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The use of post-anaesthesia care units as a supply of ICU beds while maintaining scheduled surgery: a cross-sectional web-based feasibility survey in France

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Dear Editor,

One year after the emergence of the coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the global outbreak led to over 77 million infections, 2,500,000 deaths worldwide, and has remained a major public health issue. This new pandemic has increased the inflow of new intensive care unit (ICU) patients, which at times overwhelmed many Hospitals' surge capacity.

Outside a pandemic context, the volume of ICU beds is tailored to the population's needs. However, following the COVID-19 pandemic, conventional ICU beds were quickly filled up and new makeshift ICUs were built up in many countries around the world ^{1,2}. In most cases, the opening of these ICUs was only temporary, in order to cope with the successive COVID-19 outbreaks. However, as future outbreaks and their nature are still unknown, it remains challenging to accurately estimate the upcoming needs for ICU beds while maintaining optimal care and access for all patients ³. Yet, creating new permanent ICU beds takes time, remains costly, requires specialized staff recruitment and may prove superfluous in the absence of a subsequent pandemic recurrence.

In France, physicians and nurses trained in both Anaesthesiology and Critical Care Medicine have been on the front line since the beginning of the COVID-19 pandemic ^{1,4}. They are highly skilled in providing mechanical ventilation, invasive procedures, and administering specific ICU drugs (neuromuscular blocking agents, sedatives, vasopressors, *etc.*). Therefore, they represent a critical and readily available workforce for the staffing of newly created ICUs and the provision of quality intensive care for the critically ill patients, whether they suffer from COVID-19 or other severe conditions. The COVID-19 pandemic has also taught healthcare providers that a sudden ICU surge may impede scheduled procedures and impose deleterious therapeutic delays for many patients. Thus, it appears essential to maintain scheduled surgery even during a pandemic period or during a sudden inflow of ICU patients ⁵. Post-anaesthesia

care units (PACU) and ICUs share common foundations, including high-end equipment and skilled healthcare professionals working under medical supervision. Nurses working in the PACU (whether anaesthesia or ICU nurses) are also familiar with mechanical ventilation, monitoring intubated patients, and administering ICU-specific medications. Although this is not their general purpose, PACUs may be customized to ICU patient care. The use of beds available in the PACU could therefore buffer a temporary overload of critically-ill patients, obviating the need to open new ICUs and limiting the risk of surgical cancellations. We therefore hypothesized that the French healthcare system, equipped with many PACUs that take care of patients around the clock, may possess the required supplementary ICU resources to cope with a sudden ICU surge, without downsizing scheduled surgical procedures.

To test this hypothesis, we conducted a survey using administrative electronic database to contact all anaesthesiologists in charge of a PACU in France (IRB: 10254-2021-045). Since PACUs are often open wards, it could be considered suboptimal and not safe to offer PACU beds to contagious COVID-19 patients. Therefore, each survey respondent was asked how many non-COVID patients requiring critical care could be admitted in her/his PACU without impacting the operating room schedule. Consequently, their estimation was based on their PACU bed occupancy rate during non-pandemic periods.

We received 225 responses among the 677 possible centres in France (response rate 33%). These 225 centres account for 662 different PACUs. The responding anaesthesiologists estimated that 540 ICU patients could be admitted in these PACU beds without impeding surgical activities. Among responding centres, 32% (n=73) reported being unable to accept any ICU patients. It was estimated by the respondents that 1585 patients could be admitted in their PACU on the condition that a reduction of current surgical activities was allowed. Detailed description of the PACU is reported in Table 1, while geographic locations of these PACUs in France is presented in Figure 1.

These results suggest that PACU beds are immediately available resources for crisis management at a national level while maintaining a normal elective surgical activity. This strategy has several strengths: no additional costs related to the opening of new ICU beds, no need to cancel surgical or interventional procedures, no need to create a temporary ICU structure, and no need for accelerated training of unskilled staff for clinical care.

As expected, a large proportion of the potentially available PACU beds are located in the most populous regions in France, where many busy hospitals function day and night (Lille, Nantes, Paris, Lyon, Marseille, Bordeaux, Strasbourg; see Figure 1). However, similar to most web-based surveys, the main limitation of this study lies in its design with the potential lack of response and reporting bias. Given that there are approximately 1000 hospitals in France which provide surgical care, the estimated proportion of responding services probably did not exceed 30% of the global national PACU capacity. We therefore report a minimal volume of available PACU beds for ICU patients in France. Moreover, our results only apply to the French settings, but it may be worthwhile to assess the feasibility of this strategy in other European countries.

In conclusion, a strategy allowing a quick increase in ICU surge capacity based on selected PACU beds appears feasible in France without impacting scheduled surgery.

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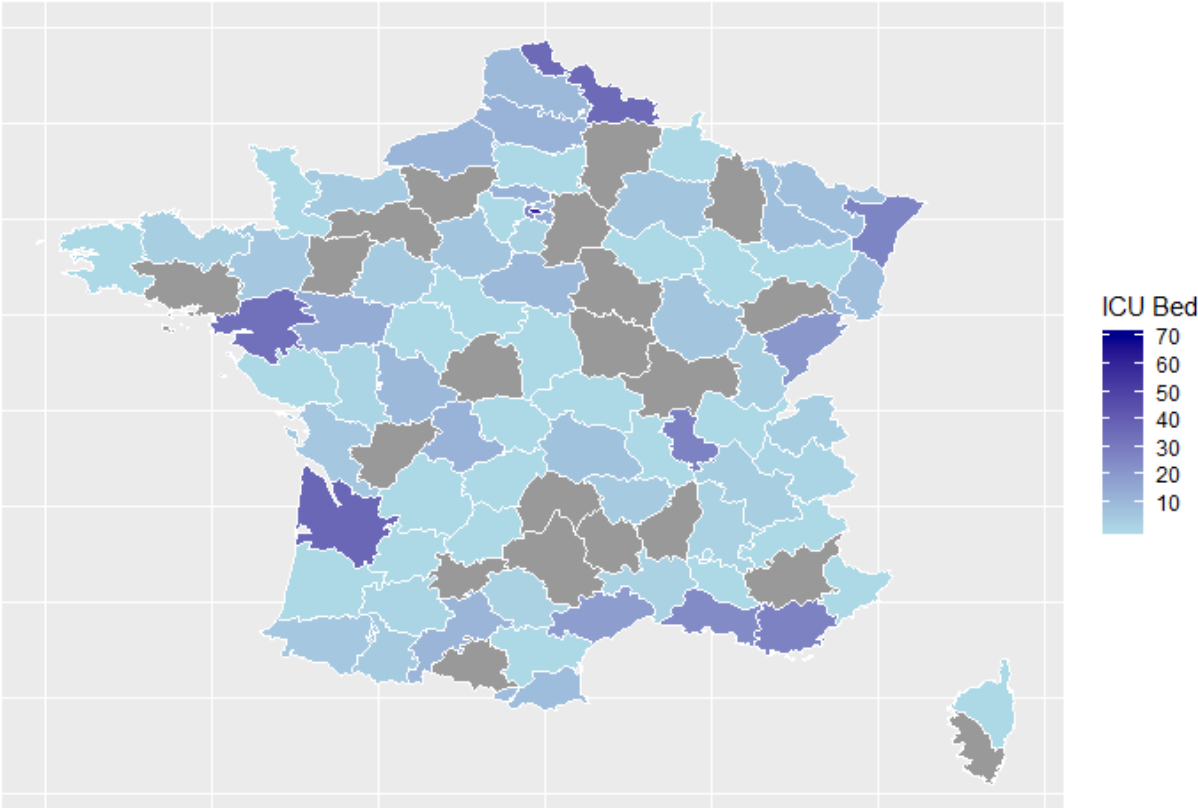
Figure 1

A –Responding post-anaesthesia care unit description

	Responding PACU (n=225)
Type of structure	
- Public university hospital	73 (32.7%)
- Public non-academic hospital	64 (28.7%)
- Private hospital	86 (38.5%)
- NA	2 (0.01%)
Bed in ICU (/hospital)	12 [0, 24]
Bed in step down units (/hospital)	8 [6, 14]
Number of PACU in the hospital	1.00 [1.00, 3.00]
PACU beds	
- Total number of beds during the day	16 [10, 24]
- Number of beds open 24h/24	4 [0, 9]
Number of ICU patients who could be admitted to PACU	
- Without impacting scheduled surgery	2 [0, 4]
o NA	35
- With an impact on scheduled surgery	6 [3, 10]
o NA	19
Ressources	
- ICU physician	195 (87.5)
- Nurses and other care givers	1 [0, 2]
- Ventilators	6 [3, 11]

Data are presented as median [interquartile range] and absolute value (%). ICU, intensive care unit; PACU, post-anaesthesia care unit; NA, non-available.

B- Responding post-anaesthesia care unit capacities for ICU patients' admission without impact on scheduled surgery (by department).



Number of PACU beds available for non-COVID ICU patients without impacting scheduled surgery. Department without responses are reported in grey. ICU, intensive care unit; PACU, post-anaesthesia care unit.