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. Front-line healthcare workers (HCW) in patient-facing roles are at increased risk of acquiring COVID-19 in comparison with the general community. There is evidence that ear, nose and throat (ENT) surgeons in the UK are among the highest risk of specialties to acquire the infection. The primary modes of transmission appear to be through droplets, aerosol spread and surface contact. 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. 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. 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 HCW 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 2  Physical impact. VAS, visual analogue scale.

on personal preference of instrumenta-
tion 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 mois-
turisers, 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 manda-
tory 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 identi-
fication 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
the risk of COVID-19 transmission, our
study demonstrates the undeniable nega-
tive 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 anaesthesiologists,
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 under-
taken by this cohort.10 Multiple AGPs are
part of standard ENT elective and emer-
gency 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 institu-
tional 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, venti-
lation 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 3 min),11 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 representa-
tive 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
date effects of PPE.

The detailed feedback from the respon-
dents 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 par-
amount 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.

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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 $O_2$ in inspired air, $CO_2$ 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?

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