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COVID-19 CORRESPONDENCE

Protecting healthcare providers from COVID-19 through a large simulation training programme

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Editor—The sudden and unexpected severity of the coronavirus disease 2019 (COVID-19) pandemic revealed our unpreparedness. No country, healthcare system, or hospital had an operational 'pandemic plan' ready to face what was to follow. For those affected later, opportunities existed to adapt organisations and better prepare healthcare providers (HCPs). We report the creation of an intense, large, and targeted COVID-19 personal protective procedural training campaign in a university hospital in France, which preceded the arrival of cases and enabled 1143 HCPs in potential COVID-19 units (emergency department [ED], COVID-19 units, ICUs, and operating theatres) to be trained over 10 days so they were better prepared while providing patient care. We found that HCPs attending the training were four times less likely to contract COVID-19 than HCPs who did not qualify for the training because they were not assigned to work with COVID-19 patients. This study was approved by the Ethics Committee CERAR, IRB 00010254-2020-103 on May 20, 2020.

To prepare for a potential surge in COVID-19 patients, the number of dedicated units (mainly ICUs) and available resources was rapidly increased.[1] This required identifying HCPs with previous ICU experience, operating theatre staff, and other qualified volunteers to be redeployed to those units. Knowing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is highly contagious,[2] it was mandatory to provide a high level of security regarding contamination for patients and HCPs. In accordance with guidelines, it appeared necessary that all ED, ICU, and redeployed HCPs would benefit from specific training early before managing COVID-19 patients.[3] Such training was also critical to potentially limit viral spread among HCPs, which would risk other patients and deplete our skilled labour pool.[4]

A day before the first COVID-19 patient hospitalisation (March 13, 2020), six specific procedural skills simulation sessions were designed for: (1) hand sanitising, (2) fitting N95 mask respirators, (3) donning, and (4) doffing specific to droplet precautions, and airway management for (5) confirmed and suspected COVID-19 patients (both intubation and suction techniques) and (6) non-COVID-19 patients. Over three distinct days (see Fig. 1 for timeline), three instructors designed the sessions and made them operational by defining the relevant educational framework and pedagogical concepts; adapting institutional guidelines for airway management (for non-COVID-19 and COVID-19 patients); sequencing procedural steps to design needed cognitive aids, checklists (for validating procedures and skills), and video tutorials; and recruiting trainers and developing the training schedule. We applied a modified Peyton's approach[5] for each procedural session (adjusted for practicality) combined with rapid cycle deliberate practice[6] and integrated with a competency learning approach inspired by mastery learning.[7] In practical terms, for each session, HCPs viewed a tutorial (1) without and (2) with commentary, then each took turns (3) performing the skill while other HCPs and instructors rated them using specific checklists on tablets and gave immediate feedback, which was repeated until every HCP received the minimum passing score. The first four procedural sessions were grouped into a 1 h course, whereas the two airway management sessions were taught in a separate 1 h course.

For us to train a maximum number of HCPs in a minimum amount of time before the arrival of large numbers of patients, an experienced team of 10 instructors with dual skills as simulation instructors and anaesthesiology or ICU faculty and staff was created. Their instructor training lasted half a day and began early (Fig. 1) so that these experienced instructors

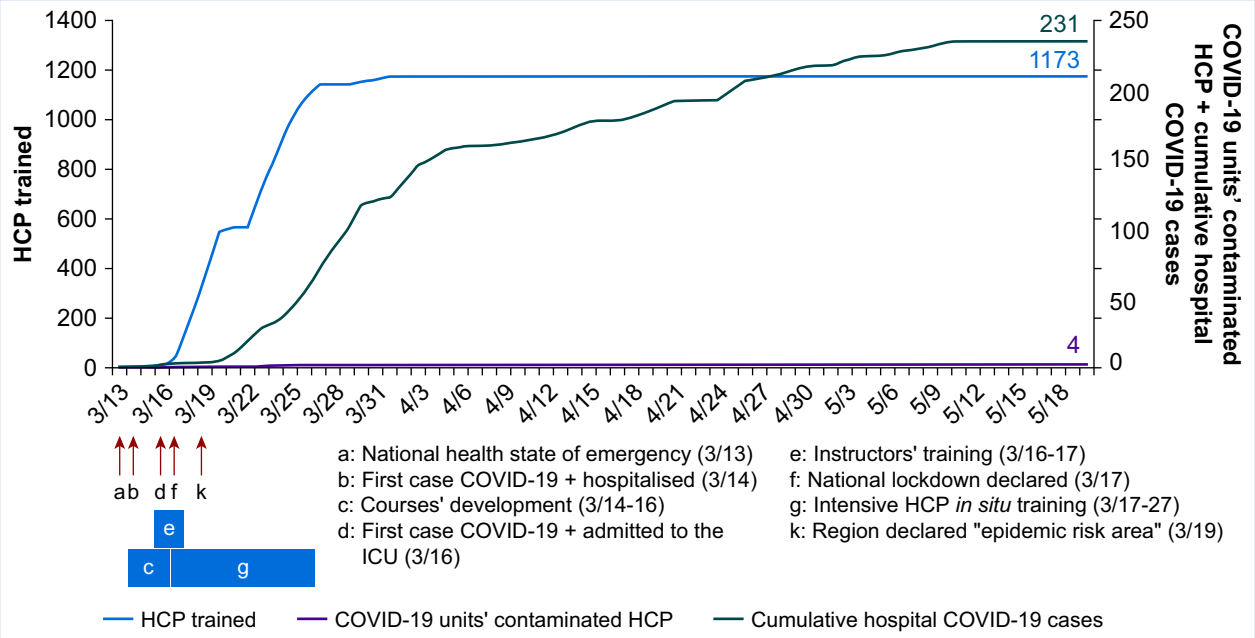

Fig 1. Cumulative numbers of trained healthcare providers (HCPs), COVID-19 units infected HCPs and COVID-19 patients hospitalised from our declared national health emergency state onset (March 13, 2020) until the time of submission of this letter (May 20, 2020).

could immediately initiate training for priority services. Human resources management team members regularly adjusted the priority training order so that HCPs were trained before they were required to care for COVID-19 patients. The training was made mandatory by the hospital and was highly desired by the HCPs.

Because physical distancing was mandatory, and large groups (≥10) were prohibited, we adopted a strategy of nights and days where targeted *in situ* training in small groups of six learners were trained by a pair of experienced instructors. This made it possible to train 1143 healthcare staff in 10 days, which constituted 27% of the hospital's HCPs and 96% of those involved with COVID-19 patients. Informal feedback from participants was generally positive on the courses. With a time frame of 7 weeks, 231 patients with COVID-19 have been hospitalised as of [May 8, 2020]. Among all hospital HCPs, 62 (1.5%) became COVID-19 positive including 4 (0.35%) trained and working in COVID-19 units (with no ICU HCPs infected). Despite being potentially more exposed, HCPs in COVID-19 units converted at a rate of four times lower than others not redeployed to work with COVID-19 patients. We hypothesised our training contributed to this, although we did not test this directly. However, we were unable to determine the source of infection for any of the infected HCPs, which is a limitation of our report.

Figure 1 summarises the cumulative numbers of trained HCPs, COVID-19 units' infected HCPs and COVID-19 patients hospitalised from our declared national health emergency state onset until [May 20, 2020]. After the training campaign, training remained available on demand, and all training materials were freely accessible online so that others could use them.[8] Local news outlets and social media aided educational advertisement, and the video tutorials alone have accumulated more than 62,000 external views from 21 countries.

It is difficult to prepare for the unlikely, and impossible to prepare for everything. However, we can speculate that there will be a need for rapid, massive, and targeted adaptation to a future health crisis. By applying solid educational theory and targeted practical training to achieve competence, we were urgently able to support skill acquisition in new procedures for a large number of HCPs as demonstrated by low rates of infection in our 1143 trained HCPs. The use of video tutorials and social networks made it possible to extend the benefit beyond our hospital to an international forum. Through rapid organisation, hospital leadership involvement, and educational expertise, the courses and sessions we designed may be modified to teach other critical skills. Future research should compare whether this educational approach is superior to others, as in an emergency context education of HCPs must occur.

Authors' contributions

Study design: CB
Data collection: CB
Conceptualisation: CB, MOF
Writing of the original draft: CB, RDM
Review and editing: CB, RDM, MOF
Visualisation: CB
Supervision: MOF

Declarations of interest

The authors declare that they have no conflicts of interest.

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Personal protective equipment during tracheal intubation in patients with COVID-19 in China: a cross-sectional survey

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Editor—Severe acute respiratory syndrome-related coronavirus-2 (SARS-CoV-2) is transmitted through droplet, contact, and aerosol routes with a basic reproductive number of 2.68.[1] About 17% of patients with coronavirus disease 2019 (COVID-19) develop acute respiratory distress syndrome, and 4% require tracheal intubation and mechanical ventilation.[2] Tracheal intubation is an aerosol-generating procedure. Healthcare workers (HCWs) who perform tracheal intubations have a three to six times greater risk of getting infected.[3] Several studies have recommended the highest level of personal protective equipment (PPE) available when taking care of infected patients.[4,5] However, the protective effects of different levels of PPE when performing tracheal intubation have not been fully studied. By collecting information on PPE use by HCWs, we aimed to evaluate the protective efficiency of different levels of PPE and make suggestions for the minimum PPE level required during tracheal intubation.

This study was authorised by the Airway Management Group of the Chinese Society of Anaesthesiology (CSA). The project was approved by Beijing Hospital and the requirement for written informed consent was waived by the institutional review board (No. 2020BJYEC-048-01). We conducted a cross-sectional survey among the hospitals designated for the treatment of COVID-19 in China. Chiefs of each anaesthesiology department were required to complete an online questionnaire giving detailed information on the number of anaesthetists in the department, PPE levels available at various different times, number of infected anaesthetists, PPE levels of infected anaesthetists, symptoms of infected anaesthetists, and their contact history with infected patients. Infection by SARS-CoV-2 was confirmed by reverse transcriptase polymerase chain reaction (RT–PCR). PPE levels in China were divided into four levels (PPE1–3^{+}; Table 1).[5] Questionnaires were uploaded to the Wenjuanxing platform (https://www.wjx.cn) on March 18, 2020 and remained through