



Building better hospitals for the future:

Lessons from the COVID-19 pandemic

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Houssin D, Bassil M. Building better hospitals for the future: Lessons from the COVID-19 Pandemic. Doha, Qatar: World Innovation Summit for Health, 2022.

ISBN: 978-1-913991-17-3

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FOREWORD

For many hospitals across the world, the COVID-19 pandemic has been both revealing and stressful.

Due to the remarkable resilience and perseverance of the healthcare workforce, hospitals were able to save the lives of many patients weakened by the virus, even within an unprepared or sub-optimal healthcare context. The dedication of hospital personnel and the solidarity within and between hospitals (even across different regions or countries)¹ were essential in helping to turn the tide in the fight against COVID-19.

Nonetheless, many hospitals were overwhelmed by COVID-19 patients, reaching or exceeding capacities in terms of hospital beds and human resources during pandemic peaks. In many countries, the hospital sector already had weaknesses, including staff, bed or equipment shortages, which exacerbated the impact of the pandemic. Many hospitals also lacked the necessary infection control equipment required to provide sufficient protection for their personnel, who faced an unprecedented workload during this time.²

Across countries, many health and hospital authorities have reached the same conclusion: hospitals must be better equipped, more resilient and better prepared for future pandemics.³ This policy paper outlines the main areas of weakness exposed throughout the crisis and provides recommendations for strengthening our hospitals to ensure that we are prepared for future pandemic shocks.



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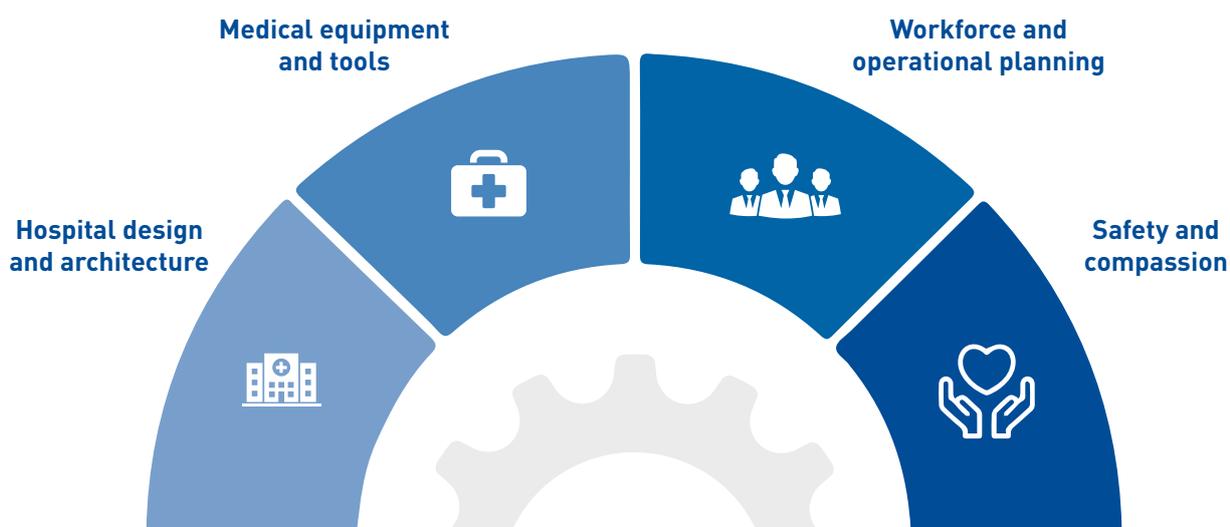
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INTRODUCTION

Since its onset, the COVID-19 pandemic has shown that many hospitals are ill-equipped to handle the surge in demand for services brought on by the disease. They often lack co-operation and co-ordination. There is insufficient capacity, in terms of infrastructure, equipment, funding, and human resources. And hospitals haven't been able to adapt when it comes to redistributing resources during a crisis.

This paper outlines the main areas of weakness exposed during the pandemic and how hospitals can improve in these areas to address future shocks. Figure 1 shows a summary of the areas hospitals should target to strengthen to prepare for the future.

Figure 1. Target areas hospitals should strengthen



Hospitals do not exist in a vacuum: the actions of regional, national, global entities, and other interrelated sectors, can greatly affect hospitals' ability to provide quality care. For instance, national governments are usually responsible for procuring vaccines, pandemic regulations and restrictions, and other key factors that slow the spread of disease and reduce caseloads. However, this paper focuses solely on the areas that hospitals can influence directly. The report looks at hospital design, medical equipment and tools, workforce and operational planning, issues of patient safety, and the importance of ensuring compassion during a pandemic – with an eye toward improving the preparedness of hospitals for future shocks. The report concludes with recommendations for health policymakers in all the target areas – recommendations that can be adopted as first steps to prepare for the future of hospitals post-COVID.

SECTION 1: HOSPITAL DESIGN AND ARCHITECTURE

1. DESIGN FLEXIBILITY

During the COVID-19 pandemic waves, hospitals adopted an emergency response, replanning and redesigning the use of their buildings almost overnight. In many places, this switch to ‘pandemic mode’ involved ensuring surge capacity, either by converting existing buildings, stadiums or conference centers to COVID-19 units, or by building entirely new hospitals to accommodate these patients. Such measures were sub-optimal. They highlighted the importance of flexibility and having extra capacity available before a crisis occurs,⁴ and underlined the importance of long-term strategies that anticipate future pandemics.⁵

Engineers already take into account emergencies such as natural disasters and mass shootings in hospital design. Future design strategies should focus more on pandemic preparedness, reinforcing existing design elements that support emergency preparedness. These plans should account for flexible spaces that can be transformed and reused after crisis events have ended. For example, when additional intensive care beds are no longer needed, they may be used as overflow wards during the winter season, or as training areas for medical students and residents.⁶

Redundancy in design – or extra space – is often rejected because it can add complexity and costs. It may not comply with set standards and codes, and its benefits may be long-term rather than immediate. Yet the pandemic has shown that not having extra space can significantly disrupt operations and hospital services during times of stress, which may be even more economically damaging.⁷

Merely including extra space within departments is not sufficient, however, as hospital equipment is often complex and cannot be simply ‘plugged in’ to any existing space. For example, while medical gas systems could theoretically be extended within hospitals, existing pipework is often not large enough to accommodate this change. Extending pipework during the design phase would have a marginal influence on the overall cost of hospital construction, particularly in comparison to the cost of doing so after initial construction is complete. Therefore, instead of designing hospitals based on the strict minimum set out by codes and standards, designs should be flexible. As WSP (2020) says: “flexibility is now the most valuable component of healthcare buildings.”⁸ A process known as ‘value delivery’⁹ can help planners to decide which features to invest in to maximize flexibility while being cognizant of overall costs. This involves breaking down a project into separate component clusters and evaluating the added value of each one.

Following the COVID-19 pandemic, many hospitals are considering focusing on: more infectious disease sectors/rooms or flexible spaces that can be easily converted; larger emergency departments,¹⁰ with an increasing emphasis on the compartmentalization of air flows;^{11,12} and increased use of technology, telemedicine, and artificial intelligence to increase adaptability.¹³

2. CRITICAL CARE BED CAPACITY

To provide quality patient care during a medical surge such as a pandemic, it is important to be able to scale-up, repurpose and redistribute capacity in a timely and efficient manner. Yet doing so can be a complex and costly endeavor, as evidenced by the experience of hospitals during the COVID-19 pandemic.

The following lessons have emerged for effectively addressing critical care bed capacity during a healthcare shock:¹⁴

- Scaling-up and having sufficient capacity are more challenging for systems that typically have high bed occupancy rates.
- Rapid scale-up is possible through co-operation with other sectors. Increasing a hospital's capacity in critical care beds can be done by relying on beds from the military or private sectors, as well as through transferring patients to different hospitals, cities, or even countries.
- Increasing the number of beds or available space for critical healthcare provision needs to be accompanied by an increase in human resources or healthcare personnel.
- Co-ordination and open communication are crucial within the medical equipment supply chain to ensure that beds are fully equipped and operational in a sustainable manner.
- Transparency and availability of real-time data are essential for the efficient management of resources. Having efficient hospital information systems is critical.
- Funding and being able to redistribute finances and mobilize additional resources in a time of crisis are important requirements for scaling-up.

Having sufficient critical care beds is key – however, it is also important not to neglect primary care's role in managing patient demand, and to prioritize admission of patients who cannot be treated in ambulatory care.

3. PATIENT FLOW AND COMPARTMENTALIZATION

Two of the most important hospital design considerations for effectively managing patients during pandemic shocks are: patient flow – how patients move through healthcare facilities; and the ability to separate infected from non-infected patients – known as compartmentalization. Several hospital design models have been analyzed within the context of the pandemic, with varying levels of success.¹⁵

A condensed or compact vertical design model can decrease the distances that patients need to travel within hospitals by organizing services around the patient. This ensures short distances and links between the emergency room, medical imaging, operating rooms, and intensive care unit (ICU). If the post-interventional surveillance rooms are transformed into temporary resuscitation units, the proximity between the aforementioned services allows this area to be transformed into a dedicated COVID-19 unit.¹⁶ Another option involves distributing services horizontally around a medical-technical platform placed over two floors. This model offers multiple routes to facilitate patient flow.¹⁷ Overall, both models revolve around the importance of having facilitated patient flow to reduce travel time, and separating infected from non-infected patients.

To achieve this, a viable policy proposal would be to, where possible, compartmentalize emergencies by segregating patients who are exhibiting symptoms of transmissible infections as soon as they enter the hospital. This could include a ‘multimodal’ entry portal – separating infected patients in emergency rooms by using technology such as air sensors or biometric identification.¹⁸ Yet this model must work within existing fire safety regulations and ensure that all patients have access to all emergency room services and resources.

Another important way to manage and reduce patient traffic is through using telemedicine. This allows some services to be provided remotely, limiting exposure to potential infection for patients who do not require hospital care.¹⁹

SECTION 2: MEDICAL EQUIPMENT AND TOOLS

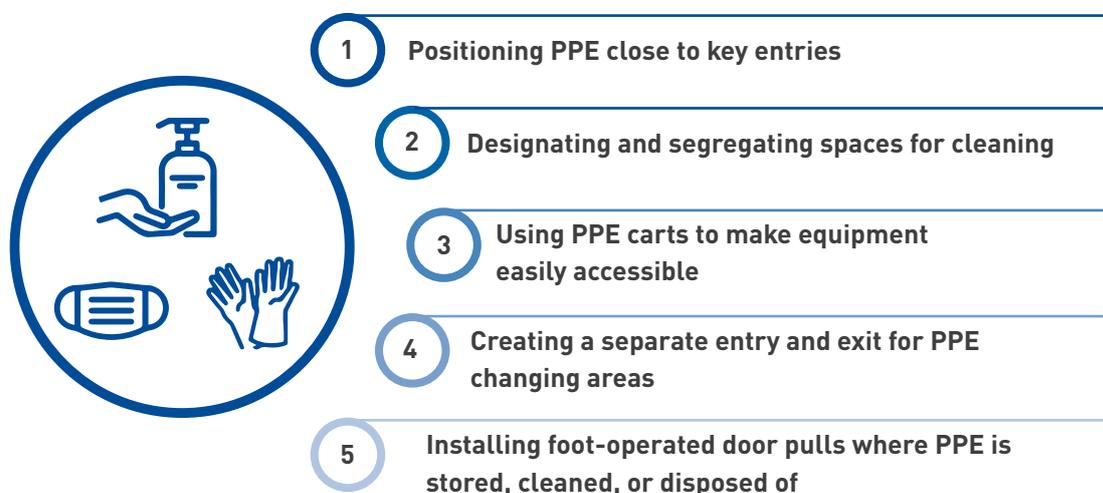
1. PERSONAL PROTECTIVE EQUIPMENT AND INFECTION CONTROL TOOLS

Infection control measures help to protect patients and healthcare workers from disease – a key priority for hospitals. Personal protective equipment (PPE) and infection control tools – including hands-free technology and air purification systems – are key components of hospital strategies to prevent the spread of disease, particularly during pandemics.²⁰ For instance, treating a single COVID-19 patient in the ICU requires an estimated 36 pairs of gloves, 14 gowns, three pairs of goggles, and 13 N95 face masks.²¹

It is essential that all hospitals have a comprehensive PPE strategy that ensures adequate supply, placement, and training for staff. While most PPE procurement, production, and supply chain considerations are primarily influenced at the national and regional level – and therefore outside the scope of this paper – hospitals also play a role in obtaining a steady and adequate supply of PPE. Tools such as the US Centers for Disease Control and Prevention (CDC) personal protective equipment burn rate calculator can help hospitals to calculate the consumption rate of different types of PPE at their facilities.²² Identifying a facility’s consumption rate enables hospitals to estimate the sustainability of their current stocks and determine when to place new PPE orders to maintain a steady supply.

In addition to supply, hospitals should have a clear strategy to ensure that PPE is used effectively, as shown in Figure 2.

Figure 2. Strategies to ensure effective PPE use



Source: Ifasso et al. (2020)²³

These strategies should also include staff training for PPE use, especially procedures for putting on and removing PPE properly.

Important infection controls within the hospital remit also include ensuring air purity and the safety of touchable surfaces.²⁴ Strategies to prevent the spread of pathogens on surfaces include installing touch-free controls, using materials that are less hospitable to pathogens (such as stainless steel), and installing electric switchable privacy glass (with opaque and translucent functions), instead of using window curtains.²⁵ From a more technical point of view, issues relating to air handling, compartmentalization or air filtration could also improve air purity.^{26,27}

As pathogens are transmitted in a variety of ways, it is essential to have an all-risk approach to infection control. This starts with a thorough risk assessment and identification of weaknesses in managing the transmission of different types of pathogens.

2. RESPIRATORY SUPPORT

The COVID-19 pandemic showed that many hospitals were unprepared to provide adequate respiratory support – ventilators and sufficient medical oxygen supply – during times of peak demand. For instance, at the beginning of the pandemic, there were an estimated 160,000 ventilators available in the USA, but a projected need for several hundred thousand in case of a COVID-19 surge.^{28,29} Investments in these tools will be needed beyond the COVID-19 pandemic, since respiratory support is essential for many other diseases.³⁰

Ventilators have been one of the most important tools for fighting the pandemic. However, as for PPE, many of the strategies to improve procurement and increase supply are above hospital level and so beyond the scope of this paper. However, it is important to note that, at the beginning of the pandemic, many hospitals were mostly focused on acquiring and relying on ventilators. This sometimes led to a diversion from other necessary preparations, including PPE and oxygen supply.³¹ Hospitals should set clear priorities at the outset of an emergency to ensure that no necessities are neglected.

The importance of medical oxygen supplies was highlighted in India and Nepal, where the lack of supply had a detrimental impact on the survival of COVID-19 patients. Patients were eventually expected to arrive at the hospital with their own medical-grade oxygen.³²

Different oxygen supply tools are available (liquid oxygen plants, pressure swing absorption oxygen plants, oxygen concentrators, oxygen cylinders), each with advantages and disadvantages. Choosing which oxygen supply to rely on depends on several factors, including the quantity needed, funding and infrastructure available, local supply chain, dependability of local electricity supplies, and capacity to properly maintain these tools. Regardless of the oxygen sources chosen, it is important that hospitals always have oxygen cylinders available as a back-up.³³

Another important consideration is the way oxygen is distributed to hospital equipment. This can be through an intra-hospital pipeline, which allows for oxygen distribution without having to transport heavy oxygen cylinders. Nevertheless, these pipelines require significant funding and trained personnel for their installation and maintenance.³⁴

3. DIGITAL HEALTH SOLUTIONS

Digital health tools have facilitated monitoring and surveillance activities. To some extent, they have also been efficient in relieving hospitals that have been overwhelmed by COVID-19 cases. They have done this by permitting:³⁵

- remote continuing care for patients with chronic diseases, thus reducing their risk of transmitting or contracting the virus by visiting the hospital, and
- remote patient triage – for example, non-emergency ambulance calls can be diverted to a remote video consultation, avoiding unnecessary mobilization of ambulances and emergency room entries.

Investment in electronic diagnostic tools could be an important asset in supporting overwhelmed hospital staff during various emergency crises – including pandemics, terror attacks, or natural disasters.³⁶ However, hospitals should consider that integrating and using digital health tools depends on the legal framework available in their country.

SECTION 3: WORKFORCE AND OPERATIONAL PLANNING

1. HEALTH STAFFING

Throughout the pandemic, staff shortages and insufficient health workforce supply resulted in a disruption in care for COVID-19 patients. This also affected patients with chronic disease, such as cancer, or those expecting surgery.³⁷ In response, hospitals either mobilized the existing workforce, recruited new personnel, or both. The following points are considerations for the workforce:³⁸

- Data on the existing workforce needs to be available – including their skill profiles – before implementing changes.
- The workload of existing staff can be increased by prolonging hours or cancelling or postponing vacation days – though this risks burnout and mental health consequences.
- Modifying and adapting staff tasks according to their skillsets can help in optimizing staff mobilization.
 - ➔ This is facilitated when strategies for well-developed and organized task shifting are already in place.
 - ➔ Appropriate training and retraining, adapted to specific skillsets, are crucial for success.
- Some tasks can be shifted to non-practicing healthcare professionals, such as medical or nursing students, retired healthcare professionals, or volunteers. Keeping an updated register of reserve/retired staff and volunteers can facilitate this process.

Burnout and poor mental health of healthcare personnel can have a detrimental impact on their abilities to provide adequate healthcare services. Ensuring staff wellbeing is crucial, and can be done by:³⁹

- supplying appropriate PPE for personnel,
- providing financial support by giving bonuses and rewarding extra hours, which can make staff feel appreciated and recognized for their hard work,
- responding to some of the workers' practical needs, such as providing childcare and transportation options or housing for staff who live with vulnerable individuals, and
- training staff in pandemic preparedness and response, which can increase confidence and prevent workers from feeling overwhelmed.

2. CONTINGENCY PLANNING

Initially conceived to manage a large flow of victims in a hospital, contingency plans (*plan blanc* in France) were an essential tool throughout the pandemic. These plans include reallocating resources to departments with the greatest need, particularly critical care departments, and deprioritizing non-urgent services.⁴⁰

The main objectives of contingency plans include:⁴¹

- guiding healthcare staff, health authorities and management bodies through stressful periods,
- ensuring efficient care for patients and the safety of healthcare personnel,
- limiting pathogen transmission, and
- addressing staff shortages, optimizing the distribution of healthcare staff, and mobilizing them in an ethical and organized manner.

Contingency planning can help hospitals optimize their spaces to create temporary COVID-19 specialized units, including:⁴²

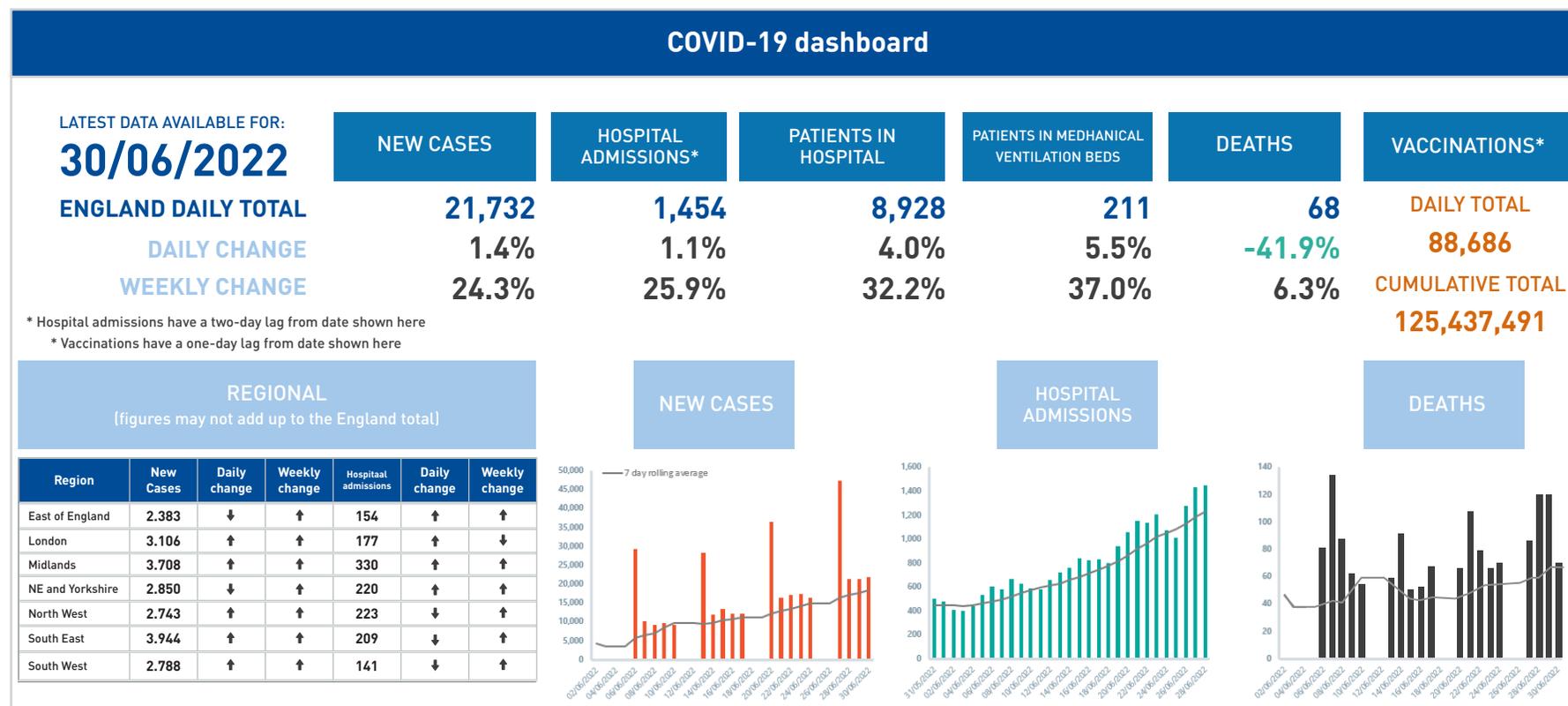
- intermediate care units used as ICUs, if nurse-to-patient ratios are adjusted and proper medical equipment is made available,
- resuscitation units and post-recovery units used as critical care units, if non-urgent surgeries and procedures are postponed, and
- adapting spaces close to the ICU, if respirators, medical oxygen, and vacuum supplies are brought in.

In the most extreme situations, when the number of COVID-19 patients in a critical stage exceeds the capacity of the critical care sector, hospitals should abide by specific inter-hospital patient transfer protocols to transport patients to other institutions, regions, or countries that are specially equipped for intensive care.

3. DATA COLLECTION

Many hospitals have collected comprehensive data throughout the pandemic, capturing information about the number of COVID-19 patients and deaths, the percentage of critical cases, changes in bed capacity, health workforce distribution, and more. This data (see Figure 3 for an example from England) combined with data from national surveillance sources, has allowed hospitals to anticipate surges in cases and increased demand for scarce resources, such as critical care beds and ventilators.

Figure 3. England's COVID-19 dashboard



Source: NHS Providers, example from 16 June 2022.⁴³

While not always fail-safe, this information allows hospitals to enact contingency plans and staffing changes to ensure care quality.⁴⁴

In general, robust data allows hospitals to evaluate the adequacy and efficiency of changes made in task allocations, bed distributions and contingency plans. Yet tracking the immediate and long-term impacts of these strategies is only possible if adequate data-collection strategies and mechanisms are adopted from the beginning.⁴⁵

Moving forward, hospitals must ensure that data-collection systems are robust, appropriately funded, and agile enough to take advantage of improvement opportunities and prepare for future pandemic shocks.

SECTION 4: SAFETY AND COMPASSION

1. PATIENT SAFETY AND WELLBEING

All of the issues addressed in this paper contribute directly and indirectly to the main objective at the heart of global healthcare delivery, whether during a pandemic or 'normal' times: patient safety.⁴⁶ In addition to the actions already discussed, it is crucial that we engage with patients and the public, to actively involve them in their care and in strategies to reduce the spread of infectious diseases such as COVID-19.

In addition to a patient's physical safety, hospitals must also consider their mental wellbeing. This is particularly pertinent during crises such as a pandemic, and highlights the important support that families provide. The physical presence of family has, however, been interrupted during COVID-19, as visiting restrictions were put in place to reduce the risk of transmission. Health systems were urged to develop alternative family-centric strategies to support patients, relying on tools such as videocalls. Effective strategies should include the following objectives:⁴⁷

- putting family members in contact with the patient, and respecting their roles as caregivers,
- allowing collaboration between the family and healthcare personnel to ensure their involvement in decisions regarding their loved one's wellbeing, and
- maintaining and respecting the family's integrity.

Yet relying on videoconferencing and internet-based tools assumes that families have access to these technologies and know how to use them – this could lead to socioeconomic discrimination. It is therefore important to assess individuals' access to and ability to use these resources, and to develop strategies to overcome any barriers.⁴⁸

Hospitals may also decide to make exceptions to visiting restrictions for family members when this presence is necessary for patient protection. Examples include patients suffering from severe neurocognitive disabilities, mothers in labor or in post-partum, and under-age patients in pediatrics. However, these exceptions must be clearly and transparently stated and communicated to ensure equitable treatment of patients.⁴⁹

As we move out of the pandemic and toward a more 'normal' state of affairs, it is essential that hospitals continue to put patient needs at the center of care, and continue to support family involvement.

2. DIGNITY AND COMPASSION

Unfortunately, the COVID-19 pandemic has resulted in a tremendous loss of life, bringing into focus the delicate role that hospitals play for patients and families at the end of life. Situations where patients are near the end of their lives are particularly difficult and require the utmost respect for the patient's and family's feelings. Difficult conversations such as ones involving transferring the patient to palliative care need to be handled delicately and can be done over videoconference if necessary.⁵⁰

The COVID-19 pandemic has challenged the management of a body after death in hospitals and at funeral homes, especially as cases were surging and services were overwhelmed. The World Health Organization (WHO) published guidelines on the management of patients who had died from the virus, including allowing family members to view the body before cremation or burial, without kissing or touching the body. The family's right to see and bury the body, based on their beliefs or religious rituals, should be fully respected, within WHO guidelines.⁵¹ These rituals and the performance of last rites are sometimes essential for families to be able to grieve and accept their loved one's death. Hospitals should therefore develop strategies that respect these rituals in times of crisis. For example, during the COVID-19 surge, some hospitals allowed religious leaders who were healthy and aged under 60, and wearing proper PPE, to visit hospitals and nursing homes to perform the last rites.⁵²

SECTION 5: CONCLUSION

There are many unknowns regarding the impact of the ongoing COVID-19 pandemic on the functioning of hospitals. Therefore, this policy paper should be seen as a preliminary assessment and a first attempt at identifying the areas to focus on to improve the preparedness of hospitals for future shocks.

Beyond the identification of such ways for improvement, additional steps are required to select the most important and efficient strategies. This could start with the definition of the specific needs, inputs, outputs, and intermediate, medium-term and long-term outcomes.

For health policymakers, developing post-COVID hospitals requires an alliance involving all stakeholders – particularly health professionals and patient representatives – at all steps of the project, from conception to implementation and also evaluation. At this stage of the pandemic, the following recommendations can be adopted as first steps to prepare for future hospitals post-COVID.



Hospital design and architecture

- Hospital design should start with preliminary research and risk assessment, integrating flexibility at the heart of the design process – in infrastructure, equipment, and use.



Medical equipment and tools

- PPE acquisitions, stockpiling, placement and distribution, as well as overall strategies for decreasing pathogen transmission, need to be planned during or before the hospital's design phase.
- Digital health and e-health tools should be leveraged to decrease flows and optimize healthcare delivery.
- Oxygen supply and distribution are essential, and back-up cylinders should be placed in all facilities.



Workforce and operational planning

- Quality control measures should be prioritized in all hospital programs and strategies. Constant feedback from patients and healthcare staff, as well as data collection in general, are crucial to ensure these measures. Hospitals should be prepared with contingency plans as well as transfer protocols, plans for mobilizing resources and optimizing task allocations.



Safety and compassion

- Patient safety and wellbeing are at the heart of healthcare delivery and should be prioritized above all.
- Family support and humanity should also be ensured and facilitated by relying on tools such as video calling, and by respectful treatment in the case of death.

Acknowledgments

The paper was written by Prof Didier Houssin and Michelle Bassil of AP-HP International.

Sincere thanks are extended to following advisors, who reviewed this report:

- Jorge Cardoso Cúneo, MD, PhD, Instituto de Oncología Angel H. Roffo, Universidad de Buenos Aires, Buenos Aires, Argentina
- Surendra K. Mathur, FACS, Zen Digestive Disease Centre, Mumbai, India
- Aristide Talon, MD, Conseiller santé, Présidence, République du Bénin

We would also like to thank Sultana Afdhal, CEO, WISH, and Didi Thompson, Director of Research and Content, WISH, for their support and constructive comments on this report.

The opinions expressed in this publication are those of the authors. They do not purport to reflect the opinions or views of any entity or organization they represent. Any errors or omissions remain the responsibility of the authors.

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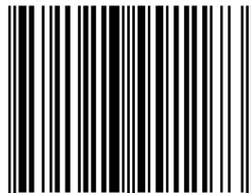
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ISBN 978-1-91-399117-3



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