Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

Increased risks of SARS-CoV-2 nosocomial acquisition in high-risk COVID-19 units justify personal protective equipment: a cross-sectional study

Sir,

We read with great interest the studies by Martin and colleagues on the dynamics of SARS-CoV-2 reverse transcriptase polymerase chain reaction (RT-PCR) positivity and seroprevalence among high-risk healthcare workers and hospital staff [1], and Zheng and colleagues on characteristics and transmission dynamics of COVID-19 in healthcare workers at a London teaching hospital [2]. Taken together, these two studies underscored the efficacy of personal protective equipment (PPE), the acquisition of infections predominantly around lockdown time, and possible extraprofessional exposures as the source of infections. We report here a seroprevalence study of differentially exposed healthcare workers and hospital personnel to COVID-19 patients, which showed similar results, but, in contrast, a significant increased risk of COVID-19 in staff working in high-risk COVID-19 units.

With the expansion of infections in France, authorities implemented a national lockdown on 17 March 2020 which lasted until 11 May 2020. Measures implemented at our hospital and their timelines are detailed in Figure 1. Between 21 April and 3 June 2020, we included 647 healthcare and hospital personnel volunteers from highly, mildly and unexposed COVID-19 units who had physically been present during the lockdown. Highly exposed volunteers had worked in the medical, intensive care and screening COVID-19 units, mildly exposed in the non-COVID-19 medical units, and unexposed personnel from the administration or laboratories. For highly and mildly exposed healthcare workers, eligibility implied being in contact with patients or their immediate environment (i.e. cleaning agents). After completing an investigator-led questionnaire, a blood sample for serological determination was collected, using the anti-SARS-CoV-2 IgG antibobies with the ID Screen® SARS-CoV-2-N IgG Indirect assay (ID.Vet®). Highly exposed participants had a systematic concomitant nasopharyngeal swab for SARS-CoV-2 RT-PCR test; participants in other groups were swabbed only if seropositive. Seropositive participants were investigated by two specialists to determine whether SARS-CoV-2 acquisition was most likely professional or extraprofessional. We aimed to include at least 156 subjects per exposure group, and to compare rates in each group using an exact logistic regression adjusted on age, gender and profession (doctor/resident, paramedical or other).

We included 261 highly and 227 mildly exposed (representing 70% and 93% of the corresponding eligible workforce, respectively), and 159 unexposed volunteers. Mean age was 38.3 (standard deviation (SD) ± 11.0), 496 (77 %) were women. Mean days of work in the highly exposed was 21.5 days (± 11.0). Thirteen personnel tested positive for SARS-CoV-2 NP IgG (prevalence rate of 2.01 % (95% confidence Interval: 0.93–3.09)); 10 people (3.91 % (1.53–6.28)) in the highly exposed group, two (0.8 % (0.0–2.1)) in the mildly exposed group and one (0.63 % (0.00–1.86])) in the unexposed group (P=0.022). After adjustment, the odds ratio (OR) of being positive for SARS-CoV-2 in the highly exposed group was 4.43 (95% CI 1.15–17.06) vs mildly and unexposed groups (P=0.031). One highly exposed healthcare worker had a positive SARS-CoV-RT-PCR at study entry, with a positive COVID-19 serology.

The study protocol was reviewed and approved by the University Hospital of Montpellier Institutional Review board (RB ID: 202000465), and registered on clinicalTrials.gov under the ID: NCT04376944. All participants consented to the study procedures and objectives. The participants were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Seven seropositive cases had exposures prior or within 14 days of lockdown (Figure 1). Extra professional exposure was deemed most probable for six cases. Four of the seven most probable professional acquisition occurred in workers who recalled unprotected contact with a COVID-19 case prior to full implementation of PPE in a non COVID-19 department, and in one worker from the medical COVID-19 department intermittently using a surgical mask in presence of colleagues. Two workers did not report any known specific exposure.

Despite an increased risk of acquiring COVID-19 in highly exposed personnel, seroprevalence was low, reflecting the efficacy of PPE and barrier procedures, in line with two non-comparative studies carried out in highly exposed healthcare workers [3,4]. Most nosocomial COVID-19 infections occurred at the beginning of the lockdown, a period in which recommendations were being fully upgraded and implemented, and extraprofessional acquisition more probable due to the high community viral circulation. It was also a time during which medical and paramedical teams were still inexperienced and stressed, which could enhance mistakes when using new protective gear [5]. Also, some data suggest possible airborne transmission of SARS-CoV-2 in enclosed environments, against which surgical masks may lack efficacy [6]. Our findings

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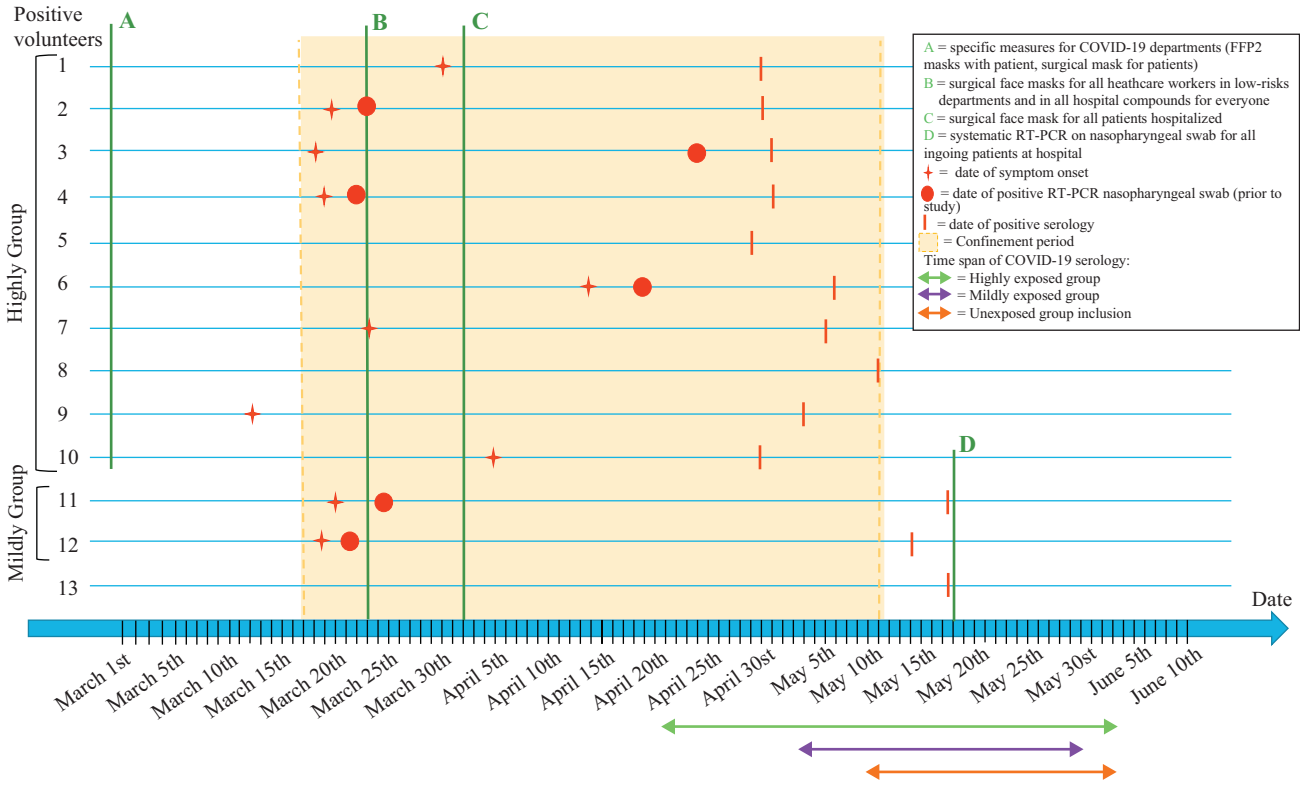

Figure 1. Timeline of clinical events according to implementation of barrier measures in the 13 serological positive volunteers. To better understand potential infectious dynamics, see the time-dependant A, B, C measures in our hospital setting detailed in this figure. In all units, physical presence of non-essential personnel, social distancing at work, systematic hand sanitizing, and virtual meetings were encouraged. Professionals exposed to COVID-19 patients were specifically trained to use and discard PPE, including protective suits, FFP2 masks, double pairs of gloves, eye protective gears, shoe covers, mobcaps and gowns.

contrast with a Chinese study of 420 healthcare professionals deployed to Wuhan for direct care of COVID-19 patients, for whom serology and SARS-CoV-2 RT-PCR of nasopharyngal swabs on return revealed no infection [7]. However, in this study, Liu and colleagues described full measures implemented prior to the personnel's arrival, but also very strict extraprofessional rules which may be difficult to implement in other parts of the world and over an extended period.

In conclusion, SARS-CoV-2 nosocomial transmissions to healthcare workers occur in high-risk settings, but PPE procedures are effective in reducing acquisition. Many cases were likely due to extraprofessional exposures and incomplete compliance with procedures. Following strict PPE procedures at work and outside are essential to reduce nosocomial acquisition of SARS-CoV-2.

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Author contributions

All authors contributed to the investigation, data analysis and interpretation, and final approval of article. M.B. and O.V. carried out most of the investigation and the first draft of the article, F.G., M.C.P., G.M. and A.M. conceived of and planned the study.

Conflict of interest statement

The authors report no financial relationships with any organizations that might have an interest in the submitted work in the previous three years, and no other relationships or activities that could appear to have influenced the submitted work.

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