

Impact of enhanced personal protective equipment on the physical and mental well-being of healthcare workers during COVID-19

ABSTRACT

Background The COVID-19 pandemic has necessitated the use of enhanced personal protective equipment (PPE) in healthcare workers in patient-facing roles. We describe the impact on the physical and mental well-being of healthcare professionals who use enhanced PPE consistently.

Methods We conducted a single-centre, cross-sectional study among healthcare professionals who use enhanced PPE. A web-based questionnaire was disseminated to evaluate the effects on individuals' physical and mental well-being. Physical and mental impact was assessed through a visual analogue scale.

Results Prospective analysis of the views of 72 respondents is reported. 63.9% were women and 36.1% were men. Physical impact included exhaustion, headache, skin changes, breathlessness and a negative impact on vision. Communication difficulties, somnolence, negative impact on overall performance and difficulties in using surgical instrumentation were reported.

Conclusion Our study demonstrates the undeniable negative impact on the front-line healthcare workers using enhanced PPE and lays the ground for larger multicentric assessments given for it to potentially be the norm for the foreseeable future.

The COVID-19 pandemic affecting 216 countries has resulted in significant mortality and morbidity worldwide.¹ Front-line healthcare workers (HCW) in patient-facing roles are at increased risk of acquiring COVID-19 in comparison with the general community.² There is evidence that ear, nose and throat (ENT) surgeons in the UK are among the highest risk of specialties to acquire the infection.³ The primary modes of transmission appear to be through droplets, aerosol spread and surface contact.⁴ This has led to an increased drive towards the use of personal protective equipment (PPE) to reduce nosocomial infection. Recommendations made by the WHO have been adapted according to the setting, personnel and type of activity.⁵ We describe the impact of PPE and the effects on the physical and

mental well-being of healthcare professionals who use PPE consistently in the course of their clinical duties.

We conducted a single-centre, cross-sectional study among healthcare professionals who use enhanced PPE. The study was registered as a service evaluation using the UK National Health Service research authority assessment tool. Hence, neither ethical approval nor consent was deemed necessary.⁶ A 23-item, online questionnaire was disseminated to all teams using enhanced PPE consistently, within the hospital to evaluate the effects on different aspects of individuals' physical and mental well-being. Data entry was voluntary and completed anonymously. The study targeted a broad category of staff from varied specialties and skill mix. Professionals using enhanced PPE recommended by Public Health England comprised the study group. Components of the enhanced PPE include: FFP3 mask, visor, waterproof gown and gloves. The environment, where PPE was worn, the duration of use of PPE without a break and the frequency of use of PPE, formed part of the evaluation. Physical and mental impact was assessed through a visual analogue scale (VAS). Questions on physical impact included perception of physical exhaustion, headaches, skin changes following the use of an FFP3 mask, effect on communication, breathing and influence on performance. The impact on vision with the type of face shield used, specifically plastic visor versus goggles was also studied. Questions on mental impact involved anxiety, depression, somnolence, insomnia and the fear of contracting the virus while wearing PPE. Respondents were also asked about preferences of gowns, preventative measures taken to reduce pressure sores and the impact on use of instrumentation such as intubation, surgical loupes and microscopes. An opportunity was also given to respondents to suggest practices to help reduce the

negative impacts experienced while using enhanced PPE.

Between 1 July and 20 August 2020, 72 responses were collated from HCWs across the trust. Of these, 63.9% were women while 36.1% were men. Respondents included anaesthetists (30.6%), midwives (25.0%), surgeons (16.7%), registered staff nurses (13.9%), support workers (5.5%), specialist nurse practitioners (4.2%), obstetricians (2.7%) and healthcare assistants (1.3%).

Enhanced PPE were worn predominantly in operating theatres and the intensive therapy unit, with inpatient wards, emergency and outpatient departments comprising the rest.

The frequency of use of PPE per week varied with 32.4% of HCW using it 5–10 times per week, 51.5% using it less than five times per week and 16.2% used it more than 10 times a week. Enhanced PPE was worn by 37.5% for more than 4 hours of the day without a break.

Analysis showed that 70.8% of respondents reported exhaustion with a VAS of 7 and above. Headache with VAS score of more than 7 was reported in 61.4%. Skin changes with VAS score of 7 and above as a consequence of wearing masks were reported in 43.2% of HCW. Breathlessness was reported as 'often' in 23.6% of HCW.

Plastic visors as face shields were worn by 66.7%, 12.5% wore goggles and 20.8% used both plastic visors and goggles at different times. Respondents reported a negative impact on vision. While 43% of respondents who used plastic visor had a VAS score of 8 and above, only 23.7% of respondents who used goggles had a similar impact (figure 1).

Communication difficulties were perceived with 90.3% reporting a VAS score of 7 or above. Negative impact on overall performance was perceived by 47.3 of respondents with VAS score of 7 and above. Up to 48.5% of respondents felt that use of PPE had a negative impact

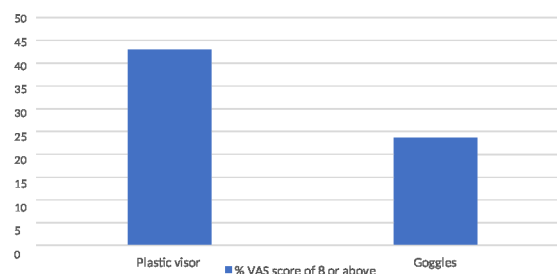


Figure 1 Impact on vision. VAS, visual analogue scale.

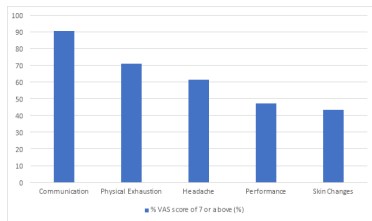


Figure 2 Physical impact. VAS, visual analogue scale.

on personal preference of instrumentation like surgical loupes and microscopes. The data on negative physical impact are shown in figure 2.

Disposable theatre gowns were preferred by 77.8% of HCW. Preventive measures for skin pressure ulcers were undertaken by only 17.6% of the study population. Respondents used facial moisturisers, slit tape, barrier films and cream to prevent breakdown in skin.

The impact on mental well-being was studied with a VAS score of 7 and above reported for anxiety in 27.8% and 19.5% for depression. The VAS score of 7 and above for somnolence was 40.3%. The VAS score of 7 and above for insomnia and fear of contracting virus while doffing was 26.5% and 18.1%, respectively. The data on negative mental impact are shown in figure 3.

Suggestions made by personnel to reduce the negative impacts of wearing enhanced PPE included taking mandatory regular breaks, maintaining optimum temperature and ventilation in the working environment and ensuring adequate hydration. Masks tailored to fit different sizes, surgical masks with inbuilt visors, less tight fitting and non-reflective visors, hoods for skin breakdown and name tags or colour codes for easy identification were proposed by respondents to alleviate some of the difficulties caused by wearing enhanced PPE.

Enhanced PPE is essential for the healthcare professionals who treat both patients with COVID-19 positive and patients who may be asymptomatic, where aerosol generating procedures (AGPs) are required. While the use of PPE reduces

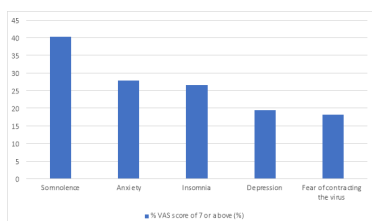


Figure 3 Mental impact. VAS, visual analogue scale.

the risk of COVID-19 transmission,^{7,8} our study demonstrates the undeniable negative impact on physical and mental well-being on the front-line HCW who are required to use it. The participants of this study were broad mix of anaesthetists, doctors in surgical specialities and nursing staff who had to endure long periods of wearing PPE and thus were an appropriate representative sample within the hospital in which this study was carried out. This ensured that the results could be more widely applied to the HCW in general.

While PPE-associated headaches and exacerbation of their pre-existing headache disorders have been reported in the past,⁹ our report adds to the literature about the overall impact of PPE on front-line staff using it for prolonged periods. The use of protective eyewear varied between visors and goggles. Due to the unique challenges faced by some clinicians who must use microscopes, endoscopes and surgical loupes, we observed participants opting for glasses and goggles as opposed to the standard face shield commonly used by other staff members. The limitation of wearing protective eye wear in situations of potential AGPs also leads to responses showing a negative impact. The mental well-being of our respondents clearly identifies somnolence as a major feature which could be attributed to possible physiological derangements in prolonged wearing of FFP3 facemasks; however, no objective analysis was carried out in this regard. Interestingly a vast majority of HCWs preferred disposable theatre gowns to the regular plastic apron, citing the breathability of the fabric when wearing PPE for prolonged duration of time.

There are currently no uniform best-practice recommendations for surgical procedures in the setting of COVID-19. ENT surgeons are at increased risk of COVID-19 exposure because of the nature of assessments and interventions undertaken by this cohort.^{3,10} Multiple AGPs are part of standard ENT elective and emergency care. In addition, the proximity of the clinician performing procedures to an infected patient's upper aero digestive tract increases the risk of exposure. Larger infective doses resulting from prolonged exposures during long procedures increases the severity of disease.¹¹ Current ENT specialty-specific guidance in the UK advocates the consistent adoption of enhanced PPE.¹² Hence ENT surgeons are more likely to use enhanced PPE frequently and for more prolonged periods than others. It is important for institutional planning committees to be aware of these differences and ensure that this

reflects in subsequent protocols. Measures to minimise the sessional duration and thus the negative impacts of wearing PPE for prolonged periods include, adhering to recommended operating theatre, ventilation standards. The use of Laminar flow theatre ventilation systems with up to 300 air changes per hour helps to reduce aerosol clearance times by four times (20 min to 5 min),¹³ with overall reduction in times of individual sessional use of PPE. Other measures include individualised patterns in break times, regular staff well-being and debriefing sessions.

Our study represents a small cohort of professionals at a single hospital in the UK with specific inclusion criteria and is a questionnaire-based survey of opinion. While this may not be totally representative of the majority views, it will be instructive when planning multicentric interventional studies in the future. It will be instructive for a larger multicentric study for a more objective analysis of interventions to alleviate the perceived side effects of PPE.

The detailed feedback from the respondents in this study is educational and provides valuable insight into the negative impact of PPE. It should be the basis for measures that should be urgently taken to mitigate the evident risks. This is paramount given the potential for further waves of COVID-19 infections and new-onset pandemics in the future. Since the suggestions are from end-users rather than centralised policymakers, changes once implemented are likely to have a greater chance of acceptance and success.

Ramanathan Swaminathan ¹, **Bimantha Perera Mukundadura**,¹ **Shashi Prasad**²

¹Ear, Nose and Throat Department, Warwick Hospital, Warwick, UK

²Ear, Nose and Throat, University Hospital Coventry, Coventry, UK

Correspondence to Dr Ramanathan Swaminathan, Warwick Hospital, Warwick CV34 5BW, UK; arrassu@hotmail.com

Acknowledgements We would like to acknowledge the support of the staff at South Warwickshire NHS foundation Trust and Professor B. Nirmal Kumar.

Contributors All authors have contributed to this article. RS conceptualised, designed the study, collected and analysed data and finalised the report. BPM generated the questionnaire, contributed to data collection and analysis, and reviewed the final report. SP was the supervising author.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; internally peer reviewed.

Main messages

- ▶ Personal protective equipment (PPE) is critical for protection of front-line healthcare workers although it can lead to considerable physical and mental distress to the users.
- ▶ Physical impact of PPE use includes headaches, skin changes and negative overall performance.
- ▶ Mental impact includes somnolence, anxiety and depression.
- ▶ Proactive measures are required to minimise the risks associated with PPE use given the need to do it for the foreseeable future in the wake of ongoing and future pandemics.

Important research questions that arise following this study

- ▶ Could reduced O₂ in inspired air, CO₂ retention, rebreathing and increased temperature in isolation or combination during prolonged PPE use contribute to physical exhaustion?
- ▶ Does the diffraction index and make of protective eye equipment contribute to eye damage when used long term?
- ▶ Could regular debriefing on the logic for use and objective data from regular risk assessments improve coping mechanisms and help reduce the negative effect on mental health on front-line medical personnel?

This article is made freely available for personal use in accordance with BMJ's website terms and conditions for the duration of the covid-19 pandemic or until otherwise determined by BMJ. You may download and print the article for any lawful, non-commercial purpose (including text and data mining) provided that all copyright notices and trade marks are retained.

© Author(s) (or their employer(s)) 2022. No commercial re-use. See rights and permissions. Published by BMJ.



To cite Swaminathan R, Mukundadara BP, Prasad S. *Postgrad Med J* 2022;**98**:231–233.

Accepted 14 November 2020
Published Online First 3 December 2020

Postgrad Med J 2022;**98**:231–233.
doi:10.1136/postgradmedj-2020-139150

ORCID iD

Ramanathan Swaminathan <http://orcid.org/0000-0002-7951-3380>

REFERENCES

- 1 World Health Organization. Coronavirus disease (COVID-19) pandemic. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019> [Accessed 13 Sep 2020].

- 2 Nguyen LH, Drew DA, Graham MS, *et al.* Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health* 2020;**5**:e475–83.
- 3 Stephenson K, Sowerby LJ, Hopkins C, *et al.* The UK national Registry of ENT surgeons with coronavirus disease 2019. *J Laryngol Otol* 2020:1–5.
- 4 Sommerstein R, Fux CA, Vuichard-Gysin D, *et al.* Risk of SARS-CoV-2 transmission by aerosols, the rational use of masks, and protection of healthcare workers from COVID-19. *Antimicrob Resist Infect Control* 2020;**9**:100.
- 5 WHO. Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19)- 2020.
- 6 NHS Health Research Authority. Is my study research? Available: <http://www.hra-decisiontools.org.uk/research/> [Accessed 1 Sep 2020].
- 7 Public Health England. Guidance: COVID-19: infection prevention and control (IPC). Available: <https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control> [Accessed 13 Sep 2020].
- 8 Lockhart SL, Duggan LV, Wax RS, *et al.* Personal protective equipment (PPE) for both anesthesiologists and other airway managers: principles and practice during the COVID-19 pandemic. *Can J Anaesth* 2020;**67**:1005–15.
- 9 Ong JY, Bharatendu C, Goh Y, *et al.* Headaches Associated With Personal Protective Equipment - A Cross-Sectional Study Among Frontline Healthcare Workers During COVID-19. *Headache* 2020;**60**:864–77.
- 10 Bann DV, Patel VA, Saadi R, *et al.* Impact of coronavirus (COVID-19) on otolaryngologic surgery: brief commentary. *Head Neck* 2020;**42**:1227–34.
- 11 Mick P, Murphy R. Aerosol-generating otolaryngology procedures and the need for enhanced PPE during the COVID-19 pandemic: a literature review. *J Otolaryngol Head Neck Surg* 2020;**49**:29.
- 12 Royal College of Surgeons of England. Aerosol-generating procedures in ENT. ENT UK, 2020. Available: <https://www.entuk.org/aerosol-generating-procedures-ent> [Accessed 13 Sep 2020].
- 13 Royal College of Surgeons of England. Managing theatre processes for planned surgery between COVID-19 surges 2020.