

## Assistance Publique–Hôpitaux de Paris’ response to the COVID-19 pandemic

Assistance Publique–Hôpitaux de Paris (AP-HP) is the largest teaching hospital trust in Europe, with 39 hospitals, 20 000 beds (10% of all public hospital beds), and an association with seven universities. AP-HP also hosts 40% of the French biomedical research. As a result of its size and location, AP-HP has been a major player in France’s COVID-19 response, as it was in responding to terrorist attacks.<sup>1</sup> AP-HP has a reputation of being an institution with a size, cumbersome operations, and internal competition that prevent any nimble response. We are a group of health-care professionals at AP-HP who are directly involved in the management of the COVID-19 response by AP-HP. Having faced the COVID-19 pandemic, and remaining humble in facing the future, we describe how size and coordinated management might actually have helped the organisation, speed, and consistency of the response to the COVID-19 crisis.

AP-HP initially estimated that no more than 1000 patients with COVID-19 would be simultaneously admitted to intensive care units (ICUs) in the Île-de-France region; 400 of these patients would be admitted to ICUs in the AP-HP, close to the maximum capacity. However, the situation became worse than expected (appendix). At the height of the COVID-19 pandemic, 2677 patients with COVID-19 were admitted into ICUs in the region, 41% of whom were admitted to AP-HP. A few points deserve discussion.

A specific medical organisation was established, led by a central crisis medical director who was appointed by the CEO and supported by medical directors in each hospital. A clear chain of medical responsibilities enabled a

reactive operational decision-making process throughout the whole institution.

Human resources for recruiting and training specialised staff were allocated from a single platform (appendix). We experienced shortage of various equipment and consumables made in Asia.<sup>2</sup> Centralised logistics made it possible to adjust quantities daily, in response to supply shortages. Universities called upon thousands of students in medicine, nursing, pharmacy, and dentistry who underwent specific training to work as paramedics, research assistants, or operators on a telemedicine platform.<sup>3</sup>

Management of available beds was crucial, so a central ICU bed-allocation system was organised at the regional level to optimise patient transfers across hospitals. This allocation unit was led by surgeons who were available as a result of the postponement of non-essential surgeries.

Using multidisciplinary working groups, practical guidelines were edited within 48–72 h, shared among all hospitals, and published on an AP-HP website. Examples of guidelines include the appropriate use of scarce equipment or drugs, optimal use of ventilators, and ethical issues. These guidelines were discussed during the central crisis team’s twice-daily telephone meetings. Critical care response was coordinated through a daily meeting of ICU heads.

A COVID-19 research committee developed a global research strategy that was shared with the universities and INSERM. The top priorities were establishment of patient cohorts, biobanking, and clinical trials. More than 40 clinical studies enrolled more than 7000 patients. This fast initiation of research was possible because of a shared research support infrastructure and reallocation of all research personnel, supplemented by volunteers. The centralised pharmaceutical office made drugs and placebos available at each hospital. The value of this research effort will be

judged from the peer-reviewed scientific output in the near future.

The response to the crisis was data-driven, thanks to a single institutional data platform fed by a single information system, providing important decision-making parameters (eg, length of stay, treatment, clinical pathway) in real time.

Large-scale initiatives were rapidly developed. Each day, a farm of 63 3D printers manufactured 1000 parts of various medical devices, bypassing a slow supply chain and avoiding disabled equipment. The Covidom telemedicine platform monitored more than 50 000 patients at home (appendix).<sup>3</sup>

A region-wide patient-tracing programme, COVISAN, was set up.<sup>4</sup> Devised by AP-HP under the umbrella of the regional health authority, the COVISAN programme brought together local authorities, general practitioners, non-governmental organisations, and private companies, which helped to secure the national lockdown exit plan.

All this was made possible because of extraordinary mobilisation and joint efforts of medical, paramedical, and administrative staff and with reinforcements from other regions (appendix). The COVID-19 crisis hit an institution that already had a shortage of nurses. A substantial number of health-care professionals became infected. We wish to acknowledge the tireless work of the highly motivated personnel at AP-HP. The COVID-19 crisis is not yet behind us; nevertheless, at a time when virtually every health system in the world is facing unprecedented challenges, we hope others will find our initial lessons helpful.

Members of the COVID19-APHP Group are listed in the appendix. We declare no competing interests.

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For the **Covidom application** see <https://www.nouveal.com/covidom-le-suivi-des-patients-porteurs-du-covid-19/>

For the **COVISAN programme** see <https://www.aphp.fr/actualite/lancement-de-covisan-un-dispositif-de-suivi-renforce-des-personnes-covid>

For the **AP-HP COVID-19 database** see <http://covid-documentation.aphp.fr/>

1 Hirsch M, Carli P, Nizard J, et al. The medical response to multisite terrorist attacks in Paris. *Lancet* 2015; 386: 2535–38.

2 European University Hospital Alliance. University hospitals urgently call for more European collaboration to prevent drug shortages. March 31, 2020. <http://www.euhalliance.eu/2020/03/31/university-hospitals-urgently-call-for-more-european-collaboration-to-prevent-drug-shortages/> (accessed May 1, 2020).

3 Assistance Publique-Hôpitaux de Paris. COVIDOM: une solution de télésuivi à domicile pour les patients porteurs ou suspects Covid-19 co-construite par l’AP-HP et Nouvel e-santé. March 12, 2020. <https://www.aphp.fr/contenu/covidom-une-solution-de-tele-suivi-domicile-pour-les-patients-porteurs-ou-suspectes-covid-19> (access May 1, 2020).

4 Piarroux R, Riou B. Coronavirus: pour déconfiner sans provoquer une deuxième vague, une approche centrée sur le patient. April 27, 2020. [https://www.lemonde.fr/idees/article/2020/04/27/coronavirus-pour-deconfiner-sans-provoquer-une-deuxieme-vague-une-approche-centree-sur-le-patient\\_6037850\\_3232.html](https://www.lemonde.fr/idees/article/2020/04/27/coronavirus-pour-deconfiner-sans-provoquer-une-deuxieme-vague-une-approche-centree-sur-le-patient_6037850_3232.html) (accessed May 1, 2020).

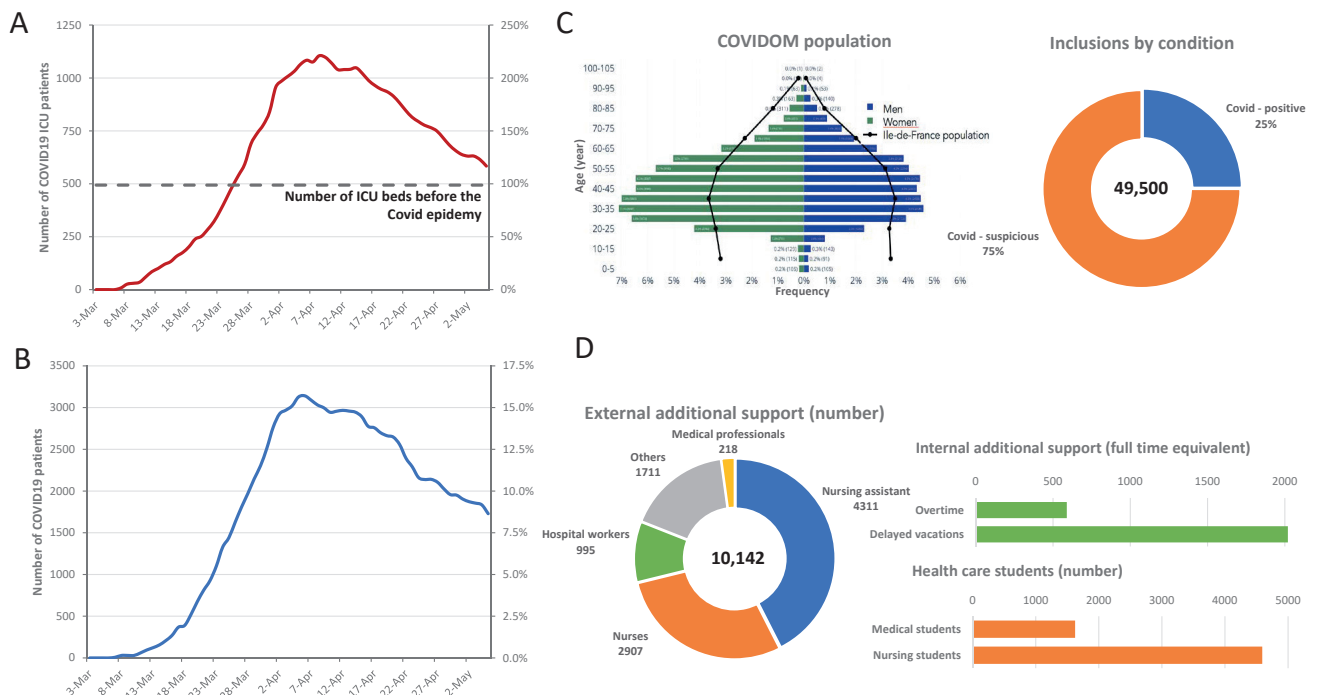
# THE LANCET

## Supplementary appendix

This appendix formed part of the original submission. We post it as supplied by the authors.  
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## The COVID19-APHP Group

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**Figure:** (A) Numbers/proportion of ICU patients in APHP (red line) during the COVID-19 pandemic from March 3rd to May 5th. The dashed line represents the number of ICU beds in the APHP (excluding pediatric and burn units), among those more than 85% are usually occupied. The maximum number of COVID-19 ICU patients was reached on April 8th with 1105 patients. (B) Number/proportion of patients hospitalized in conventional medical units. (C) Numbers, conditions, gender, and ages of patients enrolled in the COVID-19 telemonitoring COVIDOM platform.<sup>3</sup> (D) On the right, additional external support according to the function actually occupied (independently of their initial category); Medical professionals includes MD, PharmD, and residents. On the right detailed information regarding internal paramedical additional support (expressed as full time equivalent due to overtime or delayed vacations from March 1 to May 31) and external additional supports (healthcare students and medical professionals). Internal additional medical support has not been estimated yet. Medical students includes medicine, pharma, and dentistry.