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ANALYSIS OF ADVANCES AND CHALLENGES IN CLINICAL BIOSECURITY

What US Hospitals Should Do Now to Prepare for a COVID-19 Pandemic

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The World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC) have called on health systems around the world to prepare for a possible COVID-19 pandemic. The purpose of this article is to offer to American hospital administrators and clinicians specific judgment on what hospitals should do to prepare for a COVID-19 pandemic.

This is an update of a similar perspective related to pandemic influenza, published in 2006.[1] These recommendations derive from the authors' analysis of the consequences of a flu pandemic, review of many existing hospital plans, analysis of the federal government's recommendations, and meetings with a number of leaders in health care, public health, and emergency management. Recognizing that any such recommendations must be based on numerous untestable assumptions, any of which can be reasonably challenged, we propose specific actions and priorities for the purpose of making the discussion of hospital pandemic preparedness issues more operationally useful. This commentary pertains to hospitals, but long-term care facilities, outpatient clinics, medical offices, and other healthcare facilities must also urgently prepare.

The Argument for Urgent Preparedness

The current COVID-19 epidemic looks very much like an early influenza pandemic in many important respects. It is spreading from person to person efficiently, much like influenza, including some degree of pre-symptomatic spread. Although the true case fatality rate is as yet uncertain, all evidence suggests that it is as severe as, if not more severe than, influenza

pandemics of the last century. The case fatality rate (CFR) of confirmed COVID-19 patients in China is estimated to be 1-3%, although this may not account for all mildly symptomatic or asymptomatic infections. In some regions of China outside Hubei, the CFR has been less than 1%. For comparison, the CFR of the 2009 influenza pandemic was around 0.1%, the 1968 and 1957 pandemics in the United States were about 0.5%, and the CFR of the 1918 pandemic was estimated to be 2.5 % in the United States.

Because it will take considerable time to fully understand the epidemiology of COVID-19, it is reasonable to begin preparations using a model we have studied extensively for decades and that seems similar to COVID-19—pandemic influenza. The threat of a novel influenza pandemic has stimulated international, national, and local planning and preparedness efforts for years. In the event of a 1918-scale flu pandemic, hospitals would be flooded with sick patients seeking care.

The impact of a COVID-19 pandemic on hospitals is expected to be severe in the best of circumstances. Currently, US hospitals routinely operate at or near full capacity and have limited ability to rapidly increase services. There are currently shortages of healthcare workers of all kinds. Emergency departments are overcrowded and often have to divert patients to other hospitals.

In recent years, there has been a reduction in the overall number of hospitals, hospital beds, and emergency rooms. During an epidemic, the healthcare workforce would be greatly reduced. Healthcare workers would face a high risk of infection because of contact with infected patients; many would need to stay home to care for sick relatives, and, in the absence of vaccine, others might fear coming to work lest they bring a lethal infection home to their families. The provision of medical services to both COVID-19 and non–COVID-19 patients may be adversely affected in most communities.

Detailed modeling projections for COVID-19 have not yet been released by the US government or WHO; however, the US Department of Health and Human Services (HHS) released official planning assumptions for pandemic influenza, ranging from a moderate pandemic like 1968 or 1957, to one based on a very severe pandemic like 1918.[2] These may be the best tools we have at the moment. They differ by more than 10-fold in the number expected to need hospitalization, intensive care, and mechanical ventilation (see Table 1).

Table 1

HHS pandemic planning assumptions

Moderate Scenario (1968-like)	**Very Severe Scenario** (1918-like)
38 M needing medical care	38 M needing medical care
1 M hospitalizations	9.6 M hospitalizations

200,000 needing ICU	2.9 M needing ICU

As a comparison, there are about 46,500 medical ICU beds in the United States and perhaps an equal number of other ICU beds that could be used in a crisis. Even spread out over several months, the mismatch between demand and resources is clear.

Some patients in China have been treated with extracorporeal membrane oxygenation (ECMO), and some US medical centers with this technology are preparing to use it as well. For US hospitals with this capability, it would be prudent to think through how this scarce resource would be allocated if demand exceeds resources.

Preparedness Defined

Based on such calculations, it would seem that preparing for a pandemic of even moderate severity is a difficult challenge. For the purpose of this analysis, we use the following definition of preparedness:

Every hospital, in collaboration with other hospitals and public health agencies, will be able to provide appropriate care to COVID-19 patients requiring hospitalization while maintaining other essential medical services in the community, both during and after a pandemic.

This definition recognizes that what constitutes "appropriate care" and the criteria for hospital admission may well change during a pandemic.

The Top Priorities

Individual hospitals and groups of hospitals involved in regional coordination of pandemic preparedness should focus their initial preparedness efforts in the following priority areas:

1. Comprehensive and realistic planning based on actual CDC FluSurge projections in each hospital, and collaborative planning among all hospitals in a region (eg, healthcare coalitions).
2. Limiting the nosocomial spread of the virus to (1) protect the healthcare workers and, thus, maintain a hospital workforce; (2) prevent the hospital from being a disease amplifier; and (3) protect the non–COVID-19 patients from infection, so as to maintain the ability to provide essential non–COVID-19 health care.
3. Maintaining, augmenting, and stretching the hospital workforce.
4. Allocating limited healthcare resources in a rational, ethical, and organized way so as to do the greatest good for the greatest number.

Specific Priority Actions to Be Taken

To implement the priority goals above, hospitals should undertake the following specific actions:

1. Employing a comprehensive and realistic planning process:
    - Employ at least 1 full-time hospital emergency manager in each hospital.

- Dedicate a full-time infection prevention practitioner to work on infection prevention aspects of the preparations, including education, training, and exercises.
- Designate a medical director to work closely with the emergency manager and infection prevention practitioner.
- Create a pandemic preparedness committee (or use an existing emergency management committee) that includes representatives of all clinical and support departments as well as senior administrators.
- Participate in a local healthcare coalition, which includes neighboring hospitals, local public health agencies, and emergency management. Members of multi-hospital health systems should integrate system-wide planning with local planning with other local hospitals.
- We do not yet have modeling tools or planning assumptions for COVID-19. CDC has developed FluSurge 2.0, which can be used in conjunction with HHS planning assumptions to guide planning for both a moderate and severe pandemic.[3] Note that the default assumptions in FluSurge are based on a 1968-like pandemic. To model a severe pandemic, FluSurge allows the assumed number of hospitalizations to be modified to correspond to the HHS planning assumptions for a severe pandemic.
- Be able to make 30% of licensed bed capacity available for COVID-19 patients on 1 week's notice. About 10-20% of a hospital's bed capacity can be mobilized within a few hours by expediting discharges, using discharge holding areas, converting single rooms to double rooms, and opening closed areas, if staffing is available. Another 10% can be obtained within a few days by converting flat spaces, such as lobbies, waiting areas, and classrooms.[4]
- Collaborate in regional plans to be able to make at least 200% of licensed bed capacity in the region available for COVID-19 patients on 2 weeks' notice.
- Use telephone and internet-based advice lines to reduce unnecessary visits to the hospital emergency department.

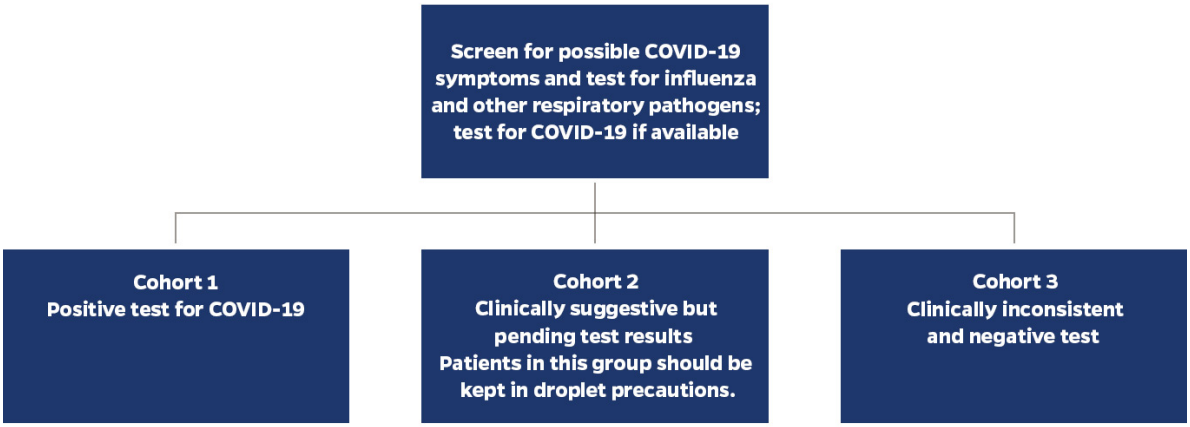
2. Limiting the nosocomial spread of the virus:
   - The CDC has provided good technical guidance on infection control for COVID-19 in healthcare facilities.[5]
   - Limit the accidental contamination of the hospital environment by implementing respiratory etiquette and by using simple surgical masks for everyone entering the facility (staff, patients, and visitors) during a pandemic. Assuming re-supply may be difficult during a pandemic, stockpile enough masks for 3 weeks.
   - Prevent staff from getting infected by training healthcare workers on the use of personal protective equipment (PPE) and infection control procedures and by stockpiling a supply of PPE. PPE availability is currently limited, but hospitals should purchase what they can, recognizing that a local outbreak could last at least several

weeks to several months. Given the preeminent need to protect healthcare workers, we feel the highest level of protection available should be used. We call for the use of N95 respirators for healthcare workers with direct contact with COVID-19 patients. This is in concert with the CDC's COVID-19 guidelines. Powered air-purifying respirators (PAPRs) should be available for use in high-risk aerosol-generating procedures.

- Limit the number of staff who are exposed to COVID-19 patients by cohorting (dedicated staff in dedicated units) (see Figure 1). Utilize overtime and long shifts for staff in the COVID-19 units to limit the number of staff needed. When possible, use staff who are immune (recovered) in the COVID-19 units.
- Prevent infected staff from working (except with COVID-19 patients) by tracking staff who are sick and testing for COVID-19, if possible, and keeping a log of staff who have had confirmed COVID-19.

Figure 1

Cohorting



3. Maintaining, augmenting, and stretching the hospital workforce:
   - Vaccinate all staff for influenza to reduce the burden of that disease.
   - Organize in-home childcare for well children of healthcare workers if schools are closed, using screened volunteers.
   - Provide medical daycare for sick family members.
   - Allay fear through open, honest, and transparent planning and careful training.
   - Shift clinical staff to highest-need areas from areas that may be closed or quiet; employ "just in time" education and "buddy teaming."
   - Augment clinical staff with nontraditional personnel, employing "just in time" education and "buddy teaming." Use (1) medical professionals with prior clinical experience (eg, administrators, researchers, retirees, etc); (2) related health professionals (eg, dentists, veterinarians, emergency medical technicians, etc); (3)

nonclinical hospital personnel; and (4) nonclinical outside personnel. Specific training and operating procedures for each group must be created in advance.

- Coordinate plans with other hospitals in the region to recruit and use volunteers.

4. Allocating limited healthcare resources in a rational, ethical, and organized way so as to do the greatest good for the greatest number through deferral of nonemergency care and, if necessary, institution of alternative patient care routines.
    - Prioritize which services and types of procedures can be deferred, for how long, and with what consequences and create an alternative plan for patients who will be deferred. Create a process for refining and updating this plan as circumstances change. Create a process to track deferred patients.
    - Plan for the graceful transition to contingency and crisis standards of care. In a severe pandemic, not all patients in need of intensive care will be able to be accommodated in the ICU. Normal staffing ratios and standard operating procedures will not be able to be maintained.
    - Plan for alternative sites to provide ICU-like care within the hospital (eg, catheterization lab, catheterization recovery, OR, PACU, endoscopy units, etc).
    - Implement contingency and crisis standards, which will be justified when conventional standards cannot be maintained despite the use of all available resources, including mutual aid arrangements. The legal and ethical framework for these decisions should be considered well in advance of a crisis. Alterations in hospital policy and procedures should be implemented by an active decision of the hospital leadership in consultation with the medical staff and civil authorities.
    - Create criteria/clinical guidelines for use (or denial) of resource-intensive services (eg, admission, mechanical ventilation, invasive monitoring) based on national guidelines, such as the Crisis Standards of Care report[6] in regional collaboration with other hospitals.
    - Establish a process for triage of patients competing for limited resources, including admission, early discharge, and life support. These decisions should not be made solely by 1 person. The criteria used to make these decisions should be created in advance and formally sanctioned by the medical staff and hospital administration.

How to Proceed

Although a COVID-19 pandemic seems all but inevitable, there is still uncertainty about its severity in the United States. Time will tell, but, in the meantime, hospitals should not delay. In the event of a pandemic, the predictable costs of not preparing, in human, societal, and political terms, would be huge. Decision makers at all levels—including hospital CEOs and their boards and state and federal officials—should consider these issues and how to proceed. Several of the first priority items (comprehensive and collaborative planning, discussing allocation of scarce resources, and planning education and training) take substantial time. Hospitals should begin these actions now.

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