

# Personal Protective Equipment: A Pandora's Box

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## ABSTRACT

Countries all over the world writhing under the wrath of coronavirus face not only the challenge of protecting their population but the tougher challenge of protecting their healthcare workers (HCWs) dealing with the patient population. This pandemic has put unprecedented pressure on global healthcare systems, with personal protective equipment (PPE) being the most notable one. Apart from the challenge of procurement of PPE, the major challenge is rationalizing the use of PPE in this war against corona virus disease 19 (COVID19). Using PPE comes with its own set of problems such as extreme exhaustion, rashes, inability to consume food, or use washroom which can result in clouding of judgment and breach of infection barrier. Making PPE user-friendly and limiting the interaction of HCW with COVID19 patients coupled with the use of robotics, telemedicine, and other innovations is the need of the hour.

**Keywords:** Coronavirus, COVID-19, Healthcare workers, Personal protective equipment.

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Dear Editor,

Novel coronavirus infection, COVID19, has spread like a wild fire engulfing the whole world in pandemic proportions. Countries writhing under the wrath of this virus face not only the challenge of protecting their population but the tougher challenge of protecting their HCWs dealing with the patient population. This pandemic has put exceptional pressure on global healthcare systems, with the surge in medical demands exposing gaps in inventory of lifesaving equipment such as ventilators, basics such as hospital beds, and essentials such as personal protective equipment (PPE).<sup>1</sup>

Personal protective equipment, commonly referred to as "PPE", is an equipment worn to minimize the exposure to hazards that cause serious workplace injuries and illnesses. The PPE is one of the most valuable methods to prevent infection in HCWs who are directly or indirectly being exposed to this virus. No country in the world has proven to be adequately prepared for this pandemic or has adequate number of PPE for their HCWs. So apart from the challenge of procurement of PPE, there is a challenge of rationalizing the use of PPE in this event of global shortage of PPE.

If PPE are used rationally, there will be less shortage. Not everyone requires a full set of PPE. The HCWs exposed to aerosol generating procedure requires a full set of PPE as compared to an HCW who is shifting the patient. Similarly, a cleaner in COVID19 ward does not need respirator and may use a triple-ply surgical mask instead.<sup>2</sup> Additionally, most HCWs are not trained in donning and doffing as was shown in a simulation-based study where 79.2% HCWs showed contamination, necessitating simpler PPE protocols and PPE education tools to ensure among HCWs.<sup>3</sup>

In view of shortage of staff and anticipation of a longer battle, HCWs are in for longer hours, which apart from mental exhaustion has shown to have physical effects. Those who have used PPE describe it as a coffin or as an essential evil. The use of PPE is a must to prevent HCWs from getting infected, but it comes with its own set of problems. Most of them describe that they become extremely sweaty in a PPE in a matter of minutes, owing to the impervious nature of the fabric used. Lack of isolated wards forces most hospitals which are centrally air conditioned to not use air conditioners in view of the risk of spreading infection. This makes wearing PPE even more exhaustive, especially in tropical climate.

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Beard in men often impairs adequate fit of respirators. Many do not shave even when it is recommended due to rigid personal preferences or religious commitments. Tight fit respirators or masks when used continuously for longer hours have shown to cause rashes and headache by increasing the blood carbon dioxide level. Inability to eat, drink, and use toilet makes wearing PPE even more troublesome. Frequent fogging of goggles, excessive perspiration, and limited mobility of limbs may cause fatal errors in patient management.<sup>4,5</sup>

## CAN WE AVOID USING PPE?

Yes, we can, but we need to look into alternatives wherein we limit the interaction of HCWs with the patients. This is possible by incorporating "telemedicine" in our practice. Right from the start, screening of the patient may be performed virtually, with a video call, where an HCW can interact with the patient and determine the need for further examination or testing, if required. Objective screening with the help of a questionnaire, for example, a mobile application-based questionnaire, where a patient can assess himself or herself if he or she requires to be screened, is suggested. Artificial intelligence-based applications would make these questionnaires even simpler and user-friendly.<sup>6</sup> Incorporation of screening booths

and kiosks which are airtight glass cubicles fitted with gloves, which can be maneuvered from inside, to take nasal and oropharyngeal swabs for testing, is another option that limits the contact of HCWs with the patients.<sup>7</sup>

Mildly symptomatic patients can directly take especially designated marked routes and lifts to isolation wards, whereas sick patients can be taken on a stretcher covered with plastic sheet, thus obviating the need of a PPE by an HCW. It is necessary to utilize robotic dispensers or mechanized carts which can be controlled with remote for dispensing medicines, food and helping in virtual physician ward rounds. Centralized vital monitoring, coupled with 24 hours dedicated closed circuit television surveillance, may be used to detect worsening patient condition. The PPE-clad HCWs can take care of critically ill patients as there is a no substitute for human skill, improvisation and touch. What a doctor or nurse can do, robots cannot, but in a pandemic like this, robots are a blessing!<sup>8</sup>

One should limit aerosol-generating procedures like nebulization and the use of noninvasive ventilation (NIV). If NIV is used, use of a helmet as an interface is recommended, rather than oronasal/nasal interface.<sup>9</sup> Cardiopulmonary resuscitation (CPR) if required can be performed by automatic CPR machines, rather than multiple HCWs.

The PPE-clad HCWs should have shorter duty hours followed by adequate relaxation, preferably 4 to 5 hours each. This can tackle the problem of eating and using toilet during the shift. The roster of the staff should be prepared in a manner that a team of only a minimum number of HCWs should be dressed in PPE and working near the patient, while another team of HCWs should be on standby, at a location away and safe. This will tackle the shortage of both PPE and HCWs, if some workers do get infected, in the long-term.

## HELP FROM AN ENGINEER FRIEND

With the help of an engineer, ventilators can be tweaked to allow adjustment of settings and alarm controls using a remote control. This, in conjugation with centralized monitoring system, would limit the number of bedside visits. Also, engineered textiles/fabric must be utilized to create PPE that are impervious but breathable and also easily washable with soap and water to make them fit for reuse. Previously, technologically improvised suits have been developed for use by miners and refinery workers, which prevent exhaustion of the user by allowing circulation of water or air in a tubing inside it to cool the temperature inside the suit.<sup>10,11</sup> Options offered by technology are plenty, and we just need to explore more.

## CONCLUSION

Difficulty in procurement of standardized PPE coupled with an unpleasant user experience with PPE makes it necessary for HCWs to look for an alternative strategy—a strategy that minimizes contact of the HCWs with the patients without adversely affecting patient care. However, HCW who has to remain necessarily in contact with patients must be clad in adequate PPE—there is no alternative to that.

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