ABSTRACT

Hospitals are the focus of the fight against SARS-CoV-2 pandemic. To meet this challenge hospitals need a Disaster Response Plan and a Hospital Incident Command System (HICS) as a crisis leadership tool. The complex dependency between the systems staff, supplies, and space during the SARS-CoV-2 pandemic is a major problem for hospitals. To take the appropriate countermeasures, the effects of the crisis on these systems must be detected, analyzed, and displayed. The presentation and interpretation of such complex processes often poses serious problems for the hospitals’ incident commanders.

In this article, we describe a new model that is able to display these complex interrelationships within the command process. The model was developed and deployed during the disaster response to SARS-CoV-2 pandemic in order to facilitate the entire command process and to improve hospital disaster response.

The approach of the model is as simple as it is innovative. It perfectly symbolizes the basic principle of disaster medicine: keep it safe and simple. It will help hospitals to improve command and control and to optimize the disaster response during SARS-CoV-2 pandemic.

Key words: disaster response command and control, contingency care, crisis care, mass critical care

BACKGROUND

The SARS-CoV-2 pandemic poses an extreme challenge to hospitals.1 During the disaster response and in order to be prepared for mass critical care, hospitals should switch leadership mode from daily routine style to a Hospital Incident Command System (HICS).2,3 The main challenge of the HICS is to lead the hospital successfully through the crisis and to ensure an adequate level of patient care, at least conventional or contingency care.4,6

Major goals of a successful HICS system are:

1. to retain comprehensive track and control on all relevant processes in the hospital;
2. to receive updated detailed information;
3. to detect system deterioration in advance;
4. to initiate adequate countermeasures earliest possible.

The University Hospital of Wuerzburg, Germany is a tertiary care hospital in the north of Bavaria. It takes care for more than 270,000 patients per year. At the beginning of the pandemic in Germany in March 2020, the HICS was activated according to the comprehensive hospitals disaster response plan. It consisted of a crisis unit with the classic staff sections S1 to S6.

The S1 Staff Management and Administration

Special Issue on COVID-19
Situational report (information gathering and assessment) (S2)

Operational command (S3)

Technology and logistics (S4)

Communication, media, and press (S5)

IT and mobile services (S6)

Each staff section was managed by a section chief. The head of the crisis unit was the hospital’s medical director. He had the ultimate responsibility for the entire operation. HICS meetings were held daily (7/7) according to a fixed schedule. If the situation required it, the HICS was convened ad hoc.

The command process of the HICS followed a fixed pattern

1. Situational report
2. Situational assessment
3. Problem identification and prioritisation of problems
4. Development of solutions and definition of new work assignments
5. Monitoring of previous assignments and decisions with regard to their degree of implementation (review)

A major problem during the SARS-CoV-2 pandemic is the complex dependency between the sectors staff, supplies, and space. In the situational assessment of the HICS, the effects of the crisis on these sectors must be detected, analyzed, and displayed. Maintaining an overview, detecting changes in the situation and taking the right countermeasures is the major challenge. The presentation and interpretation of such complex processes often pose serious problems for incident commanders. Valuable tools to visualize the situation and thus maintain an overview are precious but rare.

THE WINDMILL-MODEL OF DISASTER RESPONSE

In this article, we describe the new windmill model (Figure 1), which is able to display and visualize these complex interrelationships within the command process. The windmill model was developed during the disaster response to SARS-CoV-2 pandemic in order to facilitate the entire command process and to improve hospital disaster response. It can be applied to any other disaster response.

Levels of care during mass critical care

According to “CHEST Consensus Statement,” the three levels of care in a mass critical care situation are “Conventional Care,” “Contingency Care,” and “Crisis Care.”

1. Conventional care: The demand (D) for care is less than the regular total capacity (C) (C>D). The requirement of resources corresponds to daily routine and deployment ensures individual medical treatment of patients. The established standards and recommendations of patient care are preserved.

2. Contingency Care: The overall capacity must be increased by crisis respond planning. Staff, supplies, and space capacity are initially insufficient. The deployment of personnel and equipment and the use of space exceed the daily routine procedures. After successful implementation of crisis respond measures, the demand of resources is covered by total capacity (C=D).

3. Crisis care: Despite the exhaustion of crisis respond measures, the resource demand exceeds the total capacity (C<D). Even extended measures within the affected hospital or transfer of patients to other hospitals cannot cope with the situation. The extent of individual patient care will be limited in order to ensure survival of a maximum of patients.
Top priority should be overcoming the mass critical care situation at the level of conventional care or contingency care. The transition to crisis care should be avoided.\textsuperscript{4,5} A major problem for hospitals is surge control. In a nationwide disaster like a pandemic, hospitals will probably not have the opportunity to control their patient influx. Therefore, crisis care is a realistic scenario and emergency medicine and intensive care providers need to develop ideas how to deal with such an overwhelming disaster. Furthermore, healthcare systems should develop nationwide or even international management mechanisms in order to overcome overcrowding of local or regional hospitals. This planning needs best to be done during peacetime.

An effective method for acutely increasing surge capacity is cancelling elective surgery and outpatient services. The postponement of these patients is associated with some serious problems. First and most important is to define elective surgery appropriately, without doing harm to the postponed patients, second is the financial damage which could hit the hospitals existentially. Treatment capacity for COVID-19 patients might seriously be affected by this financial impact.

Development and application of the windmill model

The Model bases on the three sectors: staff, space, and supplies (Figure 1). Each system might be limited by the impact of the pandemic. This can cause three different states per sector:

1. The demand is less than the capacity (D<C) (status green).
2. After initiating and implementing all available countermeasures, the capacity corresponds to the current demand (D=C) (status yellow).
3. Despite initiation and implementation of all available countermeasures, the capacity is lower than the current demand (D>C) (status red).
Figure 1 shows these different states for the three windmill blades.

Each sector status (staff, supplies, and space) can be displayed in the windmill model by the color of its windmill-blade (Figure 1). According to the experiences we made during the SARS-CoV-2 pandemic and based on the definitions above, we classify the result-

- If all sectors are in status green, the overall system will be able to provide conventional care.
- If one of the three sectors is in status yellow, the overall system is in the stage of contingency care.
- If one of the three sectors is in status red, the overall system is in the stage of crisis care.

Thus, the windmill model, displays strikingly the current level of care based on the status of the three key sectors. In relation to the command process, this corresponds to steps 1 and 2. The search for the causes of impairment and deficiency represents step 3 of the command process: problem identification and analysis. To develop solutions and to give orders to the hospital staff represent step 4 of the command process. In a next step, the effect of the actions will be fed into the windmill model (step 5 of the command process). In this way, the windmill model serves as perfect compass to lead through the entire command and control cycle.

Management structured like this enables the HICS to keep track of the entire operation at any time. The model serves as an early warning system, which detects loss of conventional care at the earliest possible stage.

CONCLUSION

The windmill model of disaster response was exclusively designed for the in-hospital management of mass critical care during the SARS-CoV-2 pandemic. Nevertheless, it might be applicable to any other disaster response. It could also be used in large-scale exercises with simulated scenarios in order to plan and distribute resources. For that purpose, the definition of the windmill blades is simply changed for the new scenario. In the future, we will need prospective research to proof the feasibility of the model during simulated or real disaster incidents.

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REFERENCES


