New approach to managing COVID-19 pandemic in a complex tertiary care medical centre in Madrid, Spain

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Running title: A clinical management unit to enable surge capacity management

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Abstract:

The COVID-19 pandemic is putting healthcare systems under unprecedented stress to accommodate unexpected numbers of patients forcing a quick re-organization. This article describes the staff management experience of a third level referral hospital in the city of Madrid, Spain, one of the cities and hospitals with the largest number of COVID19 cases.

A newly created COVID-19-specific Clinical Management Unit (CMU) coordinated all clinical departments and conducted real-time assessments of the availability and needs of medical staff, alongside the hospital’s general management board. The Unit was able to (i) redeploy up to 285 physicians every week to bolster medical care in COVID-19 wards and forecast medical staff requirements for the upcoming week so all departments could organize their work while coping with COVID-19 needs, (ii) overview all clinical activities conducted in a medicalized hotel, and (iii) recruit a team of roughly 90 volunteer medical students to accelerate data collection and evidence generation.

The main advantage of a clinical management unit composed by a member of every job category - its ability to generate rapid, locally-adapted responses to unexpected challenges – made it perfect for the unprecedented increase in healthcare need generated by the COVID-19 pandemic.

ABBREVIATIONS

CMU: Clinical Management Unit
ED: Emergency Department
HULP: Hospital Universitario La Paz
ICU: Intensive Care Unit
NHS: National Health Service
Spain has been one of the countries more severely affected by the COVID-19 pandemic. On March 14th the Spanish Government introduced the Decree of State of Alarm and Health Emergency in Spain to provide a legal basis to confront the critical situation that the country was facing given the uncontrolled community transmission of COVID-19. On that date, Spain has reported 5,753 cases and by that date already 136 persons have died (1).

The unique characteristics of this pandemic and the extraordinarily high volume of cases put healthcare systems under unprecedented stress to accommodate all those patients. In Spain, Madrid was on the areas that were specifically hard hit by COVID-19, and University Hospital La Paz (HULP) was one of the clinical centres which had to provide care for those patients. COVID-19 could be viewed as a disaster whose need for care outstrips the ability to expand the capacity of the system to house and treat more patients in a staff-challenged environment quite above standard volumes with a specificity: a continuous impact on healthcare systems along several days, even weeks. Surge capacity, the ability to provide quality medical care during such a sudden increase in the number of patients, is one of the most important components of hospital for responding to emergencies and disasters.

The objective of this work is to describe the response of HULP to provide the best medical care to COVID-19 patients and the crucial role that a clinical management unit which was created amid the pandemic played to coordinating the dynamic response of HULP in the face of the avalanche of cases that were presented daily, one of the centres that had to attend one of the highest number of patients affected by this disease (2).

HULP is a university-affiliated tertiary level hospital, with a catchment area of more than 500,000 people. HULP has 1,268 beds, divided into 3 locations (La Paz, Carlos III, Cantoblanco) and a medical staff of 1,158 physicians and 564 residents (3). Following the publication of Royal Decree 463/2020 of March 14 (4), 2020 declaring “the state of alarm for the management of the health crisis”, non-urgent healthcare activity was paralyzed and
COVID-19 patient care were assigned to be managed by the staff of Emergency Department, Intensive Care, Internal Medicine, and Pneumology services. However, it was soon evident that the clinical resources of those areas were insufficient to manage the growing volume and clinical complexity of patients, which would occupy more than half of the HULP beds during the days with the greatest epidemiological pressure (689 inpatients and 139 in the ICU). The evolution of the pandemic in HULP is shown in Figure 1.

The reader may be surprised both by the magnitude of resources required to treat those patients as well as for the adaptability of this complex third-level hospital to a completely new organization. All these changes were articulated in a marked redistribution of spaces, with 778 beds of the La Paz - Carlos III - Cantoblanco complex being allocated to COVID-19 areas and more than 280 doctors eventually collaborating (including both staff physicians and residents). (5)

The COVID-19 Clinical Management Unit (CMU) was approved in March 16, and began functioning on March 23, when in HULP there were already 491 COVID-19 patients, 43 of them in ICU. The CMU was composed by an Intensivist with experience in Emergency management (Dr. Quintana-Díaz), the hospital chief-resident (Dr. Gutiérrez-Sancerni), her associate (Dr. Arcos-Rueda), a communication manager (Dr. Artiga-Sainz) and one administrative assistant (Irene Cuevas-Gordo). The role each member of the team played is expound on Table 1. The tasks and functions of the CMU COVID-19 were:

- The management of medical personnel reallocated to provide clinical support for COVID-19 areas. Overall, up to 285 professionals from 26 medical specialties, practically from all clinical specialties at the hospital, were involved and collaborated directly or indirectly in the clinical management of COVID-19. HULP hired 50 doctors. Of these, newly recruited were 35 were “R0”; that is, medical graduates who were in
the process of starting their specialty training and whose exceptional incorporation was allowed by Ministerial Order (6).

- The supervision of the activity of the “Via Castellana” medicalized hotel, carried out by 10 “R0s”, where 402 stable patients with a favorable prognosis whose outpatient follow-up was not feasible because they not being able to properly isolate at homes were admitted.

- The set-up of a data collection project of COVID-19 patients. During the first weeks of COVID-19 wave, hospital occupancy and staff compromised with clinical care, made medical data collection hard from a logistics’ point of view. The CMU decided to make a volunteering call among medical students in their three last years of training, given that they had both the permissions to access clinical information and the skills to provide a good-quality medical research after a quick training. Finally, 65 medical students worked daily in the project making possible to have an exhaustive database of the largest European cohort of patients COVID-19 at the end of April (7).

This new layout of the hospital required to interrupt the normal activity and redeploy medical staff to COVID-19 areas. To understand the rapid evolution of the reorganization in HULP we need to outline that by March 19, when the initial redistribution of medical personnel led by the CMU started, the hospital reached a maximum occupancy of 92%, even though 122 extra beds were added to treat COVID-19 patients.

As indicated by the Hospital Management Board, the 26 COVID-19 hospitalization wards were coordinated by Pulmonary and Internal Medicine Services. In this completely ad-hoc organization, each ward had a chief coordinator (a staff physician from Pulmonary or Internal Medicine) who was helped by 2 or 3 staff physicians of his service. Besides, depending on the size of the ward, a medical staff composed by 3-7 specialist and 2-7 residents from different medical or chirurgical services were allocated to each COVID-19 hospitalization
ward. The workforce needed in each ward was evaluated by the coordinator together with the CMU team, firstly on a daily basis then weekly.

The Emergency Department also required additional support, and had to be divided in COVID-19 area and non-COVID-19 areas. Several spaces became part of the COVID-19 area, such as the gym, used by rehabilitation and physical medicine patients, some waiting rooms, and a provisional tent located in the entrance of HULP and some waiting rooms. All these sectors were coordinated by Emergency staff supported by specialist and residents from different specialities.

Patients requiring critical care and mechanical ventilation could either be admitted to intensive care (ICU), post-anesthesia care unit, or specific critics labeled beds (coronary and stroke units), as the hospital had to increase critical care capacity in response to the peak in critical care demands. All critical care areas were coordinated by the physicians from the Intensive Care and Anaesthesia departments, with substantial support from physicians from the Cardiology and Pulmonary Medicine Departments.

Medical staff supporting COVID-19 areas worked in 8 hours shifts if deployed to the Emergency Department, and 8 to 12 hour shifts in the rest of hospitalisation wards. Most of the times, schedules were organized in weekly rotation schedules. When possible, each post remained assigned to the same service in the long term. For instance: a post in the Emergency COVID-19 area had to be covered by an Ophthalmology consultant all over the redeployment period.

These 7-day periods were planned to allow physicians to a) acquire clinical experience treating COVID-19 patients while 2) preventing clinicians from burn-out due to prolonged redeployments.

The chronological events happened as follows:
By the first week of CMU activity (March 19th-26th), 120 doctors (hospital staff and residents) were re-assigned to the Emergency Department and hospitalization wards. In this moment, a weekly redeployment plan was set forth to encourage teamwork and COVID-19 management experience, although daily readjustments on staff redeployment were made due to sick leaves and growing needs.

The “Vía Castellana” medicalized hotel started taking patients on March 23rd and the first 20 “R0” were hired. To guarantee the continuity of care, staff was asked to make 8h shifts and most of the 24h shifts were converted into afternoon or nightly 8h shifts.

On the second week of CMU activity (March 27th- April 3rd), 50 extra doctors were redeployed to hospitalizations wards, while 26 more were assigned to the Emergency Department as new spaces and extra beds were set up. The following week, as COVID-19 started slowing down, 1 ward coordinated by the Pneumology Service was shut down. On March 26th the Regional Health Department opened a temporary hospital in Madrid IFEMA Conference Centre started admitting patients to its full capacity (1,500 beds), and that contributed to a significant relief on the pressure on the Emergency Department. This reduction of attendance in patients at the Emergency Department allowed the CMU to plan a more equilibrated redeployment of medical staff to partially restart other clinical areas activity.

From the 4th to the 7th week of the CMU’s Support Management Plan COVID-19 activity, HULP entered into a process for a continual readjustment of spaces to return to the old organization and COVID-19 wards and Emergency Department areas were progressively closed. Concurrently, the amount of staff redeployed to ensure healthcare activity in those areas was reduced always assuming a conservative approach, allocating more doctors to COVID-19 areas that what the forecast showed necessary just in case a new outbreak was to happen. An example of the chart used to distribute medical workforce is shown in Figure
2. The CMU settled the beginning of the “new normal” in hospital activity on May 9th, coinciding with the easing on lockdown measures in the country.

In a first time, CMU redeployed medical personnel in a reactive stance, covering immediate needs and sick leaves, for the first 3 weeks. Subsequently, the experience gained managing the clinical staff together with the epidemiological forecasts available allowed the Unit to adopt a proactive perspective and design a plan for progressive withdrawal and allowing progressively hospital activities to go back to the “new normal”, which began in the second half of April and ended on May 9th, at the end of 7th week. Figure 3 shows the evolution of the reassignment of clinical personnel and hospital beds in relation to the epidemiological pressure throughout the seven weeks of the Support Management Plan COVID-19.

CMU also elaborated a proposal for reorganization in case of rebound. This plan indicated the opening of a hospitalization ward for each 10% increase in COVID-19 patients when 200 patients admitted for this condition are exceeded, and the approximate assignment of a medical professional for every 4.5 patients admitted. The plan also stated the participation of doctors according to specialty and degree of training to the new COVID-19 areas.

Issues that the CMU had to face can be divided in a first phase, when a proportion of hospital beds and personnel from different clinical (e.g. medical or surgical) departments were reassigned to admit COVID-19 patients, and a second phase, when these reallocated resources had to return to their usual clinical activity.

Initially, some departments had certain reluctance to devote part of their space and workforce to COVID-19 patients, which is to some extent understandable. The way to overcome this resistance was to negotiate the terms of the redeployments with those departments. In a few cases when departments remained reticent to provide the personnel...
needed for COVID-19 hospital wards, the CMU was forced to ask for the Hospital Management Board intervention.

Once the initial peak of the pandemic was under control, all departments requested their staff back in order to resume their usual clinical activity. Such request were a source of constant negotiations between the CMU and clinical departments, as even when the peak of the pandemic was under control the burden of COVID-19 cases greatly exceeded the usual capacity of internal medicine and pulmonology wards. These situations were most often solved by calculating staff requirements based on a realistic dimensioning of their clinical activity and using a shared decision making approach between the CMU and the departments.

For instance, if a proportion of beds and providers from the Gastroenterology department were initially reassigned to admit COVID-19 patients, once the initial COVID-19 surge was under control the CMU seized the staff needs of the department (e.g. were they restarting their former activity at 50, 70, 90% of their capacity?) and planned a stepped plan where certain proportion of the beds and staff rapidly transitioned back to former activity while others remained under COVID-19 duty for a few more days/weeks. As a result, clinical departments re-gained their usual workforce a progressive manner that was accelerated or decelerated depending on the day-to-day COVID-19 caseload.

The organized return of medical personnel and the closure of COVID-19 areas also highlighted the relevance of a CMU, ensuring that this process took place without putting COVID-19 areas at risk of being overflowed.

The almost spontaneous constitution of a CMU to carry out personnel redeployment tasks, with a team in permanent communication selected for its proximity to the different medical groups of the hospital, allowed a rapidly adaptive work mechanic in which all the actors were involved in the different existing COVID-19 areas, guaranteeing “real-time” knowledge of the
evolution of the situation. The local reorganization of staff has been positively endorsed by international guides (8). It should be noted that the organizational model of the UGC is considered one of the pillars of the sustainability of the NHS, since it provides greater efficiency and quality (9). Certainly, it demands a significant involvement of professionals, but in return, it renders a more comprehensive view of the patient or, in this case, of a hospital that must be rethought to respond quickly to an emerging need.

The characteristics of Madrid metropolitan area, a densely populated zone, with an aged population having a high prevalence of hypertension or diabetes (10), makes it a highly vulnerable population at-risk for severe COVID-19, virtually guaranteeing a high-impact. The COVID-19 infection overwhelmed both the local primary care and hospital local infrastructure capacities, which were not experienced, trained, equipped, or resourced to support an affected casualty load of this magnitude. COVID-19 has had a tremendous death toll in Spain but we cannot forget the heavy burden that it has had on healthcare personnel: more than 54,494 infected, and 63 have died (11)

The daily number of admissions of COVID-19 patients was increasing exponentially several days before regional and national public health authorities recognized the dimension of the COVID-19 pandemic in Spain. The hospital successfully reacted to accommodate an unprecedented number of very severe, complex, and highly infectious patients for whom scarce scientific evidence was available. Notably, these patients had to be treated by physicians with diverse clinical backgrounds – some of whom had limited experience treating severe acute respiratory distress. Under a highly stressing context and with limited time to determine the most appropriate functional and organizational approach to the management of the personnel needs driven by the pandemic, we did not consider alternatives to the one we adopted. All steps in the development of the CMU included substantial reflection and negotiation between stakeholders, which helped us redeploy
personnel while keeping under consideration the preferences and needs of all clinical
departments.

La Paz University Hospital is Spain’s most important major teaching hospital and has led
regional and national responses to several crises, including natural disasters, aviation
accidents, etc. In particular, we consider that the Hospital Management Board could react in
a short lapse of time and adopt a CMU model because of its previous experience dealing
with International Health alarms: The first European case of Ebola virus in 2014 is a salient
dexample (12). Following the successful response to the Ebola crisis, La Paz University
Hospital keeps regular meetings and updates emergency response protocols that were for
sure key for the rapid coordinated response to the COVID-19 crisis.

This reality shows why surge capacity planning is critical to mass-casualty incidents like this,
when thousands of persons need medical attention, and there will be insufficient resources
to support the affected population if deliberate planning is not been done to address surge.
The ability of our public health and healthcare system to respond to catastrophic events and
save as many lives as possible will remain the single most important measure of national
preparedness.

The added value of the intervention carried out in the HULP lies in the adequate choice of
the roles and identity of its members, and in the speed with which its constitution was
executed. Although, it is still necessary to evaluate its efficiency and compare it with other
approaches adopted in the field of hospital micromanagement (13), the HULP experience
provides a practical approach on how to address the temporary restructuring of a hospital in
a health emergency with mass casualties, moving from a “silo” organization towards a
network-centric architecture for improved healthcare response that goes beyond the normal,
limited scope of clinical interest and professional demands.
BIBLIOGRAPHY


Table 1: CSMU’s distribution of tasks and specific aspects of the job among members.

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<th>Function and specific aspects of the job</th>
<th>Tasks</th>
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| **COVID-19 Support Management Unit Coordinator** | A. Direct communication with the executive team.  
B. Team representation in organisational meetings on COVID-19 with the heads of Internal Medicine, Pneumology and Emergency services.  
C. Coordination and handling doctor’s issues.  
D. Supervision of “R0” work in the medicalised hotel Via Castellana.  
E. Planning the Data Gathering team’s activity. |
| Assigned to an Intensive Care specialist with experience running Emergency service teams.  
Daily work in the Critical Unit allowed to have an accurate knowledge of the situation and provided interaction with doctors from different units.  
His link to the University as an Associate Professor allowed him to communicate with alumni which joined the hospital as residents who had not chosen their first allocation (R0) and students which worked with the team that gathered data. | |
| **Resident Coordinator** | A. Coordination and handling resident’s issues.  
B. Attendance to organisational meetings in the Internal Medicine Ward. |
| Carried out by the head of residents or the stand-in head when she was on leave. She was therefore already a reference for this collective before COVID-19.  
Kept to her workday in the hospitalisation ward in Internal Medicine which allowed an in-depth knowledge of the needs and immediate changes happening in this area. | |
| **Communications Manager** | A. Drafting and distributing official documents.  
B. Coordinating general issues and handling extraordinary COVID-19 contracts.  
C. Support and help with the organisation of the Data Gathering team. |
| Two people took on this job: hospital’s department secretary and an “R0” with training on Sanitary Management.  
Solely dedicated to the CSMU allowing a fast response to incidents and regular checks to ensure all COVID-19 areas were functioning appropriately.  
They were physically located in the same area as the Data Gathering team which allowed the logistical support and prompt solving of any issues this team may have had. | |
Figure 1: Evolution of the epidemiological pressure driven by COVID-19 patients at Hospital Universitario La Paz, Madrid, between March 15 and May 3, 2020.
**Figure 2: Organizational chart for the week 4-10th April on COVID hospitalization wards coordinated by Internal Medicine in Hospital Universitario La Paz hospital’s main building.** An equivalent chart was used in the rest of COVID-19 areas. Note that each ward workforce is composed by an Internal Medicine coordinator, several Internal Medicine associates and 1 to 7 specialists from other Services. Residents affected in hospitalization wards were mainly in the 3rd, 4th and 5th year (R3, R4 et R5), while the youngers were redeployed in the Emergency Area.:

The following week, a 5% reduction was expected on COVID-19 hospitalization cases, allowing to close down the smallest ward (7th floor) so the Hematology specialist and the residents working in therear could go back to their former services.
Figure 3: Evolution of medical staff reallocated related to COVID-19's occupancy at Hospital Universitario La Paz, Madrid wards and Emergency Department.

Medical staff reallocated related to COVID-19's occupancy in Hospital Universitario La Paz wards

- Attending Physicians
- Residents
- COVID-19 patients in wards

Medical staff reallocated related to COVID-19's occupancy in Hospital Universitario La Paz's Emergency Department

- Attending Physicians
- Residents
- COVID-19 patients

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