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Letter to the Editor

An observational study to identify types of personal protective equipment breaches on inpatient wards



Sir,

In response to the coronavirus disease 2019 (COVID-19) pandemic, UK infection prevention and control (IPC) guidelines have been published on using personal protective equipment (PPE) in various healthcare settings [1]. Improper PPE use may compromise the protection afforded by it [2]. The IPC guidelines highlight actions which may constitute a PPE 'breach'. In response to a Cochrane review calling for research into barriers to proper PPE use, we investigated the most common types of breaches observed across several inpatient wards [1,3]. The results highlight areas of practice that could be improved to optimize PPE use and reduce nosocomial transmission of infection [4].

A behavioural observation study was conducted to investigate whether, based on national guidelines, healthcare workers wear correct PPE, what breaches occur, and how frequently [1]. This study was completed in a large acute hospital in May 2020 during the COVID-19 pandemic. National guidelines recommend different PPE requirements according to two different settings, which we have classified as 'all PPE' zones and 'mask only' zones [1]. 'All PPE' zones constitute any room housing COVID-positive patients, or when within 2 m of any patient. 'All PPE' zones require a fluid-resistant surgical face mask (FRSM), disposable apron, disposable gloves, and, subject to risk assessment, eye protection. 'Mask only' zones represent any area which is not 'all PPE' but where staff are working (e.g. the reception desk), and only FRSMs are required. Examples of PPE 'breaches' can be seen in [Figure 1](#).

The observations were carried out on three medical wards (one designated for COVID-positive patients and two without identified COVID-positive patients). Permission to conduct an observation was obtained from each ward manager but staff were not informed of the purpose of the study. To minimize the Hawthorne effect, observers were unknown to ward staff and the observation period was limited to 30 min. For each worker, PPE use was evaluated for the session of work undertaken, and any observed breaches were recorded. If, within the 30 min period, an individual left and re-entered a zone, s/he was counted as a separate worker as this represents another

working session. Eye protection was not reported as part of the 'required' PPE on non-COVID wards, as this could not be objectively measured in the context of individual risk assessments.

Across sixteen 30 min observations, 271 members of staff were observed: 45 in 'all PPE' zones and 226 in 'mask only' zones. A previous study showed that only 34% of healthcare workers donned all recommended PPE for droplet precautions [5]. In our study, workers donned the required PPE on 71.1% of occasions in 'all PPE' zones and 94.2% in 'mask only' zones. 'All PPE' zone compliance was 100% on COVID-designated wards and 48% on non-COVID wards. Though eye protection was discounted in non-COVID 'all PPE' zones, it was noted that visors were not used by any staff in these areas. It is likely that some individual risk assessments would have indicated wearing eye protection. This suggests that further IPC interventions are likely required to improve compliance with PPE use.

Having recorded absolute numbers of PPE breaches, data were normalized to the number of staff observed in each zone across wards so that results were comparable ([Figure 1](#)). Normalization was necessary as our methodology tracked staff as groups, rather than individual staff members. In the 'mask only' zone, the most common breach was touching the mask, with a normalized frequency of 0.75 occurrences per individual. The data showed that breaches were scattered across staff groups, and it was reported that breaches were common among all observed staff rather than specific individuals. As such, these results suggest that around 75% of staff breach their mask by touching it. In the 'all PPE' zone, the most common breaches were failing to remove disposable aprons (0.69) or gloves (0.53) between patients.

Audits into PPE typically offer a binary view of whether it is used or not [6]. This is problematic as infection transmission risk is not eliminated simply by wearing correct PPE. Workers must also refrain from breaching PPE in a way that might increase the risk of transmission. This study provides an insight into how workers behave while wearing PPE. Investigating common breaches identifies possible routes of infection, establishes recommendations for improving PPE design, and enables IPC teams to educate healthcare workers accordingly. Further work is needed to evaluate methods for reducing PPE breaches. An example might be the 'eagle-eyed observer' approach, as suggested by Peng *et al.*, which could detect PPE breaches and encourage correction [7]. During training, more attention could be given to the use of PPE besides what types are needed and when. Improvements in PPE design with enhanced comfort will also likely increase compliance and reduce the risk and frequency of breaches.

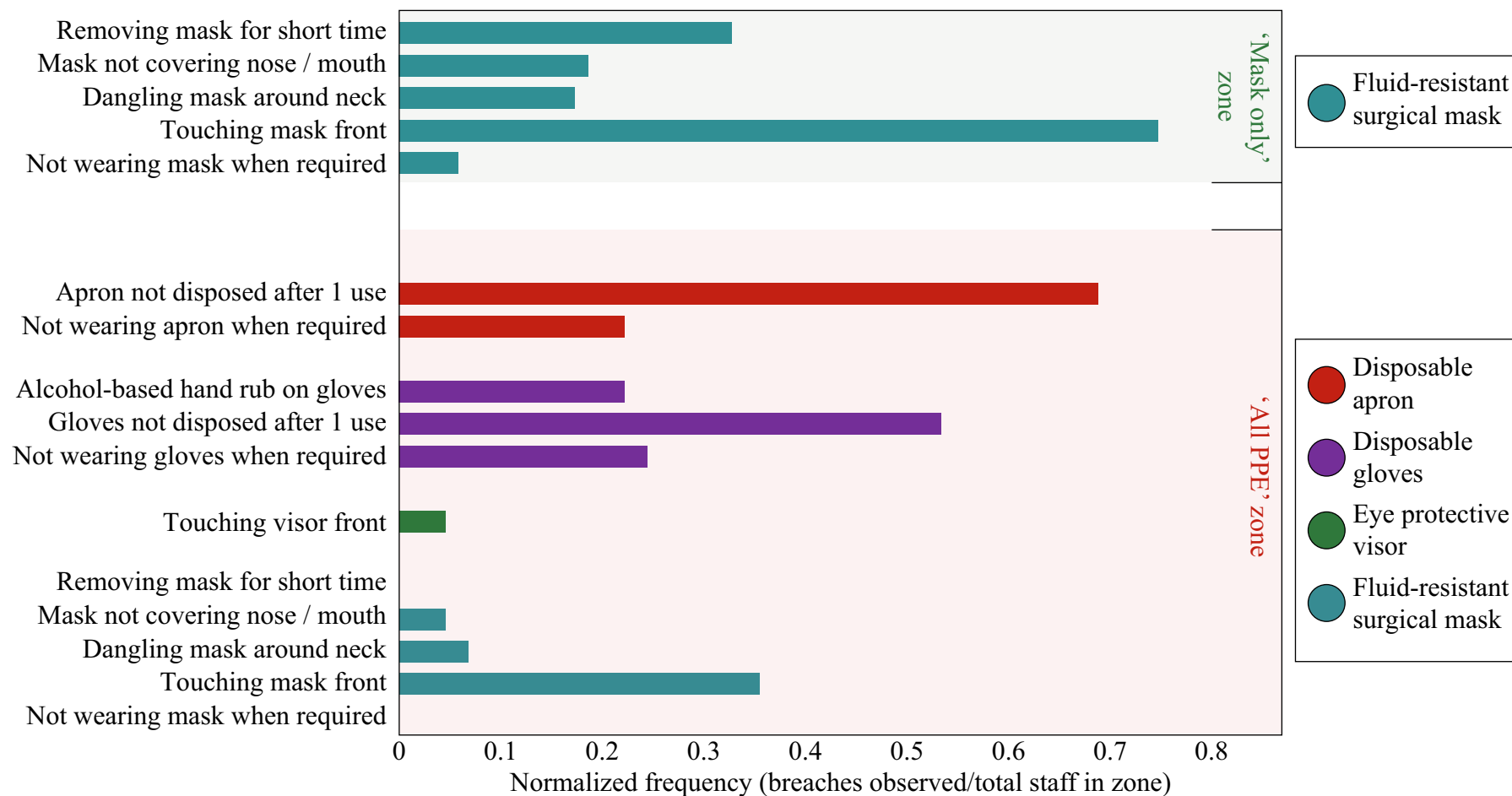


Figure 1. Frequencies of different types of breaches to personal protective equipment (PPE) observed across inpatient wards. Data represent breaches to PPE as defined by Public Health England [1]. Data from the 'all PPE' and 'mask only' zones were normalized to the number of staff observed in the 'all PPE' zone (N = 45) and 'mask only' zone (N = 226), respectively.

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Conflict of interest statement

None declared.

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