Beyond the PPE Shortage: Improperly Fitting Personal Protective Equipment and COVID-19 Transmission among Health Care Professionals

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Received: June 01, 2020; Published: July 29, 2020

Abstract

Three cases of improperly fitting masks in health care professionals (HCP) in a New Jersey hospital may have contributed to their eventual COVID-19 infection. We believe these anecdotal cases raise the important issue of improperly fitting personal protective equipment (PPE).

Keywords: Covid-19; Personal Protection Equipment (PPE); Facemask; Transmission; n95; Transmission; Equipment; Testing

Abbreviations

PPE: Personal Protective Equipment; HCP: Health Care Professional; RT-PCR: Real-time PCR

We report three cases of COVID-19 infection due to improperly fitting masks in health care professionals (HCP) in a New Jersey hospital. All three HCP worked on a COVID-19 designated inpatient floor, 12-hour shifts for several weeks. The index HCP had a low-grade fever but was initially asymptomatic. A colleague noticed his N95 mask was ill-fitting and sent him for qualitative fit testing. He could not smell the test substance, which prompted SARS-CoV-2 RT-PCR testing that was positive. His symptoms of fatigue, myalgia, chest heaviness, and ageusia ensued the following days, while he was no longer febrile. He reported adherence to CDC guidelines while caring for COVID-19 patients.

Upon the news of his COVID-19 infection, several HCP working on the same floor went for fit testing. Among them, two were found to be COVID-19 positive. One had been asymptomatic, and the other had rhinorrhea and "allergy-like" symptoms.

All three subjects denied any known COVID-19 contact except in the hospital. They were self-quarantined at home. The individuals may have unknowingly been exposed to COVID-19 outside the hospital, e.g. shopping. The initial cause of the infection may have occurred in an assortment of places. The improper fitting of PPE or N95 masks makes infection more likely regardless of where the N95 masks or PEE are used.

Although these cases were anecdotal, they raise the important issue of COVID-19 transmission due to improperly fitting personal protective equipment (PPE). While much attention has been given to PPE shortages, less has been given to the importance of appropriate fit in intra-hospital transmission prevention. A preliminary search on pub med resulted in minimal mention of assessment of PPE fit. Lit-
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Citation: Xue Ming., et al. "Beyond the PPE Shortage: Improperly Fitting Personal Protective Equipment and COVID-19 Transmission among Health Care Professionals". EC Pulmonology and Respiratory Medicine 9.8 (2020): 81-82.

Literature emphasized appropriate PPE for specific work tasks (i.e. for aerosol-generating procedures, use of a gown, gloves, eye protection, and an N95 or powered air-purifying respirator) [1]. The need for retraining staff on the safe use of PPE was also cited, however ensuring satisfactory fit was not discussed [2]. For adequate respiratory protection, annual fit-testing alone is insufficient. HCP must assess for appropriate facemask fit prior to each use using “fit checks” outlined in the manufacturer’s instructions [3].

Due to inadequate supply, HCP across the country have reported reusing PPE, raising the additional issue of breakdown and loss of fit over time. While the CDC has recommended decontamination and reuse of filtering facepiece respirators as a “crisis capacity strategy,” they cannot determine a generic maximum possible number of safe reuses [4]. A 2019 study on the effect of multiple consecutive uses of N95 respirators on fit in 25 subjects found that 48% failed at least one fit test after 1 of 7 episodes of re-donning [5].

This report does not try to determine the source of the SARS-CoV-2 transmission. The three co-workers who were affected by SARS-CoV-2 within a few days of the initial observation had improperly fitting N95 masks, so this may be a potential cause of their diagnosis. Thus, the aim of this report is a call for awareness of the proper use of N95 and PPE. We recommend that ill-fitting caused by facial hair, weight, or other factors, be considered when training individuals on proper fitting and ordering of PPE.

Healthcare providers are working tirelessly in the fight against COVID-19, extended hours, and extra shifts. Repeated donning and doffing of PPE undoubtedly adds to their physical fatigue and mental stress [1]. It is imperative that HCP are educated in inadequate PPE fit and work together to take care of each other’s safety and well-being, as seen in the above case.

Conflicts of Interest
The authors declare no conflict of interest.

Bibliography