cancer, or diabetes) have been identified as potential risk factors for severe disease and mortality. However, Olum et al., (2020) stated that HCWs are mostly at the frontline of the COVID-19 pandemic response and are exposed to dangers like pathogen exposure, long working hours, psychological distress, fatigue, occupational burnout and stigma, and physical violence. Verbeek, Rajamaki, Ijaz, Sauni, Toomey, Blackwood, et al. (2020), opined that in epidemics of highly infectious diseases, such as Ebola, severe acute respiratory syndrome (SARS), or coronavirus (COVID-19), healthcare workers (HCW) are at much greater risk of infection than the general

population, due to their contact with patients' contaminated body fluids. Personal Protective equipment (PPE) can reduce the risk by covering exposed body parts.

Nonetheless, to introduce and install effective control measures, having knowledge of basic hygiene principles and modes of disease transmission and measures against the spread of the scourge in our environment is of immense importance. Odusanya, et al., (2020) reported that for now, non-pharmacological interventions (NPIs) have become the mainstay of response to COVID-19 and are being used worldwide to flatten the epidemiologic curve with some success. Effective NPIs include isolation and quarantine, physical distancing, use of face masks and hand hygiene. These measures are best used in combination and simultaneously. The evidence is that they should be instituted early in the pandemic and for sustained periods. They should also be implemented in the context of the cultural and socioeconomic conditions of the populace. Ineffective NPIs include ultraviolet irradiation and spraying of outdoor spaces and individuals. We recommend that decision-makers weigh the evidence carefully, as it applies to the local setting to inform public health decisions.

The World Health Organisation (2020) recommended the following rational use of personal protective equipment (PPE) in healthcare, community settings, and during the handling of cargo; in this context, PPE includes gloves, medical masks, goggles or a face shield, and gowns, as well as for specific procedures, respirators (i.e., N95 or FFP2 standard or equivalent) and aprons. It is intended for those involved in distributing and managing PPE, as well as public health authorities and individuals in healthcare and community settings, and it provides information about when PPE use is most appropriate. The World Health Organisation will continue to update these recommendations as new information becomes available.

Preventive Measures for COVID-19 Disease

Based on the available evidence, the COVID-19 virus is transmitted between people through close contact and droplets, not by airborne transmission. The people most at risk of infection are those who are in close contact with a COVID-19 patient or who care for COVID-19 patients. Preventive and mitigation measures are key.

The most effective preventive measures in the community include: performing hand hygiene frequently with an alcohol-based hand rub if your hands are not visibly dirty or with soap and water if your hands are dirty; avoiding touching your eyes, nose, and mouth; practicing respiratory hygiene by coughing or sneezing into a bent elbow or tissue and then immediately disposing of the tissue; wearing a medical mask if you have respiratory symptoms and performing hand hygiene after disposing of the mask; maintaining social distance (a minimum of 1 metre) from persons with respiratory symptoms. Additional precautions are required by healthcare workers to protect themselves and prevent transmission in the healthcare setting. Precautions to be implemented by healthcare workers caring for patients with COVID-19 include using PPE appropriately. This involves selecting the proper PPE and being trained on how to put it on, remove, and dispose it of (WHO, 2020).

More so, to ensure that the use of PPE is rational and appropriate. PPE

should be used based on the risk of exposure (e.g., type of activity) and the transmission dynamics of the pathogen (e.g., contact, droplet or aerosol). The overuse of PPE will have a further impact on supply shortages.

World Health Organisation (2020) stated that observing the following recommendations, will ensure the rational use of PPE: The type of PPE used when caring for COVID-19 patients will vary according to the setting and type of personnel and activity.

Healthcare workers involved in the direct care of patients should use the following PPE: gowns, gloves, medical masks, and eye protection (goggles or face shield) to prevent infections.

Specifically, for aerosol-generating procedures (e.g., tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy), healthcare workers should use respirators, eye protection, gloves and gowns; aprons should also be used if gowns are not fluid-resistant.

Respirators (e.g., N95, FFP2, or equivalent standard) have been used for an extended time during previous public health emergencies involving acute respiratory illness when PPE was in short supply. This refers to wearing the same respirator while caring for multiple patients with the same diagnosis without removing it, and evidence indicates that respirators maintain their protection when used for extended periods. However, using a respirator for longer than 4 hours can lead to discomfort and should be avoided.

Among the public, persons with respiratory symptoms or those caring for COVID-19 patients at home should receive medical masks. For additional information, see home care for patients with COVID-19 presenting with mild symptoms and management of their contacts.

For persons without symptoms, wearing a mask of any type is not recommended. Wearing medical masks when they are not indicated may cause unnecessary costs and a procurement burden and create a false sense of security that can lead to the neglect of other essential preventive measures (WHO, 2020). Protecting HCWs from the dreaded infections with SARS-CoV-2 is an important factor in controlling the SARS-CoV-2 epidemic in the world. According to current knowledge, SARS-CoV-2 is thought to be transmitted via droplets or aerosols during close, unprotected contact or by direct and indirect contact with patients (Neuwirth, Mattner and Otchwenmah, 2020).

Current SARS-CoV-2 preventive measures aim at interrupting transmissions by maintaining adequate hand hygiene and the use of personal protective equipment (PPE) consisting of protective gowns, gloves, surgical face masks (SFM) or filtering facepieces (FFP2) and goggles for HCWs. However, PPE has not always been available, PPE was not worn or worn incorrectly, and mistakes during donning and doffing were documented among HCWs (Phan, Maita, Mortiz, Weber, Fritzen-Pedicini, and Bleasdale, 2019; Ran, Chen, Wang, Wu W, Zhangand Tan, 2019). A Study by Phan, Maita, Mortiz, Weber, Fritzen-Pedicini, and Bleasdale, 2019) observed that 90% of doffing processes were done incorrectly. The most common errors occurred in the aspect of the correct removal of gowns (65%) and contact with potentially contaminated surfaces in hospitals (48%) (Phan, Maita, Mortiz, Weber, Fritzen-Pedicini, and Bleasdale, 2019). Ran, Chen, Wang, Wu W, Zhang and Tan (2019) reported that a lack of hand hygiene after contact with COVID-19 patients led to a higher risk of COVID-19 among HCWs in Wuhan. For this reason, deficits in the use of

PPE are to be identified and analysed to provide HCWs with targeted training on the correct procedure for the appropriate use of PPE.

According to Erfani, et al., (2020), to achieve ultimate success against the on-going, encounter, against, COVID-19 in the world, people's commitment to these control measures is necessary at all levels of healthcare particularly, among HCWs. According to the KAP theory, this is generally affected by their knowledge, attitude, and practices (KAP) concerning COVID-19 prevention. Therefore, the researchers, decided to examine the Impacts of PPE utilisation on the prevention of coronavirus (COVID-19) among healthcare workers in Kwara State, Nigeria.

COVID-19 is a highly infectious and dreaded disease of the upper respiratory tract, which HCWs are prone to during the treatment of patients, particularly when clinical procedures are observed without complying with preventive measures. COVID-19 is an emerging public health problem threatening the lives of over 2.4 million people and HCWs globally (Olum et al., 2020). These diseases have claimed the lives of HCWs and so many other people across the world, without the exception of Kwara State, Nigeria. However, efforts on measures established by international health agencies like WHO, UNICEF and WATERAID, among others, yielded few results, particularly among HCWs in Kwara State. Indifferent attitudes toward the general precaution was noted among healthcare workers. Fear of death from attending to patients and lack of personal protective equipment had a strong impact on the attitude of HCWs. Several other studies have investigated COVID-19 without examining the root causes of the spread among healthcare workers, particularly in Kwara State, Nigeria. In view of the above-stated facts, the researchers deemed it fit to examine the Impacts of PPE utilisation on the prevention of coronavirus (COVID-19) among HCWs in Kwara State, Nigeria.

METHODOLOGY

The population of this study consists of all the HCWs in all five hundred and forty (540) government-owned hospitals in Kwara State, Nigeria. The multi-stage sampling procedure was used to select a total of two hundred and thirty (230) HCWs used for the study. A stratified random sampling, a simple random sampling and a convenient sampling techniques were used. The first stage involved the use of a stratified sampling technique where Kwara State was stratified into the already existing sixteen (16) local government areas. The second stage involved a simple random sampling technique, where a balloting system was used to select fifty-eight (58) hospitals from a total of 540 government-owned hospitals in Kwara State. In the third stage, a convenient sampling technique was used to select four (4) HCWs from each of the sampled hospitals, except for the University of Ilorin Teaching Hospital (being a tertiary healthcare facility), where six (6) HCWs were sampled, to get a total of two hundred and thirty (230) respondents for the study.

The instrument used in conducting this research was the researchers' structured questionnaire. The questionnaire consists of two sections, A and B. Section A measured the demographic variables of the respondents, while Section B measured the impacts of PPE utilisation on the prevention of Coronavirus (COVID-19) among HCWs in Kwara

State, Nigeria. A modified four-point Likert rating scale with alternatives of Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point was used. To establish the validity of the instrument, the questionnaire was vetted by three (3) experts in the field of Health Education, Community Health and Epidemiology at the University of Ilorin, Ilorin, Nigeria. The researchers incorporated all the suggestions made by the experts into the final draft of the instrument used for the study. The research instrument was subjected to a test of reliability using the test-retest method in which a reliability coefficient of 0.81r was obtained. The research questions raised were answered using frequency count and simple percentage statistics. The data emanating from the administration of the questionnaire were analysed using inferential statistics of Chi-square ($\chi 2$), set at 0.05 alpha level, to test the hypothesis for the study.

RESULTS

Research Question: Will HCWs perceive the utilisation of PPE as having an impact on the prevention of COVID-19 in Kwara State, Nigeria?

Table 1: Frequency count and simple percentage for responses on the impacts of HCW's utilisation of PPE on the prevention of COVID-19, in Kwara State, Nigeria

S/N	Items on Research Questions	SA (%)	A (%)	Positive response	D (%)	SD (%)	Negative response
1	Cough is contracted from no use of PPE	53 (23.0%)	83 (36.1%)	136	54 (23.5%)	40 (17.4%)	94
2	COVID-19 is contracted by HCWs who refuse to use PPE	54 (23.5%)	115 (50.0%)	169	28 (12.2%)	33 (14.3%)	61
3	Patients increase from none use of PPE by HCWs	60 (26.1%)	90 (39.1%)	150	45 (19.6%)	35 (15.2%)	80
4	SARS increase from none use of PPE	54 (23.5%)	95 (41.3%)	149	52 (22.6%)	29 (12.6%)	81
5	Spread of COVID-19 from none use of PPE	49 (21.3%)	104 (45.2%)	153	48 (20.9%)	29 (12.6%)	77
6	PPE prevents COVID-19 better than drugs	48 (20.9%)	86 (37.4%)	134	62 (27.0%)	34 (14.8%)	96
7	Infected blood is contacted from none use of PPE	60 (26.1%)	88 (38.3%)	148	50 (21.7%)	32 (13.9%)	82
8	There is a high risk of infection from none use of PPE	65 (28.3%)	86 (37.4%)	151	46 (20.0%)	33 (14.3%)	79
9	Non-Availability of adequate PPE increases susceptibility rate	69 (30.0%)	81 (35.2%)	150	50 (21.7%)	30 (13.0%)	80
10	Respiratory infections from none-use of PPE are common among HCWs	49 (21.3%)	97 (42.2%)	146	48 (20.9%)	36 (15.7%)	84
11	Safety is assured when using PPE during service provision	79 (34.3%)	61 (26.5%)	140	48 (20.9%)	42 (18.3%)	90
	Total			**148 (64.3%)**			**82 (43.7%)**

The frequency count and simple percentage table above revealed that HCWs perceived the that utilisation of PPE has impacts on the prevention of COVID-19 in Kwara State Nigeria. This is because the positive responses of 64.3% are greater than the negative responses of 43.7%.

Hypothesis: HCWs will not significantly perceive utilisation of PPE as having impact on the prevention of the COVID-19 in Kwara State Nigeria.

Table 2: Chi-square analysis of HCWs' perception on the impacts of the utilisation of PPE on the prevention of COVID-19, in Kwara State Nigeria

S/N	Items on Research Questions	SA (%)	A (%)	D (%)	SD(%)	Df	Cal. χ^2 Val.	Crit. Tab. Val.	Decision
1	Cough is contracted from the none use of PPE	53 (23.0%)	83 (36.1%)	54 (23.5%)	40 (17.4%)				
2	COVID-19 is contracted by HCWs who refused to use PPE	54 (23.5%)	115 (50.0%)	28 (12.2%)	33 (14.3%)				
3	Patients increase from the none use of PPE by HCWs	60 (26.1%)	90 (39.1%)	45 (19.6%)	35 (15.2%)				
4	SARS increases from none use of PPE	54 (23.5%)	95 (41.3%)	52 (22.6%)	29 (12.6%)	30	146.174	43.773	H_0 is rejected
5	Spread of COVID-19 from the none use of PPE	49 (21.3%)	104 (45.2%)	48 (20.9%)	29 (12.6%)				
6	PPE prevents COVID-19 better than drugs	48 (20.9%)	86 (37.4%)	62 (27.0%)	34 (14.8%)				
7	Infected blood is contacted from none use of PPE	60 (26.1%)	88 (38.3%)	50 (21.7%)	32 (13.9%)				
8	There is high risk of infection from none use of PPE	65 (28.3%)	86 (37.4%)	46 (20.0%)	33 (14.3%)				
9	Non-Availability of adequate PPE increases susceptibility rate	69 (30.0%)	81 (35.2%)	50 (21.7%)	30 (13.0%)				
10	Respiratory infections from none-use of PPE are common among HCWs	49 (21.3%)	97 (42.2%)	48 (20.9%)	36 (15.7%)				
11	Safety is assured when using PPE during service provision	79 (34.3%)	61 (26.5%)	48 (20.9%)	42 (18.3%)				
		640	986	531	373				

@ 0.05 alpha level.

The results revealed that the hypothesis, which stated that HCWs will not significantly perceive utilisation of PPE as having impacts on the prevention of COVID-19 in Kwara State, Nigeria, was rejected. This implies that HCWs perceived the utilisation of PPE as having much impact on the prevention of COVID-19 in Kwara State, Nigeria, because the calculated $\chi 2$ value of 146.174 is greater than the critical table value of 43.773.

DISCUSSION

This study revealed that the HCW's utilisation of PPE has much impact on the prevention of COVID-19 in Kwara State, Nigeria, because the calculated $\chi 2$ value of 146.174 is greater than the critical table value of 43.773. This is due largely to the fact that non-utilisation of PPE causes respiratory infections and blood infections. Improper use of PPE often increases the risk of COVID-19. This finding is in line with that of Erfani, et al. (2020), who reported that to achieve an ultimate success against the on-going encounter against COVID-19 in the world, people's commitment to these control measures is necessary, at all levels of healthcare particularly among HCWs. According to the KAP theory, this is generally affected by their knowledge, attitude, and practices (KAP) concerning COVID-19.

More so, Odusanya, et al., (2020) reported that non-pharmaceutical interventions that are effective in the prevention of COVID-19 include isolation and quarantine, physical distancing, use of face masks, hand gloves and hand hygiene. They stated that these measures are best used in combination and simultaneously. The researchers maintained that PPE utilisation should be instituted early in the pandemic and for sustained periods. The finding is in conformity with WHO (2020), which stated that the type of PPE used when caring for COVID-19 patients should be varied according to the setting and type of personnel and activity. Therefore, HCWs involved in the direct care of patients should use gowns, gloves, medical masks, and eye protection (goggles or face shields) to prevent infections.

CONCLUSION

Based on the findings of this study, it was concluded that: HCW's utilisation of PPE have an impact on the prevention of COVID-19 in Kwara State, Nigeria.

RECOMMENDATIONS

Based on the drawn conclusion, the following recommendations were made:

(i) Government should increase the training of HCWs through seminars and workshops.

(ii) Government should also provide and enforce the adequate use of PPE by HCWs in the prevention of COVID-19 infection in Kwara State and Nigeria at large.

ETHICAL CLEARANCE - Taken from Ministry of Health Ethical Review Committee,
Ilorin, Kwara State, Nigeria.

SOURCE OF FUNDING - No funding was received for conducting this study.

CONFLICT OF INTEREST - The authors have no conflicts of interest to declare.

REFERENCES

Erfani, A., Shahriarirad, R., Ranjbar, K., Mirahmadizadeh, A and Moghadami, M., (2020). Knowledge, Attitude and Practice Toward the Novel Coronavirus

(COVID-19) Outbreak: A Population-Based Survey in Iran. Retrieved on the 29 July 2021, fromhttps://www.who.int/bulletin/online_first/20-256651.pdf.

Kim, H., Hegde, S., LaFiura, C., Raghavan, M., Sun, N., Cheng, S., Rebholz, C.M., and Seidelmann, S.B. (2021). Access to Personal Protective Equipment in Exposed Healthcare Workers and COVID-19 Illness, Severity, Symptoms and Duration: A Population-based Case-control Study in Six Countries. *BMJ Global Health Journal*. Retrieved on the 13 December 2021 from: wwwhttps:// https://gh.bmj.com/content/6/1/e004611.

Neuwirth, M. M., Mattner, Marttner, F., and Otchwenmah, R., (2020). Adherence to Personal Protective equipment Use among Healthcare Workers Caring for Confirmed COVID-19 and Alleged Non-COVID-19 Patients. *Antimicrobial Resistance and Infection Control* Volume 9 (199). *Published by Journal of Biomedcentral.*Retrieved on the 23 Oct 2021 from: wwwhttps://aricjournal.biomedcentral.com.

Odusanya, O.O., Odugbemi, B.A., Odugbemi, T.O., and Ajisegiri, W.S. (2020). COVID-19: A Review of the Effectiveness of non-pharmacological Interventions. *Niger Postgrad Medical Journal*. Oct-Dec 2020;27(4):261-267. doi: 10.4103/npmj.npmj_208_20. Retrieved on the 29 July, from https://pubmed.ncbi.nlm.nih.gov/33154276/.

Olum, R., Chekwech, G., Wekha, G., Nassozi, D. R., and Bongomin, F. (2020). Coronavirus Disease-2019: Knowledge, Attitude, and Practices of Healthcare Workers at Makerere University Teaching Hospitals, Uganda. Public Health, 30 April 2020. Retrieved on the 29 July 2021, from https://doi.org/10.3389/fpubh.2020.00181.

Phan, L.T., Maita D., Mortiz D.C., Weber R., Fritzen-Pedicini C., Bleasdale SC, et al., (2019). Personal Protective Equipment Doffing Practices of Healthcare Workers. J Occup Environ Hyg. 2019: 16(8):575-81.

Ran, L., Chen X., Wang Y., Wu, W., Zhang, L., Tan X., (2019). Risk Factors of Healthcare Workers with Coronavirus Disease 2019: A Retrospective Cohort Study in a designated Hospital of Wuhan in China. Clin Infect Dis. 2020. https://doi.org/10.1093/cid/ciaa287/5808788.

Shrestha, A., Thapa, B., T., Giri, M., Kumar, S., Dhobi, S., Thapa, H., Dhami, P.P., Shahi, A., Ghimire, A., and Rathaur, E. S. (2021). Knowledge and attitude on Prevention of COVID-19 among Community Health Workers in Nepal-A Cross-sectional Study. *BioMedCentral Public Health. Volume 21, Article Number: 1424* (2021). IFHR (Innovative Foundation for Health and Research), Kathmandu, Nepal, Department of Public Health, Health Office, Lalitpur, Bagmati Province, Nepal. Retrieved on the 29 July 2021, from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-11400-9.

Verbeek, J.H., Rajamaki, B., Ijaz, S., Sauni, R., Toomey, E., Blackwood, B., Tikka, C., Routsalainen, J.H., and Balci, F.S.K. (2020). Personal Protective Equipment for Preventing Highly Infectious Diseases Due to Exposure to Contaminated Body Fluids in Healthcare Staff. National Library of Medicine, National Center for Biotechnology Information (NCBI). PubMed. 2020 May 15;5: CD011621.

doi: 10.1002/14651858.CD011621.pub5. PMID: 32412096. Retrieved 13 December, 2021, from www. https://pubmed.ncbi.nlm.nih.gov/32412096.

World Health Organisation (WHO) (2020). Emerging Respiratory Viruses, Including COVID-19: Methods 1. For Detection, Prevention, Response, and Control. https: // open who. org/ courses/ introductiontoncov (Accessed 10 October 2021).