



Lessons learned from the COVID-19 pandemic in a North African country (Tunisia)

Leçons tirées de la pandémie COVID-19 dans un pays Nord-Africain (Tunisie)

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INTRODUCTION

The coronavirus disease 19 (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been one of the greatest challenges worldwide (1, 2). After two years and half, it is time for reflection on what was done and what should have been done in order to draw lessons for future pandemics. Till August 16 2022, there were 584,406,896 cases worldwide with 1% deaths; as for Tunisia, 1,134,660 with 2% deaths (3, 4).

WHAT WAS DONE?

Public health response

Fortunately, during the first surge (March 2020-May 2020), the public health response of the Tunisia was precocious with a first meeting at the health ministry in February 2020, a month prior to the start of the pandemic. Rapidly, crisis management units were implemented both nationally and locally, to establish the needs for healthcare workers, supplies and structures (5). Several measures were carried out such as lockdowns, social distancing and contact tracing. Initially, the control of COVID-19 cases was a success, however, as the pandemic persisted, the government couldn't sustain these actions due to economic and political issues. On the other hand, there was trouble gaining the public's trust and people rarely followed the government instructions. This reflected the lack of preparation for eventual health crisis, as predicted by a review, published prior to the COVID-19 pandemic, about the preparedness for influenza pandemic in the eastern Mediterranean countries (6).

Media

At first, official media sources didn't release well-timed educational advertisements. It is only, after a couple of months of the pandemic, that experts have been invited to enlighten the public on the appropriate evaluation of the crisis (7).

Cultural competence in health care

Regrettably, the current healthcare system couldn't provide equal opportunities for high and low socioeconomic status. In some occasions, patients from high social status were more easily admitted to oxygen wards or intensive care units (ICUs) (7).

Civil society and private sector

The role of civil society revealed to be invaluable. Donations from individuals helped obtain missing equipment such as high flow nasal cannula oxygen therapy, a technique delivering a high flow of heated and humidified gas; ventilators and personal protective equipment (PPE), even though at some point, there was a mismanagement of these resources. Furthermore, the collaboration with private sector was absent. Patients admitted to private clinics had to pay exorbitant amount of money to access care.

Fear and preparedness

At the beginning of the pandemic, many obstacles arose. There were difficulties in redeployment of healthcare workers; increase of ICUs capacities and misuse of PPE (5). Hospitals lacked effective control over the workforce that, initially, resisted joining ICUs, even those with ICU training. The recruitment of ICU trainees took a long time to be effective. Some hospitals refused to take in COVID-19 patients, during the first surge, arguing they were short of isolated beds, air lock rooms, videolaryngoscopy and PPE. This resistance was mainly due to fear of a new disease and an underestimation of the severity of the pandemic (8, 9).

Medical ICUs (MICUs) preparedness

At first, only two MICUs across Tunisia were operating (10 beds-MICU, Abderrahmen MAMI University Hospital, Ariana and 10 beds-MICU, Farhat HACHED University Hospital, Sousse). A field hospital (La Coupole Field Hospital, Tunis) was created instead of investing in 12 remaining teaching MICUs and another 10 surgical ICUs.

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These departments took in patients, only, during the second (August 2020-May 2021) and third (June 2021-September 2021) surges, when COVID-19 patients exceeded ICUs capacities. In eight over twelve MICUs, 70 ICU beds were mobilized with redeployment of 147 nurses with a ICU-Nurse/ICU-bed ratio at 2/1, one ICU nurse and one ICU trainee, instead of the recommended ratio of 3/1 (10). As one of the two MICUs that participated in the first surge, the MICU of Farhat HACHED University Hospital faced many challenges. For instance, it revealed to be difficult to recruit healthcare workers and to increase ICU beds. Laboriously, the MICU managed to add a third unit to, already existing, two units in the same department, a fourth unit was created by transforming a wing of Ear, Nose and Throat department into temporary 8 beds-ICU (11). The number of paramedical staff went from 17 to 41 and the number of ICU beds went from 10 to 23, over a one-year period (August 2020 to August 2021). On the other hand, the number of attending senior physicians and interns remained the same.

Emergency department and pre-ICU management

When it came to patients' management, fear was a major reason to avoid consulting emergency departments. Many underestimated their symptoms and had home healthcare management, even had home oxygen therapy. A second reason for patients' increased severity was the longer stay in emergency department due to shortage in ICU beds especially during the second and third pandemic surge. This resulted in longer pre-ICU management delay and severe clinical presentations at admission but also diagnostic discrepancies for both COVID-19 and non-COVID-19 patients resulting in some cases in severe consequences and even death (unpublished data). A study performed in MICU of Farhat HACHED University Hospital, yet to be published, showed that a mean pre-ICU management delay of 2 days was an independent risk factor of mortality (unpublished data).

Fear and aerosolization

One particular situation, where fear of COVID-19 was predominant, was the fear of aerosolization. Vented non invasive spontaneous breathing support like non-rebreathing oxygen mask, continuous positive airway pressure, in which a constant level of pressure is continuously applied to the respiratory tract of a patient; high flow nasal cannula; nebulization and intubation without videolaryngoscopy were avoided (12). Due to the considerable scale of the pandemic and the fear from aerosolization, non-vented non invasive positive pressure ventilation has been over-utilized for COVID-19 related moderate to severe acute hypoxemic respiratory failure, to avoid invasive mechanical ventilation and improve patient outcome. While its indication remained a matter of debate, its use could have promoted patient-self inflicted lung injury. The Japanese Society of Intensive Care Medicine and The Japanese Society of Respiratory Care Medicine recently came to suggest conducting non invasive positive pressure ventilation over tracheal intubation as an initial management for adult patients with acute respiratory failure suspected of having acute respiratory distress syndrome (ARDS), an inflammatory lung injury as defined by the Berlin definition (13, 14).

Intensive care management of the critically ill

In Farhat HACHED MICU, management of COVID-19 pneumonia has been challenging in many aspects. Pre-ICU occurring patient-self inflicted lung injury substantially contributed to the severity of invasively ventilated COVID-19 patients, probably due to delirium and poorly applied non invasive positive pressure ventilation without a constant reassuring medical presence with sometimes delay in intubation due to ICU beds shortage. Patients' prognosis was determined by pre-ICU management as previously stated but also determined by ventilatory ratio, (15) a good surrogate of the severe alteration of the lung mechanics resulting from the addition of the patient-self inflicted lung injury to the first viral lung injury. We can come to the conclusion that, decreasing mechanical power applied to the lung parenchyma (volume, pressure, flow and respiratory rate), increasing lung homogeneity (positive end-expiratory pressure; proning; recruitment), and, cycle by cycle, avoid reaching the visco-elastic limits of the ARDS lung (protective ventilation) should be the paramount goals for a gentle lung ventilation strategy in ARDS.

Scientific society, research and innovation

The World Health Organization database revealed that, in 2020, 3547 trials were registered in ClinicalTrials.gov, concerning one single disease which is COVID-19 (16). In contrast, in Tunisia, there were little local and national scientific publications due to increased workload. The scientific societies found it difficult to organize multicentric studies. In Farhat HACHED University Hospital, an attempt at a multicentric trial on Hydroxychloroquine, was conducted by a multidisciplinary team but didn't come to fruition. However, there were a rise in innovative techniques, engineers and medical experts came together to create prototypes of high flow nasal cannula, ventilators and even syringe pumps.

WHAT SHOULD HAVE BEEN DONE?

According to Haldane et al. (17) an effective public health response relies on several basics, of which, pathogen identification and exposure, monitoring spread in community, breaking chains of transmission and risk communication. These goals have to be reached while being, localized, responsive, integrated and equitable. Public health systems must be reinforced to that order. Political and economic resources have to be put in place in order to ensure that lockdown and quarantine measures are respected. For low-middle income countries, this can be arduous to attain. The international community must tend to lessen the unbalance between developed and low-middle income countries in terms of access to vaccination. Besides actions must be taken to ensure public's trust in vaccination (18). Other community forces have to join and assist governments in the endeavor, namely, civil society and local organizations. Their objective would be to provide social support. Furthermore, a close collaboration should be implemented with private sector, right off the bat, in order to

enhance overall capacities. When it comes to risk communication, clear and rapid reports should be enforced to gain trust, and avoid a pandemic of misinformation especially propagated by social medias (19). Governments should rely on scientific data to carry out adequate policies (20). It would have been helpful to invest in mathematical models and artificial intelligence that can provide early predictions to plan the inventory of supplies and hospital capacities and to identify possible shortages (21). To better prepare for future pandemics, it is necessary to establish a national panel of qualified politicians, scientific clinician experts and other regional and national competences.

At the start of their career, healthcare workers should be recruited in the ICU for at least 3 years, so that all will have ICU training. They should depend on a human resources department to improve responsiveness to an eventual pandemic. Besides, they should benefit from regular training courses led by the department of hygiene. As for health assistants, it would be better to turn to subcontracting agencies to avoid shortage. The pre-ICU management can be visualized in the following manner: dividing hospital capacity to three areas; oxygen wards, a buffer area and ICU. An emergency department triage will dispatch patients in one of these areas. Oxygen wards will receive patients with minimal acute respiratory failure; the buffer space, as a temporary ICU, will receive patients with moderate acute respiratory failure and severe patients will be hospitalized in ICU. Similar dispositions were performed by 280 ICUs located in 46 countries as mentioned by the Unite study (22). Healthcare workers without ICU training will be redeployed to oxygen wards and buffer areas; healthcare workers with ICU training and ICU trainees will be redeployed to ICU. The buffer area can be created by dedicating two medical wards to this effect as was done by French ICUs (11). This area will be under the care of intensivists that will undertake daily rounds to detect patients at risk of ICU admission. In this fashion, management quality and delay can be improved. One important fact is that more consideration should have been given to research. A third party multi-disciplinary and multicenter research network and waived consent models would be of great help when clinicians are occupied tending to patients care (23). At the beginning of the pandemic, protocols should have been implemented. Protocols, such as studies to measure prevalence; clinical trials to compare treatments; prognostic studies; multicentric studies; innovation research; collaboration with engineers and so on and so forth. In this aspect, the department of epidemiology could be helpful to collect data and report findings.

CONCLUSION

This pandemic unmasked shortage of adequate health structures and material, a resistance from personnel with lack of organization. To correct these factors and behaviours, there are several aspects that can be used, such as facilitation and maintenance of said behaviours but also repression when previous actions fail to achieve wanted objectives. This pandemic challenged

healthcare systems, worldwide. Many countries presented a lack of preparation, as they were under enormous pressure. From this perspective, after more than two years and half of pandemic, a look into the past will enhance public health responses, in the future. Box 1 highlights the main points of this paper.

Box 1. Highlights

1. A lack of preparedness was mainly observed in terms of public health response. Public health systems must be reinforced while being localized, responsive, integrated and equitable.
2. Fear was the main impediment to personnel redeployment but also, in some cases, to COVID-19 management.
3. This pandemic unmasked shortage of adequate health structures and material, a resistance from personnel with lack of organization. To correct these factors and behaviours, there are several aspects that can be used, such as facilitation and maintenance of said behaviours but also repression when previous actions fail to achieve wanted objectives.
4. Management of COVID-19 pneumonia has been challenging. Patients' prognosis was mainly due to pre-ICU management delay and ventilatory ratio in the critically ill. Delirium and poorly applied non invasive positive pressure ventilation (NIPPV) probably resulted in patient-self infected lung injury (P-SILI).
5. Several aspects of dealing with COVID-19 pandemic can be ameliorated such as the collaboration between public health sector, civil society and private sector; the better redeployment of healthcare workers and better organization and management.

NIPPV, non invasive positive pressure ventilation; P-SILI, patient-self infected lung injury.

Competing interests

All the authors certify that they have no affiliations with/or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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