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COVID-19 CORRESPONDENCE

Personal protective equipment, airway management, and systematic reviews. Comment on *Br J Anaesth* 2020; 125: e301–5Massimiliano Sorbello^{1,*}, Kariem El-Boghdady², Jan Schumacher² and Imran Ahmad²¹Catania, Italy and ²London, UK*Corresponding author. E-mail: maxsorbello@gmail.com**Keywords:** airway management; COVID-19; personal protective equipment; simulation; training

Editor—We read with interest the paper by Sanfilippo and colleagues¹ on simulated airway management whilst wearing personal protective equipment (PPE). The role of simulation in the setting of PPE is crucial given the coronavirus disease 2019 (COVID-19) pandemic. Airway management with PPE carries significant challenges, including restricted movement, limited communication, impaired vision, loss of tactile sensitivity, and wearer discomfort. We thus agree with the need for a systematic review on this subject; however, we wish to highlight some concerns regarding this study.

Firstly, the search reported by Sanfilippo and colleagues¹ appears to have missed some relevant and critically important studies. Although Sanfilippo and colleagues located only a single study examining anaesthetists as subjects, five other studies, all authored by and including anaesthetists, met the inclusion criteria and would have been expected to be included in their analysis, three of which focused on the COVID-19 pandemic. These include two randomised crossover trials,^{2,3} one crossover trial,⁴ and two observational studies.^{5,6} A further study in a cardiac arrest setting might have been included also.⁷ These omissions could reflect an incomplete search strategy, inadequate screening, or unclear inclusion criteria, and significantly undermine the validity and reliability of the results and interpretation.

Secondly, for the outcome metrics sought, success rate, and time to successful tracheal intubation, critical operator characteristics were not considered. In particular, the background and experience of airway operators must be factored in as different levels of experience can cause poor performance⁸ rather than the PPE itself. The authors did not examine or report this key element of the included studies.

Thirdly, the authors compared a highly variable and diverse PPE baseline (in diverse population studies). For example, one

study compared outcomes after tracheal intubation of a manikin with either a GlideScope (Verathon Medical, Bothell, WA, USA) or a Macintosh laryngoscope with participants wearing hazmat suit and PPE,⁹ and another examined the AirwayScope (Pentax, Tokyo, Japan) with participants wearing 'chemical, biological, radiation, and nuclear PPE'.¹⁰ In the first study, a complete hazmat suit with a powered air-purifying respirator (PAPR) was used by first to third yr emergency medicine residents, whereas in the second a group of 19 volunteers with 'some prior experience of tracheal intubations on human patients using a Macintosh laryngoscope (mean number of intubations, 1.13+/-1.31)' was using 'nylon shirt and pants, antigas mask, gloves and rubber boots', which are intuitively less cumbersome compared with a full hazmat suit. This variation is emphasised in the legend of Table 1 in the paper of Sanfilippo and colleagues,¹ which reveals the diversity of the included PPE, ranging from respirator masks to PAPRs, which would have significant differences in their influence on technical performance.

The importance of simulation and training in airway management, particularly in combination with the physical and cognitive challenges imposed by PPE, has been reported elsewhere.^{11–14} We agree with the authors that training is of utmost importance; in contrast, we want to emphasise other priority factors, such as the need to identify dedicated airway teams and intubation spots,¹⁵ the need for team preparedness and pre-procedural planning (including cognitive aids and airway management and PPE donning/doffing checklists),^{12–14} and the need for clear indications for correct PPE and operative instructions to improve user compliance and acceptance.¹⁶ We cannot underestimate the additional mental workload imposed by the clinical scenario and by the fear of self-infection, which could never be reproduced even in the highest-fidelity simulation.

It is encouraging that Sanfilippo and colleagues¹ have attempted to synthesise data on this practice. However,

DOI of original article: [10.1016/j.bja.2020.06.011](https://doi.org/10.1016/j.bja.2020.06.011).

significant limitations in their data hamper our ability to interpret the evidence base, but their data do highlight that the real concern is not measuring how limited airway management is by PPE, but rather the need for better understanding of PPE diversity; correct use of PPE; and development and training in new techniques, protocols, and devices to overcome such difficulties. Otherwise, as with the Chinese proverb, 'When the wise points the moon, the fool looks at the finger'.

Declarations of interest

MS has received paid consultancy from Teleflex Medical, Verathon Medical, and DEAS Italia. MS is a patent co-owner (no royalties; DEAS Italia), and received lecture grants and travel reimbursements (MSD Italia and MSD USA). KE has received educational funding and research support from Ambu, Fisher & Paykel Healthcare Ltd, and GE Healthcare. IA has received educational funding from Ambu, Verathon, Fisher & Paykel Healthcare Ltd, and BioMarin. JS declares no competing interests.

References

- Sanfilippo F, Tigano S, Palumbo GJ, Astuto M, Murabito P. Systematic review of simulated airway management whilst wearing personal protective equipment. *Br J Anaesth* 2020; **125**: e301–5
- Schumacher J, Arlidge J, Garnham F, Ahmad I. A randomised crossover simulation study comparing the impact of chemical, biological, radiological or nuclear substance personal protection equipment on the performance of advanced life support interventions. *Anaesthesia* 2017; **72**: 592–7
- Schumacher J, Arlidge J, Dudley D, Sicinski M, Ahmad I. The impact of respiratory protective equipment on difficult airway management: a randomised, crossover, simulation study. *Anaesth Adv* 2020. <https://doi.org/10.1111/anae.15102>. Access published on April 26
- Begley JL, Lavery KE, Nickson CP, Brewster DJ. The aerosol box for intubation in coronavirus disease 2019 patients: an in-situ simulation crossover study. *Anaesthesia* 2020. <https://doi.org/10.1111/anae.15115>
- Fregene TE, Nadarajah P, Buckley JF, Bigham S, Nangalia V. Use of in situ simulation to evaluate the operational readiness of a high-consequence infectious disease intensive care unit. *Anaesthesia* 2020; **75**: 733–8
- Yang SS, Zhang M, Chong JJR. Comparison of three tracheal intubation methods for reducing droplet spread for use in COVID-19 patients. *Br J Anaesth* 2020; **125**: e190–1
- Schumacher J, Gray SA, Weidelt L, Brinker A, Prior K, Stratling WM. Comparison of powered and conventional air-purifying respirators during simulated resuscitation of casualties contaminated with hazardous substances. *Emerg Med J* 2009; **26**: 501–5
- Sorbello M, Afshari A, De Hert S. Device or target? A paradigm shift in airway management: implications for guidelines, clinical practice and teaching. *Eur J Anaesth* 2018; **35**: 811–4
- Aberle SJ, Sandefur BJ, Sunga KL, et al. Intubation efficiency and perceived ease of use of video laryngoscopy vs direct laryngoscopy while wearing HazMat PPE: a preliminary high-fidelity mannequin study. *Prehosp Disaster Med* 2015; **30**: 259–63
- Shin DH, Choi PC, Na JU, Cho JH, Han SK. Utility of the Pentax-AWS in performing tracheal intubation while wearing chemical, biological, radiation and nuclear personal protective equipment: a randomised crossover trial using a manikin. *Emerg Med J* 2013; **30**: 527–31
- Sorbello M, El-Boghdady K, Di Giacinto I, et al. The Italian coronavirus disease 2019 outbreak: recommendations from clinical practice. *Anaesthesia* 2020; **75**: 724–32
- Cook TM, El-Boghdady K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19: guidelines from the difficult airway society, the association of anaesthetists the intensive care society, the faculty of intensive care medicine and the royal college of anaesthetists. *Anaesthesia* 2020; **75**: 785–99
- Peng PWH, Ho P, Hota SS. Outbreak of a new coronavirus: what anaesthetists should know. *Br J Anaesth* 2020; **124**: 497–501
- Brewster DJ, Chrimes N, Do TB, et al. Consensus statement: safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. *Med J Aust* 2020; **212**: 472–81
- Sorbello M, Morello G, Pintauro S, Cataldo R. COVID-19: intubation kit, intubation team or intubation spots? *Anesth Analg* 2020. <https://doi.org/10.1213/ANE.0000000000004970>
- Houghton C, Meskill P, Delaney H, et al. Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: a rapid qualitative evidence synthesis. *Cochrane Database Syst Rev* 2020; **4**, CD013582

doi: 10.1016/j.bja.2020.06.038

Advance Access Publication Date: 30 June 2020

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Use of HEPA filters to reduce the risk of nosocomial spread of SARS-CoV-2 via operating theatre ventilation systems

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