

Health Care Professionals Self-Reported N-95 Respirator And Face Shield Looseness, Sweating, Discomfort And Pressure Injury During Provide Care in Suspected And Confirmed Areas Of Corona Virus Disease During COVID-19 Outbreak Pandemic In Globally : A Multicenter, Cross – Sectional Study

¹Mr. Vijay Kumar, ²Nitesh Kumawat, ³Yashawant Ramawat, ⁴Dr. Ashok Kumar, ⁵Dr. Chandra Prakash,

¹Senior Nursing Officer, ²Nursing Officer, ³Nursing Officer, ⁴Associate Professor, ⁵Associate Professor, ¹Emergency Department, ¹All India Institute of Medical Sciences, Jodhpur, Rajasthan, India

ABSTRACT: COVID - 19, very novel pandemic which could have make a holocaust around the globe. Now people all over world is fighting against this peril and indeed health care workers do a lot risking self and unsurprisingly they have been named globally as frontline warriors of COVID- 19.They are stepping forward to get their triumph over this plight with the help of only one weapon called Personal Protective Equipment(PPE). However, at times they need to wear this for huge long hours and it in turn can cause kind of pressure injuries to the workers. The main objective of the study was to develop on how much the health care professionals (HCP's) are aware of policies regarding N-95 respirator and face shield usage. Another objective was to check their knowledge about dead space that can develop around the nose and how beneficial it is to use a dressing on facial areas where the potential pressure sores can develop.

Keywords: Personal Protective Equipment, N-95 Respirator, Face shield, COVID-19, Dead space around Nasal Alar Sulcus, Pressure Injury

INTRODUCTION

Corona viruses have hitherto been not so spreaded as happened in our era. A novel coronavirus named 2019-nCoV was discovered in December 2019, and its resultant disease termed coronavirus disease 2019 (COVID-19) appeared first in Wuhan, China. On 11 March 2020, the World Health Organization (WHO) declared COVID-19 as a pandemic.^[1] The present study attempts to elucidate the characteristics of skin damage caused by N 95 respirator and face shield, and the possible preventive and curative measures required on the base of experience of the first-line clinicians working to treat 2019-nCoV infection.(Table-1)

Table-1: Health care professionals experience related to N-95 Respirator and Face shield	
If you agree to contribute to the study kindly agree and provide answers to the following questions in the questionnaires.	
Agree	522
Disagree	0
AGE (YEARS)	
18-29	188
29-39	262
39-50	60
50-60	12
Gender	
Male	390
Female	132
Educational Qualifications	
Certificate	13
Diploma	39
Graduate	293
Post graduate	139
Doctorate	38

In which area do you work.	
Autonomous body hospital	178
Central Government Hospital	166
State Government hospital	58
Private Hospital	48
Total working experiences in clinical Field(in years).	
LESS THAN 1 YEAR	88
1 to 5	98
5 to 8	102
8 to 10	149
More than 10	85
How much time have you work to the highly infected unit (in years).	
Nil	77
LESS THAN 1 YEAR	141
1 to 5	184
5 to 7	49
7 to 10	38
More than 10	33
Currently clinical working Area.	
COVID-19 Isolation Unit	98
COVID-19 Suspected Unit	178
COVID-19 Screening Clinic	104
Emergency Department	84
Paediatric Emergency	58
Do you wear N95 Mask and Face shield during treating and caring of confirmed or suspected COVID- 19 patient.	
Strongly agree	484
Agree	28
Unsure	10
Disagree	
Strongly disagree	
After the COVID-19 pandemic, health care worker become more eager to apply the N95 mask and face shield well to prevent infection.	
Strongly agree	458
Agree	41
Unsure	14
Disagree	5
Strongly disagree	4
Do you have a Any guideline or protocol to wear N95 and face shield from proper way.	
Yes	387
No	135
Do you have any guideline or protocol to prevent of pressure injury that develop due to continues use of N95 and face shield.	
Yes	38
No	484
Does head sweating come to your mouth after applying your face shield and N95 mask Along with PPE.	
Always	352
Unsure	72
Rarely	89
Never	9
Do you know the right sequence to wear N95 mask and Face shield.	
Yes	483
No	39
How many hours do you work in confirmed or suspected COVID- 19 Areas with Full PPE (In Hour's).	
4 to 7	262
7 to 10	232
10 to 12	20
more than 12	8
Do you talk and yawning after wearing the N-95 mask.	
Yes	484
No	38

Do you have neck movement after wearing the N-95 mask.	
Yes	496
No	26
Do you close the metal nose clip while wearing of N-95 at top of the nose.	
Always	471
Rarely	46
Never	5
Do you feel that metal clip of the N-95 mask get loose on Nasal bridge after the conversation, yawning and neck movements.	
Always	299
Unsure	42
Rarely	97
Never	84
Does the air exhale from the nasal bridge to outside during the nasal metal clip of your N95 mask loose.	
Always	288
Unsure	52
Rarely	103
Never	79
Do you have the following problem (pressure Marks, Red rashes, skin peeling, Erythema) on nose and cheeks after continues use of N-95 mask.	
Always	371
Rarely	57
Never	94
Are you applying any dressing material under the N-95 mask and face shield to prevent discomfort and <u>there</u> related problem.	
Always	24
Some time	20
Never	478

COVID-19 VIRUS

The SARS-CoV-2 virus is spread through inoculation of mucous membranes by droplets and aerosols containing the virus as well as contact with droplet-contaminated fomites (i.e., surfaces of varying objects and materials).^[2] Fomites connect as live-virus reservoirs for hours to days.^[3] Breaking the cycle of infection is a critical goal. Fortunately, the SARS-CoV-2 virus, an enveloped RNA virus, is highly susceptible to destruction with either alcohol-based hand sanitizers or simple soap and water when either is used during handwashing for at least 20 sec.^[4] Furthermore, agents used for routine hospital cleaning are sufficient for decontaminating any potential fomite surface.^[5-6] Coronavirus disease has a spectrum of clinical presentations. Approximately 80% of those infected will have mild disease not requiring hospital care and 15% will have moderate disease requiring oxygen supplementation. Approximately 5% will have severe disease requiring hospitalization that may include intensive care unit admission, endotracheal intubation, and mechanical ventilation.^[7]

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) work as shield for front line warrior who are fighting with COVID-19 pandemic. 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. In critical situation Personal Protective Equipment is an important component, but only one part, of a system protecting staff and other patients from COVID -19 cross -infection. Appropriate use significantly reduces risk of viral transmission. Personal Protective Equipment should logically be matched to the potential mode of viral transmission occurring during patient care, contact, droplet, or airborne. Recommendations from international organizations are broadly consistent, but equipment use is not. WHO has recommended that when health care worker dealing with suspected or COVID-19

positive patient must wear an N95 or FFP2 mask.^[8] There is also a recommendation that a medical mask, gown, gloves, and eye protection (goggles or face shield) is sufficient.^[8] 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.

PRESSURE INJURIES

Health care provider who are working in COVID-19 pandemic developing pressure injury due to PPE special mask and face shield . COVID-19 pandemic, you've probably seen images of hard-working frontline healthcare professionals how having pressure marks over face where N-95 respirator and face shields was applied. This all type of pressure marks are pressure injury that develop due to wearing respirator and face shield. N-95 respirator has a particularly high risk of injury because of the tight fit requirements. Friction and the accumulation of moisture under the respirator can also cause skin injury. A possible intervention, for instance, would be to reduce friction by applying a liquid skin sealant or protectant on skin that will be in contact with the mask, and allowing the sealant or protectant to fully dry before donning the mask. Keeping skin clean and appropriately hydrated while avoiding alkaline soaps and harsh chemical solutions is another recommendation. However, the NPUAP recommended against the use of petroleum jelly, mineral oil, or any other product, which could cause the mask to slip and thus make it less effective.^[9] Healthcare professionals who opt to use dressings with their masks are advised in the position paper not to stack multiple dressings and to make sure outer-layer dressings are not permeable.

Adequate fit and seal of N95 with the skin are required to provide expected and effective exposure reduction. The proper seal helps ensure that the majority of inhaled air will travel through the respirators filter material. Anything that disrupts the fit and seal of the respirator will result in a reduction in the level of protection that the wearer can achieve with the respirator.^[10] There were no significant differences between the percentages of cases and controls who reported the following problems: general compliance problems. Frequency of touching or adjusting the N-95 respirator, general problems with mask, problems with mask fit, and problems with fogging of goggles ^[10]

DATA COLLECTION

The clinical data related to N-95 respirator and face shield with COVID-19 in each center were collected. The questionnaire included 22 questions that examined the feelings of the health care professionals during the COVID-19 outbreak. Simultaneously, an online survey was conducted for information about the health care worker who had been worked with COVID-19 confirmed or suspected cases, responded about the continues use of N-95 respirator and face shield were kind of loosely sealable and pressure injury under the management at each center by health care professionals asking to complete a questionnaire. A total of 568 questionnaires were collected. of which 522 were valid, but 46 of these were excluded because the respondents did not work in suspected and isolation unit of COVID-19 during the pandemic outbreak. Additional clinical data was collected on respondents suspected or confirmed areas to have COVID-19.

STUDY DESIGN AND PARTICIPANT

During the study period, all healthcare workers were actively involved in the care of COVID-19 patients. Healthcare workers included doctors, nurses and allied healthcare workers from isolation unit, suspected area, screening clinic, emergency department and pediatric emergency. The study questionnaire, written in English and asked about general demographic, attitude, working area, clinical experience in clinical field and highly infectious unit, sweating come from head to mouth, pressure injury that develop due to continues use of N95 and face shield, leakage of for N-95 respirator, proper guideline for N-95 respirator and face shield etc. during the pandemic outbreak.(Table-1)

STATISTICAL ANALYSIS

The aim of this study is to report prevalence of COVID-19 in health care worker. COVID-19 infection in health care worker caused by with different efficacy was compared. We also report the clinical courses and clinical outcomes of the COVID-19 patients. There were, therefore, no formal hypotheses being implemented to drive the sample size calculation and we included the maximum number of health care worker who met the inclusion criteria.

DISCUSSION

Among the 522 participants of the study who are mostly health care workers from different nations, registered a renowned figure of 100% of agreement with the study which means no sample was refused to be a participant.(Figure -1) (Table-1). Indians were the majority among the participants with far better percent of 73.02 % (376), whereas, the other nations had comparatively less participation as 48 from USA, 29 from UK and 69 were from Indonesia. As many as 86.02% of the samples were belong to younger age group. More than the half of participants were graduates with 56%(293) and postgraduates who indulged in study also had a better figure of 137(27%). Only a nominal of 38 members were completed their PhD showing a 7%.(figure2) The study was conducted during the middle stages of covid 19 attack and respondents were chosen from those who worked in the covid 19 suspected area or isolation unit world wide.

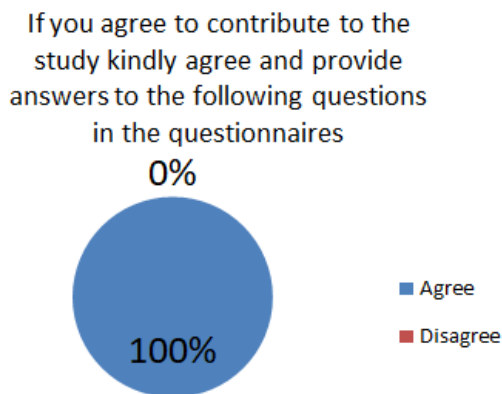


FIGURE-1

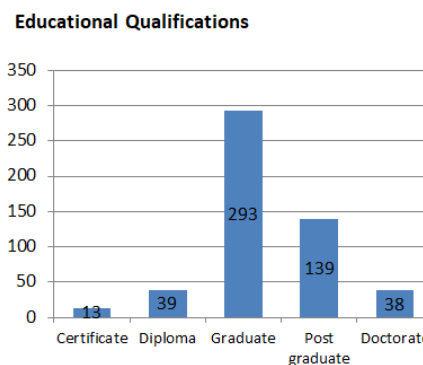


FIGURE-2

Among all, the lion's part of study was bagged by males with an astounding percentage of 75% (390) while females contributed very diminutive figure of 25% (132). (Figure -3) Among the participants, an exact half of them were belong to the age group of 29-39yrs with 50% (262) and about 36% (188) were between 18-29yrs,12%(60) were in 39-50yrs and a meagre of 2%(12) were belong to the 50-60yrs age group.(Figure - 4)

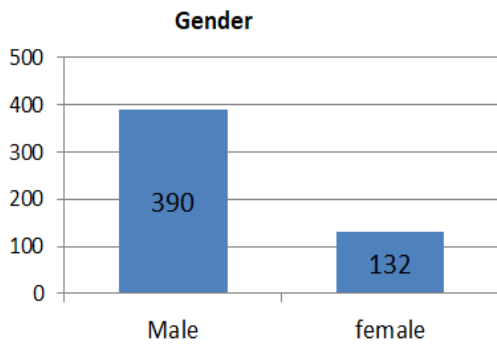


FIGURE-3

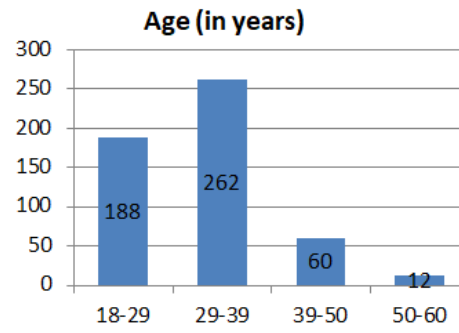


FIGURE-4

WHO has passed message globally for the care of patients who had affected with COVID -19. So most of the government and autonomous body owned hospitals are dedicated for the corona disease patient care. The survey had depicted that majority of health care workers who have been working in government sector were participated in the study as compared to the other private institutions.(Figure - 5) Also, Figure - 6 shows vividly that a substantial of 34%(179) of the participants were worked in the suspected unit while the screening clinic and isolation unit workers recorded about nearly a similar Figures as 20%(104) and 19%(98).

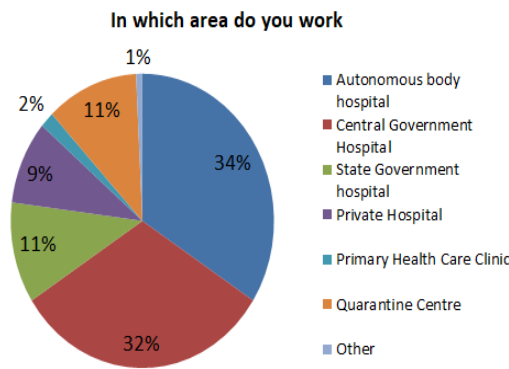


FIGURE-5

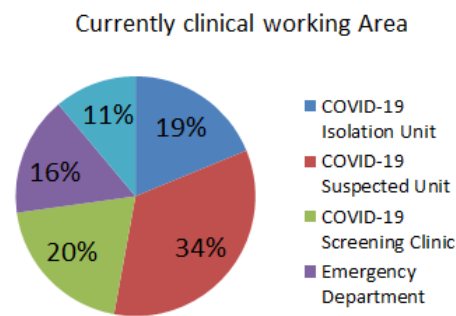


FIGURE-6

It is well known fact that with times went by as more experience and skills health care workers achieve they indeed can deliver high quality care than less experienced one. Also some studies have shown that most of the workers who worked in infectious unit have comparatively less experience. Evidences suggests that there is an inverse relationship between the number of years that health care professionals has been in highly contagious unit and the quality of care they deliver. In this study majority of the respondents were more experienced.(Figure- 7 & 8)

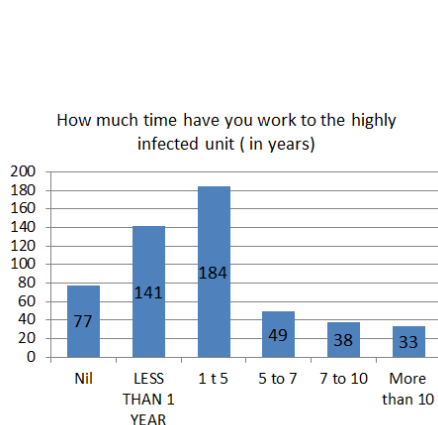


FIGURE- 7

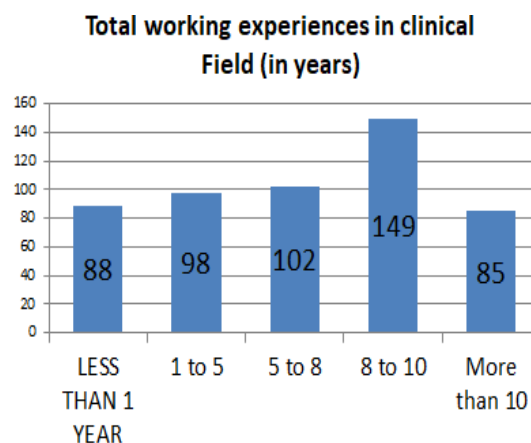


FIGURE-8

Health care workers are showing high level of compliance in wearing PPE so as to protect themselves and to prevent cross infection to others as well. Though it is really risky to get an infection especially while we do things like donning and doffing PPE and at times it can make the workers to be less adhere to the hospital policies regarding use of PPE. This survey aim to analyze what all things have been learned by the workers about use of PPE and how to improve the safety in the health care facilities. PPE is protective gear designed mainly to safeguarding the health care workers by minimizing their exposure to microbes of various kinds. The use of different PPE differs with degree of exposure and risk the workers are supposed to have depending on their area of duty like screening Centre, suspects unit, quarantine Centre and isolation unit. This study was focused on N95 respirator and face shield.

It has been noted that detailed guidelines have given by World Health Organization (WHO) and Ministry of Health and Family Welfare (MOHFW) for the use of face shield and N-95 respirator together with the complete PPE set. However, any special suggestions haven't seen yet about how to prevent the potential pressure injuries while wearing a face shield or N95 respirator. The study elucidates that a majority of 93%(484) people were replied as they are not provided with any guidelines for the same.(Figure-9). Besides, in the survey we found that most of respondents were faced the problem of dead space around the nose. This occur because of the loosening of the mask while the person is talking, yawning or moving his neck. It is seemingly unavoidable. Also, as face is the very important part of a human body in cosmetic aspect, preventing pressure injury over face is very essential. So from our study we noted that, a far excelled percent of nearly 90%(471) participants were used to close the metal strip over the nasal bridge always and a meagre of 9% (46) does it rarely and little of around 1% never does this.(Figure-10). 8% (42) were unsure about the problem at all (Figure-11). Again, the survey portrayed that 55% of people were aware of the exhalation of air to outside through this loosed area of mask and 20% were rarely aware and 10% were unsure about this issue.(Figure- 12).

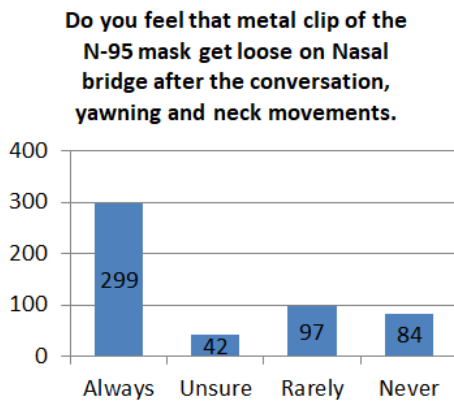


FIGURE-11

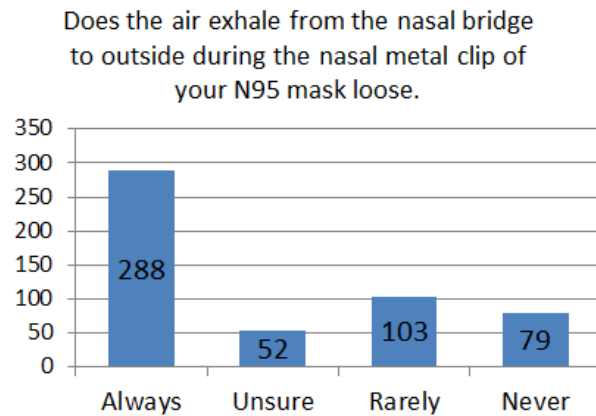


FIGURE - 12

Prolonged use of N95 respirator and face shield results in high perspiration and finally it may affect the integrity of skin. Sometimes it can lead to maceration of skin due to excessive moisture. As it is mandatory for those who working in highly infectious units to wear all these PPE, they are likely to develop itching, redness, irritation, blisters, erythema and skin erosion. From the study, it is noted that as well as 67%(352) people were always aware of the sweating issue while only a few like 17% (89) and 14% (72) of them were aware about the issue rarely and unsure respectively.(Figure-13) Also, the study displayed the figure of those who developed pressure injuries always were worth mentioning with well over 371(71%) and 57(11%) were had this rarely.(Figure-14). Clearly, the all candidates have the symptoms like pressure marks, erythema, rashes and skin peeling in varying degrees and it was exclusively because of prolonged use of PPE.

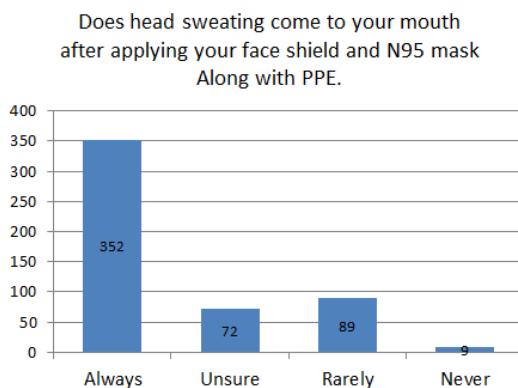


FIGURE- 13

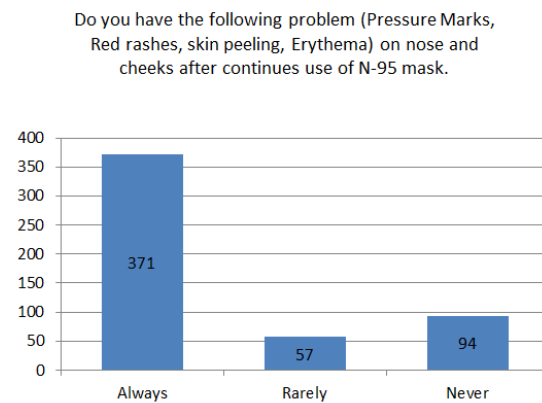


FIGURE - 14

We found that health care professionals doing appreciably good quality care to COVID-19 patients by wearing full PPE. But there is too much pressure injury for health care worker. It has been noted that no appropriate dressing is available for prevention of pressure injury. Our online survey found that a staggering figure of 478 (91%) out of 522 respondents had given response as they never used any prophylaxis dressing materials. (Figure -15)

Are you applying any dressing material under the N-95 mask and face shield to prevent discomfort and there related problem?

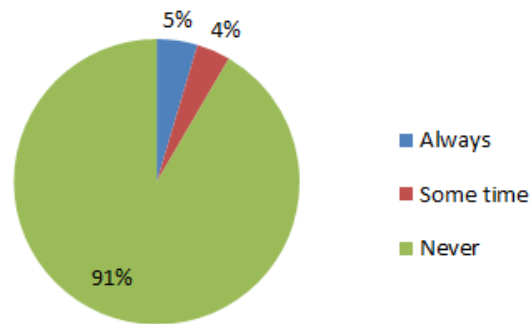


FIGURE - 15

No any proper guidelines or protocols are available yet at worldwide for prophylaxis management of N-95 respiratory metal clip loosening, to fill up Dead spaces, to absorb oral odor and to stop sweating from head to mouth via Nasal alar sulcus.

RESULT

This study was cross sectional survey. Number of participants was 522 HCP's who had worked corona virus patients. An online survey was conducted and responses were collected. Result was like most of the participants were responded about frequent dislocation of the N95 respirator from its place and majority of them were unaware about the policy of how to use these Protective Equipment. The corona virus disease (COVID-19) pandemic outbreak in globally. Besides, a number of samples weren't knew about the possibility of dead space and so the increased chance of developing infection to the personnel themselves was also disclosed through this study. Plus, there was no any standard guideline for applying dressing under the N 95 respirator and face shield. Use of Personal Protective Equipment (PPE) is considered one of the most important strategies for protecting healthcare professionals from such pandemics. However, PPE may cause a series of skin problems due to long-term sealing, friction, and pressure. Health care professionals are increased risk for infection, and specific requirement for their protection. We doubt that this might be the possible reason for health Care professionals are being affected and died due to COVID-19 widely. Health care worker all over the world have closed their eyes and put protocol in front of the COVID-19. Worldwide health workforce is leading in the front of the battle against the coronavirus pandemic outbreak. The analysis of health care workers experience and the factors affecting their attitudes and practices could provide for preventing further spread of the pandemic among health care workers.

Financial Support and Sponsorship: Nil

Conflict of Interest: There is no conflict of interest.

REFERENCES

1. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—16-May-2020>.
2. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19) World Health Organisation; Geneva: 2020.
3. Government of Canada. Coronavirus disease (COVID-19) prevention and risks. Updated April 9, 2020. Available from URL: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks.html?topic=tilelink> (accessed April 2020).
4. World Health Organization. Technical Brief. Water, sanitation, hygiene and waste management for COVID-19; 19 March 2020. Available from URL: <https://www.who.int/publications-detail/water-sanitation-hygiene-and-waste-management-for-covid-19> (accessed April 2020).
5. Ong SW, Tan YK, Chia PY, et al. Air, Surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. JAMA 2020; DOI: <https://doi.org/10.1001/jama.2020.3227>.
6. Wu Z, McGoogan JM. Characteristics of and Important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020; DOI: <https://doi.org/10.1001/jama.2020.2648>.
7. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19) World Health Organisation; Geneva: 2020.
8. WatanabeApr, Laurie. "NPIAP Releases Position Statements on N95 MaskInjuries."MobilityManagement,obilitymgmt.com/articles/2020/04/15/npiap-mask-position-paper.aspx.
9. Johnson, Arthur T. "Respirator Masks Protect Health but Impact Performance: a Review." Journal of Biological Engineering, BioMed Central, 9 Feb. 2016, www.ncbi.nlm.nih.gov/pmc/articles/PMC4748517/.
10. Lau, J. T. F., Fung, K. S., Wong, T. W., Kim, J. H., Wong, E., Chung, S., ... Cheng, A. (2004, February). SARS transmission among hospital workers in HongKong. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3322933>