Prepared by: Nir Menachemi, PhD, MPH and Jyotsna Gutta, MPH from the IU Fairbank School of Public Health

What is the best model for managing health care surge for COVID patients?

Introduction

The 2019 coronavirus disease (COVID-19) is projected to infect a substantial proportion of Hoosiers. Experts are forecasting the number of individuals who will become infected over time and the subset of those that will require hospitalization. Given the COVID-19 experience in other countries, many of those hospitalized will require intensive care services including mechanical ventilation. Demand for all U.S. hospital services is projected, by many computer models, to outpace supply. In preparation for this surge, the current brief report explores issues associated with approaches that could facilitate the expansion of acute care and intensive care capacity within Indiana.

It is helpful to differentiate between facility-based surge capacity and community-based surge capacity.

- **Facility-based surge capacity** involves action taken by a health care facility to augment services within the response structure of that organization (including responses external to the physical structure of the facility but proximal to it). These responses are under the control of the facility's incident management system.
- **Community-based surge capacity** involves actions taken at the community level to supplement health care facility responses. Such activities may include providing triage and initial treatment, non-ambulatory care overflow, and/or isolation—all of which might occur at off-site (e.g., non "hospital") locations. These responses are under the control of the jurisdictional entity (e.g., public health, emergency response) and are designed to enhance the efforts of health care facilities to respond to the acute needs of patients.

With this context, we rapidly investigated the literature to examine information that could inform the following options:

- Designating state mental health facilities and/or other non-hospital sites that can accommodate additional capacity when needed (consistent with either facility-based or community-based surge capacity)
- Facilitate regional cooperation with designated hospitals in order to more efficiently utilize resources

Overall, there is a lack of empirical studies making it difficult to make definitive policy recommendations. As discussed in a recent comprehensive review, most of the existing published articles consist of anecdotal case studies or narratives rarely including more than one site. Thus, most of the information contained herein is a synthesis of expert opinions and consensus statements of various professional organizations, including the American College of Chest Physicians.

Designating state mental health facilities and/or other non-hospital sites that can accommodate additional capacity when needed

Generally, acute care patients should be accommodated within existing health care facilities as much as possible, but in severe contagious disease epidemics, this might not be possible. In such cases, off-site locations, referred to as alternative care facilities (ACFs) might be needed either as part of facility-based and/or community-based surge capacity. Importantly, hospitals accredited by Joint Commission on

Accreditation of Healthcare Organizations (JCAHO) are required to plan for such situations and identify facilities they can use for off-site care. Staff shortages during a disaster (especially nursing) are likely to be the key restrictions on the number of patients that can be accommodated. In epidemics, health care facilities may be unable to staff their own facilities, let alone off-site facilities. With respect to facility-based surge capacity, hospitals can reverse triage (defined as discharging patients early when it is ethical and safe to do so), focus on manpower issues, augment human resource policies, and as a last resort, engage in critical care triage. Hospitals can also "surge in place" by converting post-anesthesia care rooms, chest pain observation areas, cardiac catheterization and gastroenterological procedure rooms to accommodate extra critical care capacity. Likewise, private hospital rooms may be converted to double rooms, and patients can be placed in halls. Based on previous experiences, "surging in place" strategies can increase capacity by 10-30% for immediate or near-term use.

Utilization of non-hospital sites

Hospitals and/or public health authorities can facilitate the availability of ACFs. For example, State mental health facilities can be used as ACFs to augment hospital capacity. Massachusetts has documented the intention to utilize four large state-owned mental health facilities (formerly used as acute care hospitals) in response to disaster events. In general, ACFs are not recommended for the provision of critical care because some logistic challenges have been described as "unsolvable" by experts.

As noted below, ACFs can be part of either facility-based and/or community-based surge capacity. ACFs could be used for the following purposes:

1. Serving as an overflow hospital providing a full range of care (not including ICU)
    - This should be done as an extension of a nearby hospital, as part of facility-based surge capacity, in order to require fewer specialized resources and to facilitate the credentialing of medical personnel.
    - It is expected that patients are transferred to a proper hospital facility as the local health system recovers enough to absorb the extra patient load.
    - The extent to which Indiana-based mental health hospitals have the capacity to provide a full-range of acute care can be determined by the appropriate experts.
2. For patient isolation and alternative to home care for infected patients
    - This approach, consistent with community-based surge capacity, is akin to a motel-like environment for infected patients who require minimal, if any, medical care. Such facilities can support patients who would otherwise return home but could not due to shared residence with immunocompromised individuals, or the inability to care for themselves.
3. For expanded ambulatory care
    - This approach is designed to relieve the pressure on acute care hospitals by utilizing expanded capacity to treat the surge of patients suffering from the indirect effect of the epidemic. This can be done as part of facility-based surge capacity and/or in conjunction with community-based surge capacity.
4. For care focused on those recovering from infection and/or patients not infected

    - This approach facilitates quicker discharge of previously infected patients in order to free up hospital-based resources. This approach is akin to an off-site step-down unit and is usually part of facility-based surge capacity.
5. For limited supportive care targeting noncritical patients
    - Once patients are triaged away from other more acute care settings, this approach allows them to be immediately transferred for low-grade care including hydration, antibiotics, pain management, bronchodilators, etc. This approach can be considered as part of either facility-based or community-based surge capacity.
6. For primary triage and rapid patient screening
    - This approach acts as a primary triage site that provides rapid medical screening and infection testing consistent with community-based surge capacity. Such an ACF could relieve pressure on hospitals by helping to determine who needs what level of care.
7. For quarantine
    - Quarantining individuals in the context of an influenza pandemic is not recommended because it is likely to be ineffective. How quarantine should be used in the COVID-19 situation is unknown.

ACFs should have a clearly stated mission and the site should be selected based upon this purpose. When creating ACFs as part of a community-based surge capacity, public health officials should work with local physicians to identify suitable sites, identify community-based physicians to provide care and oversee staff, and to coordinate care plans for patients. Importantly, when used as part of community-based surge capacity, it may be difficult to acquire resources (personnel, supplies, equipment) that are typically needed by hospitals. The existence and purpose of the ACF should be communicated to the medical community and the general public as appropriate.

Consistent with the purpose of the ACF, there should be restrictions on the type of patients treated at these centers, using clear inclusion and exclusion criteria, to allow for streamlined patient care that follows preestablished critical pathways or clinical practice guidelines.

Other non-hospital sites to consider can include churches, community recreation centers, fairgrounds, governmental buildings, hotels/motels, meeting halls, aircraft hangers, adult detention centers, schools, etc.

- Ideally, such sites should be publicly owned and rapidly available
- Factors to consider in selecting off-site locations including:
    - Ability to lock down facility
    - Adequate security
    - Adequate lighting, ventilation, and space for equipment
    - Door size adequate for gurneys
    - Electrical power with backup
    - Proximity to hospitals
    - Water supply
    - Internet and communication connectivity
    - Level and scope of care required (disaster-related or non-disaster care)
    - Other factors (see this report or Figure 3 in Hick et al, 2004)

Other options to consider for an ACF include a nurse triage hotline (e.g., a virtual ACF) which can assist in reducing patient volumes at hospitals or the use of temporary external shelters (e.g., tents or mobile trailers) for patient holding. The practicality of this option is a function of climate and the ability to provide water, utilities, and other infrastructure support needed to safely operate.

- Such options are considered more viable when the existing local health care infrastructure is severely damaged (e.g., due to earthquake)

The use of some ACFs could be associated with regulatory, liability, and other issues. For example, does liability coverage extend to off-site provision of care, and how are narcotics, patient records, and reimbursement handled? Clarification regarding these issues and regarding which public health regulations apply is highly recommended.

Facilitate regional cooperation with designated hospitals in order to more efficiently utilize resources

Facilitating regional cooperation among hospitals is considered a key component of effective response. This strategy should not be considered in isolation—but instead should be part of a multi-tiered approach to disaster response and surge capacity management. Because COVID-19 response is expected to require the use of specialized equipment such as ventilators, regional coordination can be particularly helpful.

Most health care systems are private rather than public entities making coordination among them challenging. Nevertheless, the close cooperation of hospitals with governmental and public health response teams is of paramount importance in large-scale disaster situations. Overall, regional coordination can be facilitated by many entities—both public and private. In the context of the current report, we envision the role by a state governmental entity with public health or health care authority.

Benefits of cooperative systems include:

- Allow for greater streamlining of requests for resources and can facilitate the sharing of staff and supplies
- Hospitals may be unfamiliar with resources available elsewhere and can benefit from coordinating with their counterparts
- Resource provision from the federal government to Indiana can be coordinated more easily
- A cooperative system can also help coordinate the needs of special populations. For example, if some responding hospitals have insufficient expertise in pediatrics, geriatrics, critical care, etc., then cooperative system can help facilitate the connection of expertise as needed
- Non-medical resource provision can be streamlined, if needed
- The cooperative system can help relieve the pressure on hospitals by assisting with placing patients being discharged sooner than usual (due to reverse triage) in the care of qualified outpatient providers (as described above under ACFs) and home health agencies.

Cooperative systems can play a key role in the movement of casualties to areas that have adequate resources by coordinating with ambulance, bus, and other transportation providers. The cooperative system can also help provide the public with key information about where and how health care resources should be accessed—including mental health support which will concurrently surge during most disaster situations. This is important in order to reduce the surge burden on health care facilities who will be inundated with patients who may not be ill but have concerns or seek further information or evaluation.

Additional items to consider:

- There is a need to establish a process for communication, resource requests, and reallocation of resources (especially during the peak of the surge).
- For cooperative systems to function efficiently, regional and/or state-level decisionmakers must have access to accurate information about hospital capacity, equipment inventories (e.g., ventilators, oxygen), and current status of other resources.

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