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Logistical and human aspects of the impact of the pandemic COVID-19

Aspects logistiques et humains de l’impact de la pandémie COVID-19

Catherine Bertrand (Senior researcher)\textsuperscript{a}
Eric Lecarpentier\textsuperscript{a}
Patrick Portecop (Medical Director)\textsuperscript{b}
on behalf WP3 and WP4 NO-FEAR
\textsuperscript{a}SAMU 94, CHU Henri Mondor AP-HP, 51, avenue du Maréchal de Lattre De Tassigny, 94010 Créteil, France
\textsuperscript{b}SAMU of Guadeloupe, Route de Chauvel, BP 465, 97159 Pointe-à-Pitre cedex, Guadeloupe

SUMMARY
This article summarizes the work carried out within the framework of the NO-FEAR project during the COVID-19 pandemic. Remote seminars, organized during each of the waves, enabled the challenges faced by clinicians in each of the project's partner countries, to be confronted. These rich exchanges sometimes served as a wake-up call by highlighting challenges to be anticipated. The retrospective analysis of shared experiences makes it possible to make proposals to better understand the next health crisis, in terms of human resources and logistics, particularly with regard to oxygen requirements. The response to pandemics requires coordination and cooperation between practitioners, suppliers, researchers and policy makers.

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RÉSUMÉ
Cet article résume les travaux menés dans le cadre du projet NO-FEAR pendant la pandémie COVID-19. Des séminaires distanciels, organisés pendant chacune des vagues ont permis de confronter les enjeux auxquels les cliniciens de chaque pays partenaire du projet devaient faire face. Ces échanges riches ont parfois servi de lanceurs d’alerte en mettant l’accent sur des défis à anticiper. L’analyse rétrospective des expériences partagées permet de faire des propositions pour mieux appréhender la prochaine crise sanitaire, au plan humain et logistique, notamment au regard des besoins en oxygène. La réponse aux pandémies nécessite une coordination et une coopération entre les praticiens, les fournisseurs, les chercheurs et les décideurs politiques.

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INTRODUCTION
The first wave of the pandemic took all countries by surprise, forcing them to implement drastic isolation measures and devote all health resources to the fight against the pandemic to the detriment of patients with other pathologies. Health care personnel became heroes who were applauded by the population. However, this health crisis has been a major disruptive factor due to its duration, the uncertainty of scientific data and the ubiquitous interference of the media and politicians.

All these elements have been factors of anxiety and ill-being. The societal result is dramatic with a delay in the management of chronic pathologies, unprecedented ethical problems, an increase in psychological and behavioral problems, sometimes leading to acts of violence, an effervescence of social networks and a division among the population between the “pro and anti” vaccines. The post-crisis period is conducive to in-depth reflection on the health system and logistics chain, particularly regarding the supply of oxygen, a major medicine in this pandemic. Healthcare

KEYWORDS
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MOTS CLÉS
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Corresponding author:
C. Bertrand,
SAMU 94, CHU Henri Mondor AP-HP, 51, avenue du Maréchal de Lattre De Tassigny, 94010 Créteil, France.
E-mail address: catherine.bertrand@outlook.com

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workers themselves were at risk of death despite barrier mea-
sures, personal protective equipment (PPE) and vaccine pro-
tection. Personnel feared endangering their families when
returning home. The latest waves brought out health personnel
"burnout," causing a shortage of medical and non-medical
staff. Since death by COVID-19 most often did not occur at
home, but rather in a care or accommodation facility, families
were deprived of mourning their isolated loved ones and of
funeral rites due to the overriding hygiene rules. As of now,
measures must be taken to better manage the end of the crisis
and anticipate future health crises.

THE IMPORTANCE OF OXYGENOTHERAPY

Treatment of patient acute respiratory distress led to invasive
ventilation by intubation, intensive resuscitation care with
prone position and, despite everything, a very poor prognosis
in cases with co-morbidities and advanced age. The paradigm
shift was achieved thanks to the alert launched by our Italian
colleagues, who were faced with sudden deteriorations in the
clinical condition of patients and were overwhelmed by the rate
of emergency hospitalization of the elderly population in par-
cular. In France, this situation made it possible to accept the
implementation of non-invasive ventilation with high volumes
of oxygen, despite initial reluctance due to the potential risks of
contamination by aerosolization. Every country showed inge-
nuity by implementing high-flow oxygenotherapy techniques
and reducing intubation and intensive care admission rates.
France promoted Boussignac’s CPAP (continuous positive
airway pressure), a very simple and safe non-invasive oxy-
genation system, equipped with a HEPA (high-efficiency par-
ticulate air) filter. It is used in pre-hospital or hospital settings,
as first-line treatment, especially for the elderly (https://www.
vyon.com/covid-19-use-non-invasive-oxygenation-cpap-
devices-prehospital-intra-hospital).

Patient monitoring on the 8th day consists of detecting signs of
hypoxemia, not clinical, but observed by the pulse oximeter.
The contribution of digital tools by start-ups for remote patient
monitoring (https://www.covidom-idf.fr/) does not allow for
early hypoxemia diagnosis, which can lead to sudden respira-
tory distress. This hypoxia, qualified as “happy” because
patients do not feel it, is one of the highlights of this pathology
and shows the limits of telemedicine when vital parameters are
not monitored.

As soon as the oxygen debt is observed, effective therapies,
such as anticoagulation and corticosteroid therapy, although
non-specific, are instituted.

The importance of oxygenation techniques, particularly non-
invasive, requires caregivers to take precautions against aero-
sols and equip themselves with PPE, which were sometimes
lacking and did not give satisfaction in terms of comfort and
use. Wearing PPE is responsible for management difficulties:
thermal discomfort, noise during displacements, difficulties
with oral communication, lack of identification, reduced tactile
sensitivity, reduced visibility with protective glasses. Caregiver
PPE needs in pre-hospital and hospital settings and the quan-
tity of masks required for the general public were not calculated
on the scale of such a pandemic and its duration. Stockpile
elimination, the same industrial restocking sources between
countries, weak logistics chains are at the origin of equipment
shortages. To hide these shortages, confusing, even contra-
dictory instructions were disseminated.

France has 15 medical dispatch centers. The paradigm shift
now consists of regulating hospitalization capacities by orga-
nizing home monitoring at the onset of the disease or by
discharging patients early, with a prescription for home oxygen
by extractors [1].

TRANSFER OF COVID-19 RESUSCITATION
PATIENTS

Patient flow management during the COVID-19 pandemic led
health establishments to cooperate in order to reduce the
workload and lack of resuscitation bed capacity in certain
areas of mainland and overseas France (NO-FEAR Webinar:
Medical and logistical constraints of COVID-19 patient air
transfers - YouTube) [2–4].

Duration of hospitalization prevents from being able to con-
sider a release of beds before three weeks. France is particular
in that it transferred patients by ambulance, trains, helicopters,
planes and even boats [5,6]. From March 2020, air transfers
began on national territory with civil and military air resources
[7]. Patient transfers must not destabilize their clinical condi-
tion and chances of recovery, but their condition must be serious
enough to justify continuing care in another intensive care unit.
Patient selection then falls on those on artificial ventilation,
posing the problem of changing ventilation and transfer modes
with a transport respirator that is often less efficient, and
underlies family acceptance. Transfer of patients on high oxy-
gen volume is not resolved given the quantity of oxygen
required and the safety aspects inherent in the aircraft cabin
oxygen concentration. France had to evacuate patients from
its overseas regions: Reunion, Mayotte, Martinique, Guade-
loupe and Tahiti. In these areas, it proved impossible to hospi-
talize all patients who needed it due to the lack of beds and
other human and logistical resources. Medical teams sent
on site were confronted with a young population that refused
vaccination for religious and cultural reasons. As a result,
medical teams had to carry out major evacuations of patients
over long distances. For these evacuations, very strict clinical
selection criteria were applied.

OXYGEN PROJECTION IN AN ISLAND
ENVIRONMENT

The COVID-19 crisis on the Guadeloupe archipelago demon-
strated the fragility of the medical oxygen supply in this archi-
pelagic island territory, which represents weakness in the
management of a biological or chemical health crisis.

Note that the very low vaccination rate in the archipelago as in
the other islands due to almost insurmountable cultural and
historical resistance created an increase in the flow of patients
to be admitted to intensive care. Hospital capacities however
do not make it possible to meet these needs for acute care or
medical services.

During the 4th wave of COVID-19, oxygen consumption at the
Guadeloupe University Hospital was multiplied by eight, while
in Martinique a near similar situation was cause for concern.
Usual average consumption was 800 L/24 h. During the 4th
wave, peaks reached 1500 L/24 h in June 2020 and 5500 L/
24 h in August (Fig. 1).
Resupply management helped prevent a total shortage. There is no industrial production of oxygen in Guadeloupe. Oxygen production in the Antilles region is provided in Martinique by the industrial company AIR LIQUIDE®, which has been present for 50 years as a virtual monopoly, with its site by separation of gases from the air. AIR LIQUIDE® imports these gases by sea to its facilities in Guadeloupe to distribute them. The high incidence of patients dependent on oxygen and increased capacity of critical care beds led to increased oxygen consumption in the two Antilles university hospitals. As these consumption levels exceeded the Antilles region’s production capacities, AIR LIQUIDE® had to resort to importing liquid gas from Guyana by sea with assistance from the French Navy’s Dumont d’Ursy.

In recent years, SOL® established itself in the Antilles, and offers solutions of the installation of oxygen concentrators, providing certain establishments with oxygen production in situ, which can be reinforced by the installation of oxygen cases.

PREPARING FOR THE FUTURE

Respiratory damage with inflammatory reaction impeded patient blood oxygenation, leading to silent hypoxemia underestimated by patients, hence the delays in treatment and sudden deterioration without intense oxygenation. Three lessons can be derived: the interest of having a pulse oximeter in any first aid kit, the interest of being able to oxygenate patients by oxygen extractor at home, which prevents hospital saturation, the need to rethink oxygen needs and its distribution in emergency services with the multiplication of outlets, and supplying remote and isolated regions. Oxygen is the essential remedy and is central to therapy. With the logistical difficulties in its supply, creating new high-speed devices are objectives for improvement. General reflection on securing oxygen distribution in the Antilles must lead to preventing shortage situations, particularly when it comes to managing exceptional health crises with sustainable kinetics. In the absence of an industrial production solution in Guadeloupe for redundancy, the issue of oxygen projection is proving to be a major component in anticipating the management of a lasting crisis.

Air evacuations benefit from civil-military cooperation and consideration at European level. The concept of the medical evacuation center (MEC) must be retained as well as that of medical coordination [8,9]. Medical teams must be trained for pre-hospital work. Installing an MEC near an airport and close to highways is an applicable strategy for many disasters. In case of a major event, the airport is always one of the first sites rehabilitated and secured. This is an example to be retained for major events in France and abroad and to be included in training.

The question of choice of transport respirators is raised as well as the constitution of monitoring batches, which can be mobilized to transfer a certain number of intensive care patients. Research and innovation to improve team safety during infected patient transfers must be pursued. One example is the Norwegian EpiGuard transport module, result of a medical and technological collaboration with Oslo’s University Hospital. Its use was publicized during the transport of Alexei Navalny to Berlin in August 2020. We can also mention the creation of the Morecambe Bay NHS Hood Powered Air Purifying Respirator (PAPR), result of a partnership between the teaching hospital...
of Morecambe Bay, BAE Systems and Lancaster. Areas of research are still to be explored to create PPE adapted to the risk of infection and to clarify the dangers of aerosolization. Consider the human factor. No need to address the social networks. It is clear that beliefs and representations, including in the medical profession, have been sources of resistance and therapeutic delay: how could we believe in the severity of this flu? How could we believe that a vaccine could be produced in one year? How could we believe that a messenger RNA vaccine would be safe and effective? The absence of real-time scientific data or the rush of major journals to publish unconsolidated results have contributed to the difficulty of medical and political decision-making. Politicians could not be relieved of the obligation to make socially difficult decisions because they were not based on evidence. An effort must be made to establish clear communication channels, concise updates (and not huge emails). Leadership must show agility, just as it is necessary to rethink educational curricula to allow more flexibility for staff, according to the needs for services and health emergency units. One of the greatest challenges during the pandemic has been the need to reassign staff to new tasks and train them during a time of crisis, particularly face-to-face, due to the practice of specific resuscitation gestures. This also increased staff stress levels. At the beginning of the pandemic, staff was very motivated, but then hospitals had to face personnel shortages. Some became sick, or came into contact with an infected person, or took medical leave, especially when PPE shortages impacted their confidence. This underlined the need for medium and long-term psychological and social support, in permanent connection with reassuring communication and information on the evolution of the disease [10,11]. Video technology enabled a certain degree of safe "face-to-face" meetings, and to promote online information. It facilitated remote work, but there were shortfalls in terms of human relations and tended to cause fatigue. Telemedicine was put forward. It will remain a useful tool but is not the only solution. Design of hospital structures must strive for versatility. Rooms with two beds became a problem. Hospital installations must be adapted: emergency and intensive care units. Hospitalization at home must be improved. Has the COVID-19 pandemic been a disaster? Yes, during the first wave in Italy, it was, and all principles of disaster medicine were applied [12]. Yes, it was in the overseas regions. In Italy, since 2020, the situation sparked an ethical discussion on end-of-life procedures with the notion of an age limit, highlighting the situations encountered in establishments for the elderly. In these nursing homes, advance guidelines could not be collected due to the lack of availability of attending physicians able to explain the situation. Then, criteria other than age were retained after individual evaluation. This was the case in the overseas departments where the population is young. Clinical criteria were then used to prioritize access to care and do the best for the greatest number according to multidisciplinary consensual proposals.

CONCLUSION

Regular exchanges between the 18 partners of the NO-FEAR project enabled a transversal approach to the management of this crisis. Each country experienced the same problems but in different time frames. The mystery of the exact origin of the pandemic from the Wuhan market and the lack of scientific certainty have contributed to confusion, concern, even anguish. Uncertainty is incompatible with medical fact. We must prepare to be surprised and not just according to the previous episode, but also anticipate, prepare relentlessly and maintain a constant effort. Investing in medical research, identifying one’s own areas of weakness when all countries have the same needs for drugs, protective equipment, oxygen, are actions to be taken. A pandemic plan worthy of the name must make it possible to deal with the event without compromising the treatment of other patients not affected by the pandemic and must consider the human factor.

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The authors declare that they have no competing interest.

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