




Hospital preparedness for COVID-19 pandemic: experience from department of medicine at Veterans Affairs Connecticut Healthcare System

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ABSTRACT

The 2019–2020 pandemic Coronavirus Disease 2019 (COVID-19) has inundated hospital systems globally, as they prepare to accommodate surge of patients requiring advanced levels of care. Pandemic preparedness has not been this urgently and widely needed in the last several decades. According to epidemiologic predictions, the peak of this pandemic has still not been reached, and hospitals everywhere need to ensure readiness to care for more patients than they usually do, and safety for healthcare workers who strive to save lives. We share our hospital-wide rapid preparedness and response to COVID-19 to help provide information to other healthcare systems globally.

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Introduction

Coronavirus Disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) originated in Wuhan, China, quickly became a global pandemic, and has impacted the U.S.A. at an extraordinary pace. Within three months from the first diagnosed case of COVID-19 in the U.S. A. in late January 2020, the number of SARS-CoV2-infected individuals in the U.S.A. is close to a million, and the number of casualties have surpassed 45,000 [1]. Globally, SARS-CoV2 has infected millions, with an overall case fatality rate of >6.5% [1]. As rapid testing becomes more readily available in the next few weeks, it is expected that many more cases will be diagnosed, and many of them would need hospitalization for care.

The severity of disease in those with the infection has overwhelmed healthcare systems and frontline healthcare providers, and has exhausted resources, revealing how ill-equipped the world was to handle this pandemic. The peak of this pandemic is expected in the next few weeks, when a surge of hospital admissions for COVID-19 will emerge globally [2,3]. In the U.S.A., while currently COVID-19 seems to preferentially be affecting densely populated urban areas, this pandemic will likely impact other urban as well as rural areas soon. Healthcare centers everywhere should prepare to implement measures for an efficient hospital-wide approach to manage the imminent surge in hospitalized patients with COVID-19. Connecticut is one of the states impacted heavily and early by COVID-19 [4]. We present an outline of how Connecticut Veterans Affairs Healthcare System prepared for this pandemic in order to share our experience, and hopefully help inform other facilities across the country and globally.

1.0 Effective and accessible leadership with rapid and cohesive response

Response to pandemic is a multi-disciplinary team effort with efficient leadership that meets several times daily to work at a quick pace in order to make effective implementation of preparatory measures before the actual arrival of the first infected patients, followed by a continuity of the same diligence to ensure modifications in plans as needed and addressing new demands as they arise. One of the first steps taken at our institution was the organization of an Incident Command Center (ICC) that comprised of leaders from all pertinent institutional departments in order to have an effective team leading the preparation for our pandemic response.

1.1 The key members of our hospital-wide response to COVID-19 were:

- (i) Administration: Director and Associate Director of VA Healthcare System of Connecticut, who led the daily ICC meetings and made the final decisions based on multi-disciplinary team input. Their leadership and effective decision-making was the key to our seemingly effortless preparedness.
- (ii) Hospital Chief of Staff: His leadership ensured that all departments and divisions worked collaboratively.
- (iii) Department Chiefs of Medicine, Emergency Medicine, Primary care, and Surgery: These departments were impacted the most, and departmental as well as inter-departmental collaboration was crucial for functional short-term and long-term plans. Department Chiefs met with the heads of all Sections in their respective Departments weekly or biweekly to assess issues and provide information and guidance.

- (iv) Chief of Nursing, Chief of Emergency Department Nursing who played crucial role in relaying nursing issues for COVID patients, restructured the nursing workforce, disseminated information and decisions gleaned at the ICC meetings, and made essential policy decisions for practical implementations.
 - (v) Hospital Epidemiology and Infection Prevention (HEIP) who evaluated the rapidly changing information and guidelines from CDC and WHO, and implemented them in the most institution-friendly and resource-conscious ways. They were available 24 h a day throughout the week via a dedicated phone that was accessible to all healthcare workers (HCWs). Such accessibility and availability is reasonably difficult at most facilities, but is indispensable when preparing to manage a surge of hospital admissions for infected patients while also ensuring protection of providers caring for these patients.
 - (vi) Heads of Environmental Health and Safety Office (EHSO), Hospital Education, and Employee Health who respectively organized an expedited respirator fit-testing as newer respirators became available at different times; provided education on appropriate donning and doffing of personal protective equipment (PPE); and provided prevention and post-exposure care guidelines for employees, managed contact-tracing and employee counseling, and outlined work-to-home safety guidelines for employees to reduce potential carriage of pathogens to their homes.
 - (vii) Chiefs of Logistics, Facility Management Services (FMS) and Environmental Management Services (EMS) who respectively replenished the inventory of hospital supplies based on acuity of need; rapidly transformed the hospital floors that needed negative pressure rooms into COVID units; and implemented new enhanced hospital-wide disinfection policies.
 - (viii) Head of Laboratory Medicine who accelerated on-site use of state-of-the-art testing platforms.
 - (ix) Chief of VA Police who ensured safe and orderly institution of gatekeeping, off-site testing, screening stations, and disruptive behavior resolution. The role of these officers cannot be overemphasized during a pandemic that leads to the sudden emergence of new hospital policies in a high-emotion and labile environment of duty-bound healthcare providers working with anxious employees, patients, and families.
- 1.2 The ICC met daily (while maintaining social distancing) to discuss and formulate policy, review all active issues, and provide real-time multidisciplinary resolutions. Robust discussions were held and an open expression of views and ideas was welcomed without fear of repercussions. Ultimately, all final decisions were made by the Director and Associate Director. This active engagement within the context of a hierarchy in the command structure helped make mutually agreed-upon decisions that then expedited implementation.
- 1.3 ICC was also accessible around the clock via a unique e-mail address, which any hospital employee with either potentially helpful suggestions or questions could write to and obtain answers expeditiously. This centripetal, accessible, and highly motivated approach of management, we find, has been an important reason why our preparedness was both rapid and effective.
- 1.4 The COVID Response Coordinator (author Dr. Gupta) streamlined both the influx of preparation needs for the ICC to potentially act on, and the administrative coordination of hospital-wide preparedness based on ICC policy decisions. Additionally she created protocols for well-informed care of patients, enhanced the education and protective measures for HCWs including residency trainees, developed a clinical algorithm to guide judicious testing, and participated in COVID-19 treatment group meetings at other institutions to help create or modify local treatment algorithms.
- 1.5 The participative leadership style of hospital administration was complimented by an affiliative leadership style at department level where developing needs were analyzed in real-time, interactive and intimate feedback from all levels of staff was encouraged, attempts were made to foresee problems that the frontrunners would confront, solutions were provided to problems as they emerged, and policies were implemented as envisioned by the administration.
- 1.6 Several committees and subcommittees conducted specialized work. Delegates from several committees would report back on committee decisions, so that a cohesive overall structure of all plans could be maintained. These committees included research and ethics committee, treatment committee, code and emergency response committee, discharge and post-discharge planning committee, scarce resource allocation committee, and a committee that included members of our ethics team and palliative care service to guide policy on the triaging of patients in case of bed shortages. Critical care staff underwent training and refreshment courses for proning, extracorporeal membrane oxygenation (ECMO), minimization of bedside personnel while still providing state-of-the-art care during high-aerosol generating procedures, etc.

2.0 Gatekeeping: screenings at entrances, off-site testing, emergency room safeguards

VA Connecticut was the first healthcare system in the state to enact several measures within a week of the first case reported on the East Coast and 3 days after the first case reported in the state. These measures were fully implemented sequentially within 2 weeks from initiation.

- 2.1 All elective and non-emergent procedures were canceled or postponed. Outpatient clinics underwent a rapid succession of conversion to video-medicine

clinics. VA has been a national leader in clinical video medicine to reach patients living far away from the VA hospitals and clinics, and the conversion from in-person clinic visits to video visits was effortless and immediate. When video visits were not feasible, telephone clinics were established.

- 2.2 Letters were mailed to patients advising them to call their primary care providers before arriving at hospital if they had fever or respiratory symptoms. Physicians staffing the call centers provided stay-at-home and social distancing counseling, as well as individualized education on symptoms that should prompt a hospital visit.
- 2.3 Off-site testing centers were erected to conduct outpatient drive-up testing for patients who were thought to have suggestive symptoms.
- 2.4 Visitation to inpatients underwent a rapid sequential limitation to eventual complete barring of all visitors to the hospital without an approval from our central command.
- 2.5 Our major healthcare facility, the West Haven VA, has multiple entrances for patients and employees. As part of the COVID response, entrance to our hospital was limited to the emergency room (ER) and two manned entrances where primary screenings were conducted on everyone entering the facility, including questions about exposure to COVID19, personal symptoms and signs, and temperature checks. Those who failed primary screening received a secondary screen by a physician who examined and collected samples for testing as indicated.
- 2.6 The ER underwent an expeditious transformation so patients could be evaluated in private rooms. Every patient arriving into ER was given a mask to wear, until evaluation and triage by ER physicians. Engineering and facilities management were able to convert some non-negative pressure rooms to negative pressure rooms.
- 2.7 All HCWs as well as ancillary staff were provided surgical masks in an attempt to prevent nosocomial transmission of SARS-CoV2. This was implemented after a patient initially admitted to the psychiatry locked unit for non-COVID-related reasons tested positive 10 days later after the development of new cough and fever, which raised concern for pre-symptomatic phase of COVID-19 among patients, and for potential transmission of virus by asymptomatic HCWs.

3.0 Droplet precautions, personal protective equipment (PPE), social distancing

3.1 CDC guidelines for respiratory isolation with airborne precautions were followed as implemented by HEIP. Negative pressure rooms were used for all patients being admitted with suspicion of COVID-19 until it was ruled out by testing. Distinct COVID units were created in the hospital. Private rooms were also prepared for a surge of patients if needed. Strict protocols were instituted for any aerosol-producing

procedures including nasopharyngeal sample collection, nebulizer administration, and intubation. Full PPE [gown, gloves and either N-95 respirator with face shield, or powered air-purifying respirator (PAPR)] was ensured to prevent infection among HCWs.

- 3.2 Regular trainings, FIT testing, and educational sessions on donning/doffing were conducted to ensure HCWs were fully conversant in PPE.
- 3.3 'Buddy system' was encouraged as a culture so that HCW would be helped and watched by another HCW while donning and doffing the PPE to ensure correct steps, and to avoid accidental contamination of self or environment.
- 3.4 Reduction of time spent at bedside was a major goal for HCWs providing care to COVID-19 positive or person under investigation (COVID-PUI), while still ensuring state-of-the-art care and management. This helps protect HCWs from unnecessary exposure and save PPEs, which are still in short supply. This was achieved by in-depth education to HCWs on novel way of providing healthcare. Patient rooms were equipped for video surveillance and in-room phones so that providers could gather the bulk of history by speaking to the patient via phone while watching them on the video. I-Pads were also issued to patients so that they could interact with providers and 'virtual visitors'. A protocol for cleaning of I-Pads was disseminated. Providers were trained to conduct team huddles to review all data they would need, examination findings they would look for, and information they would provide to the patient at bedside before one of the team members entered the COVID-PUI room. Bedside physician visit for uncomplicated patients was limited to one physician per visit per day when medically feasible. Consults were encouraged to be electronic/virtual too, if possible.
- 3.5 Nursing care was similarly streamlined with strictly enforced PPE measures and provision of care with bundled approach: carefully planned bedside nursing visit that would provide meal, medications, vital sign checks, and all other required care in the same visit if possible. Meal trays were replaced by paper service meals so that leftovers and paper plates/cups could be disposed of into trash, and nursing would not need to enter rooms multiple times to collect the used trays and have others return them for cleaning and re-use.
- 3.6 Decontamination of certain equipment with strong disinfectant wipes can reduce the shelf life of such equipment. Therefore, while also trying to conserve PPE, modifications were made to some usual practices. Instead of taking the computer-on-wheels to the bedside to obtain an electronically signed informed consent, consent for procedures could be obtained via phone from the patient, provided the patient could provide consent, and this conversation was witnessed by another provider. Echocardiograms for COVID-PUIs and COVID+ patients were limited to critical need only; all routine echocardiograms for these patients as well as

all pre-scheduled echocardiograms on stable outpatients were deferred until infected patients were COVID-19 test negative or when the pandemic eased. As medications used for management of COVID-19 can cause QTc prolongation (hydroxychloroquine, azithromycin, etc.), this interval was closely monitored for inpatients via telemetry and calculation of QTc from rhythm strip if possible. This reduced unnecessary exposure by HCW in order to obtain a 12-lead ECG to calculate the QTc.

- 3.7 Simulation was conducted several times for all HCWs to be fully conversant on conducting resuscitation and emergency procedures on COVID-PUIs or known COVID+ patients, as these involve high-risk aerosol-generating maneuvers. New policy was instituted that outlined how the code would be announced overhead so that responders would come prepared knowing it was a code for a COVID-PUI or COVID+ patient. Rapid and ensured PPE provisions were delineated carefully, measures were placed by anesthesiology for reduction of aerosol generation during code, and number of in-room personnel was streamlined significantly, with pre-designated roles in the conduction of resuscitation. A weekly virtual meeting was led by two infectious disease-trained physicians to answer questions by employees and hopefully allay their concerns.
- 3.8 All educational and clinical conferences were immediately converted to virtual meetings to ensure social distancing. Workstations were individually assigned to minimize use of shared space/keyboards. A distance of 6 feet between providers was underscored. Containers of disinfectant wipes were placed in all workstations.

4.0 Hospital bed redistribution and HCW team restructuring

- 4.1 In order to prepare for inpatients with COVID-19, negative pressure rooms were needed on regular wards, as well as ICU. Our facility had a total of 4 negative pressure rooms before the emergence of COVID-19. Within a week, negative pressure was created on an entire floor of the hospital. Portable forced air system was used to create such rooms in an ICU section too that was devoted to COVID-19 patient care.
- 4.2 ICU and on-ward policy of care was devised and revised in real-time to continue state-of-the-art management of COVID-19 patients, with a multidisciplinary team approach, involving General Medicine, Cardiology, Infectious Diseases, Infection Prevention, Pulmonary and Critical Care Medicine, and Pharmacy.
- 4.3 Patients who had been undergoing 'blind rehabilitation' were discharged to open up a floor unit and new admissions to our community living center were stopped. This was done to protect the veterans from acquiring this infection while residing in the hospital, and also to create more rooms for sick patients with COVID-19.
- 4.4 HCW teams were restructured to provide longer resting periods between service times to allow for de-stressing

and for high intensity care during service hours. We made sure to not exclude house-staff from patient care. This was done to allay fears, to enhance preparedness, to strengthen workforce and continue the dedication toward education. Medical students were excused from inpatient care, based on ACGME policy.

- 4.5 Protocols were created with back-up workforce and back-up hospital space to be deployed for anticipated COVID-19 surge in waves.
- 4.6 To facilitate discharge of COVID-19 patients who were not requiring inpatient services anymore, we were able to give each patient a thermometer and home pulse-oximeter. We established a Hospitalist-led virtual video clinic to allow daily visits with these patients and have them transmit their home data.

5.0 Testing criteria and order sets

- 5.1 While efforts to increase testing are ongoing, testing for SARS-CoV2 remains suboptimal. In addition to the CDC real-time RT-PCR test, several other molecular diagnostic platforms based on real-time RT-PCR qualitative assay were quickly developed and FDA-approved. These included Roche cobas®, Cepheid® Xpert Xpress, Simplexa® Diasorin™, and Abbott® Realtime SARS-CoV2 assays, along with CDC's own RT-PCR test. VACT leadership made six of these rapid tests available for our patients by 4 April 2020. While sequential approval of these platforms made test results achievable within minutes to hours, the shortage of assay reagents and nasopharyngeal swabs as well as viral transport media, all enforced significant limitations on testing capacity.

In addition, COVID-19 also has the notable predicament of a long incubation period that ranges from 5 to 14 days, and often causes a rapid respiratory/cardiac decompensation at any time during the illness [5,6]. Therefore, asymptomatic patients who are hospitalized for reasons other than COVID-19, and who are not tested for COVID-19 upon admission, may develop symptoms during hospitalization and may also become a source of nosocomial infection.

Until the capacity to test widely and repeatedly becomes available widely, a clinical algorithm that can be used for outpatients as well as inpatients would be helpful. We developed a clinical algorithm to help direct providers toward testing for COVID-19 (Table 1). This algorithm is based on review of clinical data from China, Italy, and within the U.S.A. [7–14]. It can be used by providers to help determine whether COVID-19 is a likely diagnosis for patients in outpatient setting, those being seen in ER, and those hospitalized for another reason and later developing suggestive symptoms. Clinical judgment must supersede any algorithms. However, this algorithm has been found to be helpful in our institution, and may be found to be useful at facilities when and where ample rapid testing is not available.

Table 1. VA clinical algorithm for COVID-19 suspicion and testing/evaluation.

Clinical judgment supersedes this algorithm

1 Major or ≥ 2 minor = test
 ≥ 2 Major = ED evaluation (the 4th major criterion would by itself deserve ED evaluation)

Major criteria

1. New respiratory distress or new hypoxia $<93\%$ on RA (for patients on chronic O_2 therapy, new increased O_2 requirement to maintain their baseline goal O_2 saturation)
2. Fever (≥ 100.4) with cough or dyspnea
3. New fatigue in immunosuppressed host
4. Cardiovascular decompensation/shock or other evidence of cytokine storm in patient with no ACS or other explanation

Minor criteria

1. Co-morbidities including CHF, COPD, or cardiomyopathy (ischemic or non-ischemic)
2. CXR showing infiltrate or CT showing GGOs not explained by another etiology
3. ≥ 1 Lab abnormalities of the following:
 - a. Lymphopenia (ALC <1000)
 - b. Elevated CRP
 - c. Newly elevated: ferritin (>700) or fibrinogen (>600)
4. Known exposure to SARS-CoV2
5. ≥ 2 Lab abnormalities of the following:
 - a. New abnormalities in liver tests (AST/ALT >60 IU, bilirubin >2 mg/dL)
 - b. New elevation of: ferritin (>400 but <700) or fibrinogen (>400 but <600)
 - c. Leukopenia with TLC <4.0 k
 - d. LDH > 350 or troponin elevation
6. Fever (≥ 100.4)
7. New onset unexplained anosmia or ageusia

Please note: Other less common clinical features of COVID-19 include nausea, vomiting, diarrhea, abdominal pain, only rarely seen without other criteria above.

5.2 In order to ensure that the proper PPE were utilized and other specific critical care instructions for COVID-PUIs were carried out, we created a COVID-order set for use by ED providers when they admitted a patient as COVID-PUI, and for use by inpatient providers when they decided to test a hospitalized patient for COVID-19 (Table 2). These orders then ensured all necessary instructions were implemented, including COVID-19 precautions/isolation, nursing orders, nutrition specifications, COVID-relevant laboratory orders, and telemetry.

6.0. Mindfulness and HCW wellness

The toll on frontline workers of a pandemic caused by a virus that is highly transmissible and virulent, especially when combined with lack of appropriate supplies of PPEs, can be profound. Early intervention, teamwork, self-care and enhancement of existing resilience are all critical for the healthcare providers who are involved in the fight against this pandemic. We therefore sought help from Employee Assistance Program (EAP), Health Psychology, and Department of Psychiatry to create a robust support system. This system was designed to provide critical and valuable mental health support, acute psychiatric first aid, coping

Table 2. COVID order set for COVID-positive/person under investigation (PUI).

ADT:

1. Ward options should only include COVID units for floor and ICU
2. For diagnosis: COVID-PUI. Not modifiable

Activity: Cannot leave room without MD order

Call MD: Vital parameters for MD alert as in original order-set

Diet: Same as standard order set. All meals are to be paper service

Telemetry and vitals:

1. Telemetry options should be included
2. Vitals: Check vitals with meals \pm at bedtime, with other nursing care only

Isolation: Unmodifiable:

1. COVID Precautions: Gown, gloves and either PAPR or N-95 with face shield.

Nursing orders:

1. COVID Precautions: Gown, gloves and either PAPR COVID-PPE to be worn each time anyone enters patient room: Gown, gloves, and either PAPR or N-95+ eyeshield. This includes entry during Rapid response and Code-blue
2. Use minimum number of visits at bedside by combining patient care in each visit: Vitals check, blood glucose, skin check, phlebotomy, medication administration, treatment, meal delivery, other patient care. Prefer to have these care times at meal times \pm bedtime
3. Use video visit or in-room phone for checking in on patient and to screen for symptoms or changes whenever possible prior to entering room and proceed with bedside assessment only if concerns identified. If patient is unable to effectively communicate by phone/video, perform routine assessment at bedside at preferred care times as above
4. Facilitate video visit or in-room phone for visits by family
5. MD order needed for visitors to enter patient room, even after they obtain permission from the Hospital Director
6. Nursing to perform phlebotomy for any laboratory tests ordered
7. Nursing to deliver meals at bedside
8. Please ensure patient can reach bedside in-room phone at all times and knows what extension to call to reach nursing

Laboratory orders:

The following orders are automatic, with option for MD to override

1. CBC with differential
2. Chem 7
3. LFTs
4. CRP
5. LDH
6. Ferritin, D-dimer, fibrinogen
7. HIV test
8. Cytokine panel

Consultation:

Health psychology consult with opt-out option

Medication orders (alert): Please time medications when possible to meal times:

- (i) QAM (BEFORE BREAKFAST) = with breakfast
- (ii) QDAILY (WITH LUNCH)
- (iii) QPM (WITH SUPPER)
- (iv) BID (WITH MEALS)
- (v) TID (W/MEALS)

strategies and tools, an app for stress-o-meter to self assess the daily stress burden, and various mindfulness and cheerfulness endeavors and workshops. Some of these materials and resources are shared here.

Conclusion

Pandemic response has never been this quickly needed globally, nor this better informed. The COVID-19 pandemic has occurred in the age of unprecedented global

connectivity, and has affected countries worldwide, turning necessity of information sharing into a blessing. Journals, networks, virtual meetings and conferences, governmental response dissemination systems, and the overall willingness to propagate information and experience have been a remarkable contribution to the preparedness for this pandemic. Our experience with hospital preparedness at our facility has been multidisciplinary and effective, largely because of the central incident command body that ensured quick and thoughtful application of measures and helped us organize our COVID-19 response. While some of the measures used at our facility may not be applicable at resource-limited healthcare systems, most of our preparedness steps can be implemented globally, and we share them here to help other institutions learn from our experience, if and as needed. While these are unprecedented and frightening times, a coordinated, facile, and effective response can help minimize the impact of COVID-19.

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