

COVID - 19 Challenges

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Adaptive Strategies for Intensive Care During the Spread of COVID-19: The Brussels Experience

This article describes the approach of the COVID-19 crisis at a tertiary Intensive Care Unit in Brussels, Belgium. Structured interventions and bottom-up initiatives are highlighted, and practical examples given.

Introduction

Optimisation of medical response to no-notice events has been an important focus of research in the field of disaster medicine (Debacker et al. 2016). However, evidence-driven development of medical response protocols in novel domains of hospital medicine is time-consuming, and time is lacking in unforeseen circumstances. The respiratory disease COVID-19 (CO-rona VI-2 rus D-isease 2019), caused by the novel severe acute respiratory syndrome (SARS) coronavirus (CoV), named SARS-CoV-2 or 2019-nCoV, has resulted in thousands of infected patients and deaths worldwide since the end of 2019 (Livingston and Bucher 2020). Countries have adopted their own timeframe of risk-reduction strategies at the level of their health service, reflecting their differential risk assessment strategies.

In response to the COVID-19 outbreak, the structure and organisation of health care at the hospital level had to be reconsidered and action plans had to be developed and implemented as new challenges kept emerging.

This article describes the approach of the COVID-19 crisis at a tertiary Intensive Care Unit in Brussels, Belgium. Structured interventions and bottom-up initiatives will be highlighted, and practical examples given. More specifically, internal reshaping

of the ICU management as an intuitive response to the urgent challenge of the COVID-19 pandemic led to the development of seven building blocks that constitute the functional organisation of the ICU, with specific responsibilities assumed by seven dedicated members of ICU staff. This novel structure was established following a senior staff meeting on March 9, 2020, before the admission of the first COVID-19 patient in ICU. During that meeting, several unmet needs were identified. Seven specific building blocks were identified and one single member of staff was appointed to take responsibility of each element, with no interference of responsibility across different elements. Crisis unit meetings were held on a daily basis, with room for feedback and discussion although ownership of responsibilities was maintained to reduce overlap of expenditure of time, energy and resources. The reshaping of the ICU management into a structure with seven key elements led by seven single commanders is depicted in **Table 1**.

Macro Level

In line with hospital rules, the head of the department has final responsibility for the ICU. Alerted by the situation in other countries, mainly Italy, the head of department had reported the status of

Macro level	Operational management	Communication and staff well-being	Non-ICU environment (Coronary Care Unit, recovery room)
Internal and external stakeholders contact	Medical and organisational command	Communication strategies Staff physical and psychological well-being Patients Family Care	Management of ICU structure and medical support in remote ICUs
Head of Department	Senior Staff Member	Senior Staff Member	Staff Member with Combined Profile
Management of non-COVID patients	Communication support	People management and training procedures	
Medical and practical management	Back-up Members Crisis Unit Confidential Counselor	Management Nursing Department Logistics, Material, Drugs	
Senior Staff member	Non-medical	Head Nurses	

Table 1. Organisational structure

Meetings Macro level

Timing	Meeting
9u.	UZB Crisiscel Covid - fixed
14u.	UZB working group patient flow
17u.	UZB Crisiscel - fixed

Table 2. Meetings Macro Level

capacity and infrastructure at the ICU and transmitted the specific needs to the CEO of the hospital, to the medical management, the head of nursing and other hospital directors, before the first patient arrived in need of critical (or invasive) treatment due to COVID-19 disease (Table 2). He had preliminary discussions with stakeholders outside the ICU to pave the way for the dynamic adaptation process of the ICU department, with an important focus on enhancement of capacity and expansion of medical and nursing staff. Additional beds were created by restraining non-urgent surgical procedures, which typically result in 600 cardiac surgery and 400 brain surgery or brain trauma patients admitted to ICU each year. This was in line with the hospital's medical emergency plan where all non-urgent medical care, including out-patient clinics and non-urgent out-patient and in-patient interventions were downscaled.

A nationwide direct line with peers from other ICU's across Belgium was set up in order to exchange ideas and materials, both medical and non-medical. The national society of Intensive Care was contacted and the website of the society (siz.be) was activated as a platform of information.

Daily information regarding the number of COVID-19 positive patients treated in ICU, patients requiring mechanical ventilation, ICU capacity and number of available respirators had to be communicated to the Belgian Government and daily briefing sessions, chaired by the head of department, were held to discuss the latest updated information provided by the seven building blocks of the reshaped ICU and



Image 1. Briefing



COVID-19 positieve patiënten op IZ UZB

Opvang en behandeling

Concept protocol versie 4.2 - 12-03-2020



Image 2: Protocol

to share this information with the entire ICU staff (**Image 1**).

In view of the need to enhance the ICU capacity, the development of a strategy to create additional ICU beds was a primary goal; indeed, further to the scenario in Italy where the impact of the spread of the disease was massive, we learnt that tripling the number of ICU beds would potentially be required. A capacity expansion algorithm was developed based on a “Phase 1 to 5 Approach” in line with a growing number of patients to treat: accordingly, it was decided to enter a higher-level phase with every series of 5 ICU COVID patients admitted to ICU, which entailed the creation of a new 6 beds ICU unit with each phase, dedicated to the treatment of critically ill COVID-19 patients. So once 5 out of 6 beds were taken, the next unit was put into action.

It was first decided to partially transform the 6 bed CCU (Coronary Care Unit) to an almost full capacity ICU: mechanical ventilation and monitoring were installed,

and invasive procedures such as percutaneous tracheostomy were introduced in this accessory ICU. The operational lead of this ICU/CCU unit was delegated to an ICU member of staff with a combined cardiology/intensive care medical profile. Within two days, the novel ICU/CCU unit was fully operational and the first patients were transferred to this remote ICU. These were non-COVID ICU patients with chronic critical illness or lower need of care. One ECMO-treated Influenza A patient was not moved to this ICU/CCU because the high complexity of care could not be guaranteed in a ‘new’ remote ICU. Expansion of ICU beds was created on this macro level in agreement with other departments. In the recovery room of the operating theatre, a COVID zone was designed for infected surgical patients, and 3 ICU beds were created. This enabled the transfer of non-COVID critically ill patients to this new ‘remote ICU.’ Mixed ICU/recovery staff was foreseen. A Medium Care unit was created when the first ICU patients were ready for step down or did not fulfill indications for full ICU therapy.

The tasks at macro level continued to evolve with new challenges during the COVID crisis.

Operational Management

The primary aim of redesigning the structural framework of the department was to provide high quality, evidence-based medicine to critically ill patients, including those suffering from COVID-19. When compared with standard care, three key differences can be identified: 1) specific evidence-based medicine is largely lacking due to the novel aspect of the disease and lack of time for a ‘traditional’ RCT driven research approach. 2) The harsh bed-side working environment (risk of viral contamination by patients with very high viral load which necessitates extended protective clothing) with priority to the safety of health-care practitioners does not allow certain ‘high-end’ medical procedures.

3) In view of the risk of work overload due to the high number of patients for a limited number of specialised health care providers (HCP), short and lean medical management is mandatory.

Two days after the initiation of the ‘COVID-19 Plan,’ the chair of operational management finalised a 15-page COVID-protocol that was made available for bedside use by HCP. Within this operational protocol, treatment strategies in patients with respiratory failure were described, including nasal oxygen therapy, ‘optiflow’ approach, the decision not to use non-invasive ventilation because of too high viral aerosolisation and rapid crush intubation, and ventilation in prone position. Other aspects of this protocol included (**Image 2**):

- Sedation strategies;
- Haemodynamics failure (drug management);
- Medical drug treatment, antivirals and antibiotics, drug interactions;
- Nutritional treatment including enteral nutrition in prone position and supplemental parenteral nutrition;
- Physiotherapy.

Standard Operating Procedures (e.g. endotracheal intubation) were developed to facilitate standard procedures and to reduce bedside time for HCP in a high-risk environment with high exposure manoeuvres. Paper versions of these documents, easily readable through plastic goggles and screens, were provided in the closed COVID-19 treatment zones.

Medical decision making on the use of resources (ICU units and medical and nursing staff) was the responsibility of the operational manager. Dedicated areas for confirmed COVID-19 patients, patients with uncertain COVID-19 status, and for patients who tested negative for the virus were created to ensure secure individual patient care (**Image 3**).

Non-COVID ICU patients were transferred to newly created remote ICUs to create a ‘buffer zone’ in the main ICU. In the absence of COVID-19 positive infants,

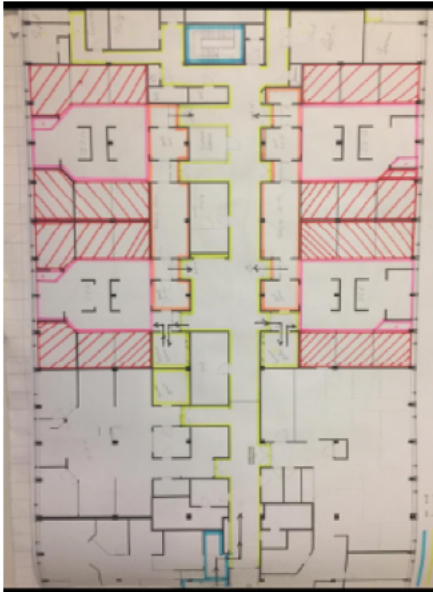


Image 3: Units

paediatric ICU was moved to a ‘clean’ part of the hospital, more specifically the operating theatres and recovery rooms of the ART (Assisted Reproduction Technologies) department.

The operational manager took the responsibility to continuously screen the literature for newly available medical information on the treatment of COVID-19 critically ill patients and to adapt the COVID-protocol where appropriate. The COVID protocol was continuously adapted & updated.

The Ethical Committee of UZ Brussel drew up a guideline that determines who will be admitted to the ICU in case of over-capacity. Triage of patients was based on the chance and quality of survival and was carried out by a team of experts consisting

of senior ICU medical staff, an emergency physician and a specialist depending on the condition.

Communication and Well-being of ICU Staff

An Intensive Care Unit is a 24/7 staffed work environment with a very broad multi-disciplinary nature. Medical doctors and highly qualified paramedical staff including nurses, physiotherapists and dieticians collaborate in an environment that is kept safe and lean by logistic personnel and cleaning staff. At Universitair Ziekenhuis Brussel, the ICU counts approximately 200 staff in total.

In an acute, rapidly changing setting, communication within this group is of cardinal importance. A dedicated communication base was set up in the main waiting area of ICU, strategically positioned and liberated as family members were not allowed during COVID crisis. Correct social distancing was ensured by barring seats, and floor marks were made to discourage staff from gathering too closely during briefing sessions.

Communication Base

Full responsibility for the building block of communication was given to a single member of staff, who physically manned the communication base during regular daytime working hours to gather questions and provide answers to other members of staff. Patient related communication was developed besides communication related to the “adaptive strategy” of the ICU. Paper flipcharts were present and all crucial information and procedures were schematised on a single-page leaflet, to make all ICU staff familiar with the new series of interventions and rules, including those staff whose knowledge of Dutch as the official language in the hospital was poor.

As emerging information had to be shared in a rapid and efficient manner, the smart phone application WhatsApp® was chosen as the communication platform for



Image 4a. Communication Base



Image 4b. Visuals

all people active in the ICU department. This represented a portable mode of communication where new information could be shared instantly within a multidisciplinary team (Nikolic et al. 2018). Visuals were attached to the ICU walls and posted on the WhatsApp platform. (Images 4a and 4b).

Positive feedback from all different levels of HCP confirmed the usefulness of this communication strategy. A laptop was made freely available to all staff to check their emails or consult the hospital's information channels. This strategy was copied to the two remote ICUs (CCU and Recovery Room).

Two days after setting up the COVID-protocol at ICU, a specific WhatsApp group named "IZ COVID" ("Intensive Zorgen COVID," intensive care COVID) was created to include every ICU staff member.

WhatsApp Information shared in "IZ COVID" included:

- Reallocation of ICU Units;
- Recordings of daily ICU briefing (Movie);
- Daily report on number of treated COVID patients;
- Educational movies on how to wear protective clothes in which areas.

Examples of WhatsApp Feedback posted within this group included:

- Practical callouts (urgent need of anti-fog spray for plastic helmets in COVID zone)
- Temperature in COVID ICU rose to 26°C: urgent question if it was allowed to open the windows.

A second WhatsApp group was created for senior medical staff only, and a third group was created in which humorous corona related jokes could be posted. This served as a 'mental break out' for ICU practitioners (Amici 2019). More than 200 jokes were shared between the members of the group in less than 10 days.

Call Centre

Critically ill patients already hospitalised in the ICU before the start of the pandemic were reallocated to newly created remote

ICUs when possible. To ensure that family members were able to keep track of their beloved ones, a dedicated Call Centre was set up on day three. Volunteers from a non-ICU department, more specifically midwives from the ART department, were recruited to man this Call Centre. For every patient who was admitted to or discharged from the main ICU department, a separate communication line was opened. As patient numbers increased, all Digital Enhanced Cordless Telecommunications (DECT) in the ICU were redirected to this Call Centre from 8 am to 8 pm so medical and paramedical staff could focus on patient care.

Examples of communication with patients' relatives through this Call Centre include:

- "Your father/mother/child/relative is present in ICU n° 13, 14, 15, 16, CCU, PACU, ...;"
- "You can call up to three times a day to the following phone number for a short status update;"
- "The medical doctor will call you between 2 and 3 pm or in case of emergency";
- "We will call you with an information summary (stable situation, worse, better) two times a day;"
- "Who is the single contact person please, what is the link with the patient and on which number can we reach him/her?"
- "Do you have any other questions? If we cannot answer them now we will get back to you."

Soon after the activities of the Call Centre had been announced through the communication base, the first calls were made. A dedicated internal phone number '9080' was provided and shared.

The Call Centre rapidly expanded to count five members of staff who manned the call centre seven days a week in shifts. After one week, eight call takers operated in two shifts with one medical coordinator and one link to remote ICUs and non-critical COVID-19 units. Members of staff

who were proficient in foreign languages were also recruited to the call centre in view of the ethnic background of our patients. Medical doctors from non-ICU departments in the hospital were relocated to join this group, to liaise between ICU physicians, the members of the Call Centre and the patients' relatives.

Psychological Support

Because of the novel and invisible nature of COVID-19, this acute challenge put a psychological strain on health care practitioners in the acute care setting of ICUs, where the background patient mortality rate is already 14%. In view of this and other factors, ICU belongs to the top three of work environments with a high burn-out susceptibility (Pastores et al. 2019). The harsh physical circumstances (double layers of protective clothes, face masks that injure nose and face, high temperature and difficult bedside manipulations of critically ill COVID positive patients) all contribute to this mental pressure, even in a skilled ICU crew. A Chinese cross-sectional study suggests that health care workers exposed to COVID-19 have a high risk of developing unfavourable mental health outcomes (Jianbo et al. 2020).

Therefore, the head of the ICU psychologist department was contacted, and a 'psychological support plan' for HCP was established. Two times per day, psychologists were present in the coffee room where medical doctors, nurses and other HCP took a break from work in COVID positive ICU's. Although mainly small talks were done, several colleagues had to be isolated with these psychologists because of sudden crying or panic attacks. A specific email address for psychological support was made available for all hospital staff, with optional support outside the hospital.

The psychiatric department was also contacted, but because of a high number of sick colleagues, they were not able



Image 5. Breathe



Image 6. CCU/ICU

to contribute. Relaxation and breathing exercises were demonstrated and shared on the communication platforms (Image 5).

Upgrading of Coronary Care Unit

The increasing patient flow and need for separation of COVID positive patients urged the need for extra ICU beds. A cardiologist with intensive care accreditation took the lead of this key element and created three ICU beds in the former CCU, which were supplemented with three quarantine beds at a later stage. Signposting and logistics were provided.

To be able to supervise ICU patients in this remote area, additional staff was

recruited: cardiologists and nephrologists were given crash courses in mechanical ventilation, inotropes and vasopressors and correct use of protective gear. A 24/7 surveillance was ensured, with direct liaison with anaesthesiologists and ICU physicians in case of specific technical procedures or questions (Image 6).

Non-COVID-19 Critically Ill Patients

A single senior staff member was made responsible for the medical care and supervision of medical treatment by clinical fellows and junior medical directors. Quality of care for these patients was not altered by the COVID-19 crisis.

Team Spirit

At the start of the pandemic, the senior management of ICU was assisted by a specialist in communication techniques and change management. This person proved to play an important role in communication between members of staff, because diplomacy might cease to exist in such a stressful situation. The professional approach of daily briefing sessions and follow-up of the activities of different working groups appeared instrumental in reducing the risk of potential conflicts among staff.

People Management

The head nurses of the ICU were engaged to fulfill the following responsibilities:

- Management of day and night shift of nurses, with attention to a fair spread of the work load in the harsh environment of the COVID-19 'war zones.'
- Incorporation of non-COVID ICU nurses in the pool, to reduce workload and to be prepared for drop-outs of ICU nurses because of illness.
- Supervision and liaison with the logistic department, facility care etc.
- Creation of new logistic areas where drugs, disposables and other material can be reached by HCP working in COVID and non-COVID zones.

The availability of medical ICU staff was optimised: the rotation of clinical fellows and junior medical directors to other departments was discontinued, which enhanced their presence in ICU. Cardiologists and nephrologists were recruited and were provided basic ICU knowledge. Clear algorithms were made with regard to when to reach out for assistance from medical ICU staff.

Anaesthesiologists, as a second in line medical specialist group, were invited to reorganise their organogram in order to be of assistance where needed. At a later stage, surgeons who volunteered to help were enrolled in the ICU step-down medium care to supervise critically ill

patients in the post-acute rehabilitation stage of disease.

The organogram of medical staff was profoundly changed, with days off scheduled randomly, in order to keep a 7/7 medical staffing present. Higher level in-house medical staff at night was organised, with three medical doctors at central ICU, one cardiologist and one resident at the remote CCU/ICU and three anaesthesiologists to cover the operating theatre and the remote recovery room – ICU. A junior staff member made daily adaptations to the medical staffing in terms of need.

Further assistance was offered spontaneously by medical doctors from various disciplines, who saw their own clinical activities downscaled. Non-medical assistance was highly appreciated too. An otorhinolaryngologist acted as supervisor for the call centre and assisted with practical issues. Medical doctors from the ART Department were in charge with supervising the Call Centre and with liaison. A urologist reached out and was added to a list of volunteers. She was subsequently relocated to the out-patient clinic for sick HCP.

A professor emeritus of oncology took over the scientific work: ongoing studies at ICU were put on hold, contacts with sponsors were made and administrative paperwork carried out by the data nurses. Prospective data registration of COVID positive patients was launched.

Conclusion

The approach of the COVID-19 pandemic at the ICU of Universitair Ziekenhuis Brussel was characterised by reshaping the structure of the department and assignment of different novel responsibilities. The design of the new structural ICU framework comprised seven specific building blocks, each chaired by a single dedicated ICU member of staff, who was made responsible for one of the following elements: macro level management, operational management, communication and psychological

support, creation of remote ICUs, non-COVID management, communication support and people management/logistics. Capacity of ICU beds was raised from 30 to 66 with a medium care up to 29 or 49 beds, medical and non-medical staff was recruited and crash course trained to occupy relevant work slots, medical management provided treatment protocols and Standard Operating Procedures, internal and external communication with patients' relatives was established, newly developed logistic algorithms were developed and the care for non-COVID ICU patients remained optimal. This narrative overview can serve as a template for other ICU departments worldwide confronting no-notice events such as the COVID-19 pandemic, to check their current practice, develop new ideas and copy whenever useful.

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Conflict of Interest

Elisabeth De Waele is an occasional member of the medical advisory board of Baxter Healthcare and consults for Baxter Healthcare, Fresenius-Kabi, Nutricia. She receives research grants from the Belgian Government, KCE, and unrestricted grants for clinical research. She is an Executive Board member of the European Society of Metabolism and Clinical Nutrition ESPEN. She declares no conflict of interest to this paper. Manu Malbrain is co-founder, former President and current Treasurer of WSACS (The Abdominal Compartment Society, www.wsacs.org). He is also co-founder of the International Fluid Academy (IFA,

fluidacademy.org), and is integrated within the not-for-profit charitable organisation iMERiT, International Medical Education and Research Initiative, under Belgian law. He is also a member of the medical advisory Board of Getinge (Pulsion Medical Systems) and Serenno Medical, and consults for Baxter, Maltron, ConvaTec, Acelity, Spiegelberg and Holtech Medical. The other authors have no potential conflict of interest with regard to the content of this review paper. ■

Key Points

- A tertiary Intensive Care Unit in Brussels, Belgium shifted to a COVID-19-centric ICU by developing seven building blocks: macro level management, operational management, communication and psychological support, remote ICU's, paediatric care, non-COVID management, and people management and logistics.
- A single dedicated staff member had final responsibility over one block.
- The ICU was optimally prepared for the arrival of a yet unknown number of severely ill COVID-19 patients, ready to upscale the care as patient numbers increased and ready to keep all staff involved, well informed and in the best possible shape to face the threat.

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