**PRACTICE MANAGEMENT**

PM&R

# The use of decision support for inpatient rehabilitation during the COVID-19 pandemic: Responding to a rapidly evolving health care crisis

## Mark E. Huang MD[1,2]

[1]Department of Physical Medicine and Rehabilitation, Northwestern University Feinberg School of Medicine, Chicago, Illinois

[2]Shirley Ryan Abilitylab, Chicago, Illinois

**Correspondence**
Mark Huang, Department of Physical Medicine and Rehabilitation, Northwestern University Feinberg School of Medicine, Chicago, IL, USA.
Email: mhuang@sralab.org

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has abruptly affected how health care is provided. The pressing issues for many organizations in response to the COVID-19 pandemic include identifying infection control standards, staffing and equipment needs, establishing care protocols, minimizing staff exposure, and ensuring staff is educated on latest updates.[1] As clinical guidelines, testing protocols for diagnosis, and treatment regimens continue to evolve, it has become increasingly difficult for health care providers to keep up with the new information. This pandemic has affected all levels of care including postacute care services such as inpatient rehabilitation facilities (IRF). IRFs also have unique challenges such as how to safely provide rehabilitation for these patients.

Decision support is a common concept in clinical informatics. As defined by the Health Information Management System Society (HIMSS), clinical decision support is "a process for enhancing health-related decisions and actions with pertinent, organized clinical knowledge and patient information to improve health and healthcare delivery."[2] The primary focus is to present the user with information to better inform them during decision making to improve patient safety and outcomes.[3] Decision support can take many forms such as rules and alerts that appear based on user actions. The use of standardized order sets that have the relevant orders for a particular diagnosis or condition is a common example. Another example is the presentation of key information on a computer screen in the electronic health record (EHR) or on a printed report.

Decision support can be a useful strategy to help alleviate many of the challenges seen with the rapidly evolving information regarding COVID-19. Although there are examples of the application of decision support in response to COVID-19 in acute care settings,[4,5] this article focuses on the application of decision support in an IRF. The purpose is demonstrate the use of decision support to aid in the screening, diagnosis, and evaluation of patients with COVID-19 in an IRF as well as informing providers of the latest information related to COVID-19.

## DECISION SUPPORT APPLICATIONS

In addressing responses to COVID-19 pandemic at an IRF, several key issues were identified: diagnostic testing for COVID-19, identification of affected patients, standardization of care for patients with COVID-19, and dissemination of updated information to providers regarding COVID-19.

### Diagnostic testing for COVID-19

Diagnostic testing is critical to identifying patients with COVID-19. The two main methods of testing for SARS CoV-2 include molecular testing and antigen testing. Order sets were created to provide clinicians with the most current options for ordering diagnostic tests and included instructions for testing indications (Figure 1 (A)). Order sets were modified based on test availability and changes to diagnostic testing guidelines at the facility. As an example, when the rapid antigen test was initially deployed, availability was limited to certain
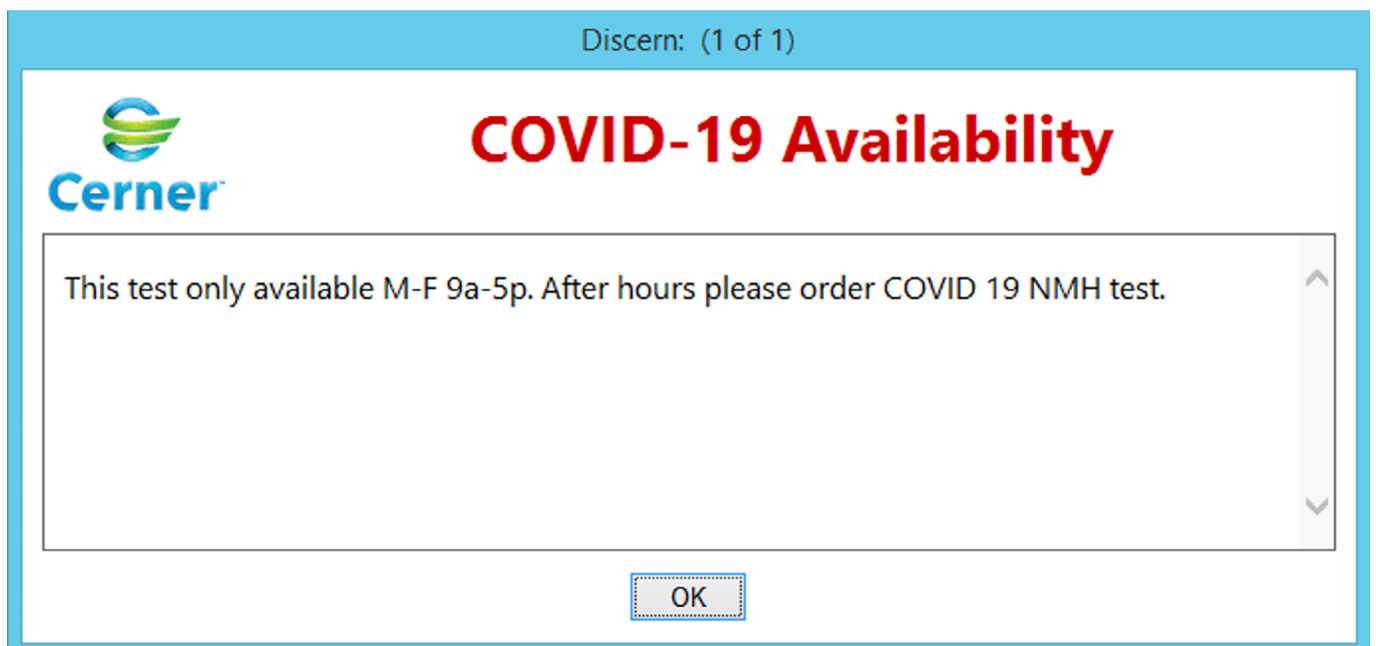
(A)
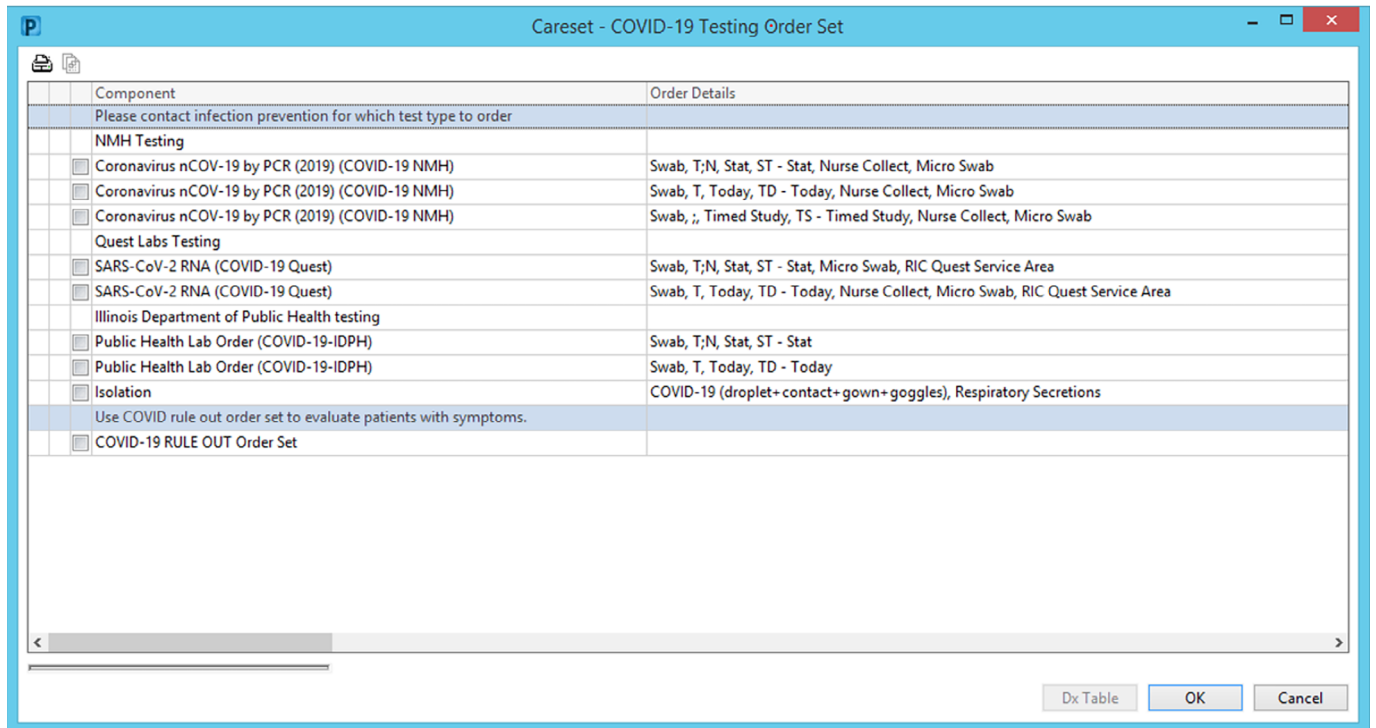


(B)



**FIGURE 1** (A) COVID-19 diagnostic testing order set. (B) Initial pop-up alert for COVID-19 rapid test when test had limited availability

times of the day because of staffing issues. A pop-up alert was created to notify users of the hours of availability (Figure 1(B)) of the antigen test. When the infection prevention committee at the facility recommended routine screening of all inpatient admissions, the molecular diagnostic test order was added to all the admission order sets by default so that these would be automatically ordered for every admission.

Table 1 shows the number of COVID-19 diagnostic tests ordered by month to show the increase in orders

since the initiation of these order sets. There was a dramatic rise in molecular test ordering once the orders were available for clinician use and routine COVID-19 diagnostic testing was performed on all patients on admission. Rapid antigen test use also increased once this option was available. The decrease in numbers of tests ordered in later months was due to a decrease in referrals to the COVID-19 unit for rehabilitation and cessation of surveillance testing for clearance of COVID-19 positive patients.

## Identification of affected patients

The EHR can be configured to create visual flags to easily identify patients with COVID-19 to health care providers. This is accomplished primarily through use of isolation orders. As COVID-19 was a novel infection, there was a need to create a separate isolation order for COVID-19. Isolation orders at the IRF were further refined to distinguish between patients with suspected COVID-19 and those with confirmed COVID-19 based on SARS CoV-2 diagnostic testing. Two separate isolation orders were created to distinguish between confirmed COVID-19 patients and those undergoing admission screening or those with suspected cases. The distinction was made to determine if patients needed to be moved to a dedicated COVID-19 treatment unit or remain in their current location with isolation precautions in place. Table 1 demonstrates the use of these isolation orders over time. The use of isolation orders decreased as the census in the COVID-19 rehabilitation unit decreased.

Isolation status was added to the patient banner bar in the EHR so that any isolation needs are easily visible when opening a patient's chart. When physicians were rounding, they wanted to identify patients with suspected or confirmed COVID-19. Isolation status was added to summary rounding pages that were printed and used by medical providers for daily patient rounds. This allowed weekend and covering physicians to easily identify patients with COVID-19 or other isolation issues especially when patients were not in their rooms. Clinicians found the addition of the isolation status to the banner bar and rounding reports helpful to plan their work day and seek appropriate personal protective equipment (PPE) when treating patients.

Once COVID-19 specific content became available from the EHR vendor, this was quickly implemented. An example is a COVID-19 patient dashboard that included relevant information such as patient diagnosis, location, respiratory assessment, respiratory symptoms, vital signs, oxygen requirement, COVID-19 test order results, and isolation orders. Both infection prevention staff as well as clinicians found the dashboard useful both for tracking patients with potential COVID-19 symptoms and ensuring that these patients had appropriate testing as well as for clinicians to more easily identify patients who might be at risk.

## Standardization of care of suspected and confirmed COVID-19 patients

To support standardized processes for caring for patients with suspected COVID-19, order sets were created to assist clinicians in providing care for these patients. The inclusion of all orders in one location is one of the hallmarks of decision support that allows clinicians to easily access the most relevant orders without having to search for orders individually. These order sets can be modified quickly by the information technology (IT) analysts to reflect any new updates that arise.

Initially the IRF did not treat patients with confirmed cases of COVID-19. Order sets were created to guide clinicians to transfer patients with suspected COVID-19 to a specific unit within the hospital to await confirmation by diagnostic testing. Patients with negative COVID-19 diagnostic test results were moved back to their original rehabilitation unit and patients with positive test results or imaging results suggestive of COVID-19 were transferred to an acute care hospital for management. The order set included isolation orders, visitor restrictions, and instructions regarding the appropriate PPE. Furthermore, the orders specifically instructed that patients could not leave the room for rehabilitation therapies when they were undergoing testing for a rule-out scenario. Other orders included hospitalist consultation, chest radiograph, and laboratory tests such as a D-dimer and procalcitonin.

Once the IRF began accepting patients for rehabilitation following recent COVID-19 infection as well as treatment of asymptomatic COVID-19 positive

**TABLE 1** COVID-19 diagnostic testing and COVID-19 isolation orders entered per month

| | COVID-19 diagnostic test | | | Isolation order |
| Month | Internal lab molecular PCR | Outside lab molecular PCR | Rapid antigen test | Number of COVID-19 isolation orders[a] |
| --- | --- | --- | --- | --- |
| March | NA | NA | NA | 38 |
| April | 90 | 10 | NA | 78 |
| May | 326 | 1 | NA | 208 |
| June | 555 | 0 | 30 | 336 |
| July | 474 | 1 | 38 | 375 |
| August | 452 | 0 | 89 | 393 |
| September | 326 | 0 | 53 | 269 |

Abbreviations: COVID-19, coronavirus disease 2019; NA, order not yet implemented; PCR, polymerase chain reaction.
[a]Represents suspected and confirmed COVID isolation orders.

**FIGURE 2** Employee intranet page with COVID-19 updates link

**TABLE 2** Page views per month (total views and COVID-19 update page)

| Month | All intranet page views 2019 | All intranet page views 2020 | COVID-19 update views 2020 |
|---|---|---|---|
| February | 7810 | 9560 | NA |
| March | 9371 | 15,742 | 6201 |
| April | 9572 | 11,424 | 3422 |
| May | 8461 | 9641 | 1783 |
| June | 7951 | 8161 | 737 |
| July | 8200 | 7035 | 1228 |
| August | 8935 | 6936 | 835 |
| September | 10,587 | 7731 | 383 |

Abbreviations: COVID-19, coronavirus disease 2019; NA, page not yet implemented.

patients, a new order set was created for treatment of confirmed cases of COVID-19. As patients with COVID-19 were noted to be hypercoagulable,[6] inflammatory markers such as D-dimer and C-reactive protein scheduled on a routine basis were included in the order set so that clinicians could follow laboratory trends for these markers. There was a clinical observation of higher incidence of need for speech assessments for dysphagia,[7] most likely late sequelae from respiratory failure and intubation in the majority of these patients. This led to the addition of speech language pathology evaluations to the order sets so that these assessments occurred automatically.

Another evolving process was determining when patients no longer required isolation. Because there was initially little literature in regard to when patients with COVID-19 would no longer be contagious, our hospital infection prevention committee recommended COVID-19 antigen test on admission as well as on Day 7 and Day 10 in an attempt to clear COVID-19 positive patients with two consecutive negative tests. As information evolved regarding resolution of symptoms and clearance of viral load, patients were no longer being routinely tested except in certain circumstances and in most cases clearance was time based on symptom onset or time of first positive test result.[8] As a result, the order sets were changed to remove routine COVID-19 antigen testing.

## Dissemination of Updated Information Regarding COVID-19

To supplement email notifications and inservices, an employee intranet website was used to display the latest COVID-19 updates. The intranet website provides general information to employees using a webpage that automatically loads whenever the employee logs into a corporate computer at the IRF. The intranet provides up-to-date information regarding various common questions including the travel policy, masking and PPE policy, employee health screening policy, and other information regarding patient care. If a new update is posted, the date of the update is added so employees

can determine if they need to open the link for new information (Figure 2). Having this information passively presented to employees upon login allows them to have an instant visual update if new information has been posted.

The COVID-19 update link has become one of the most frequently visited pages on the employee intranet site. Table 2 shows overall page views of the corporate intranet site as well as the COVID-19 update page. The most commonly viewed sites included transportation options and masking reminder webpages. As a result of the COVID-19 update page, the overall use of the intranet pages increased early in the pandemic. For 2020 there was a 67% increase in March and 19% increase in April when compared to the respective months in 2019. A subsequent decrease in overall intranet traffic during summer months corresponds to staffing reductions during the summer months as employees were encouraged to take time off. COVID-19 page traffic increased in July when new state travel restrictions went into effect.

## DISCUSSION

The COVID-19 pandemic forced organizations to create processes to adapt to a rapidly changing health care situation. Many organizations created special committees, task forces, and command centers to address the organizational response to the pandemic. Ensuring that new recommendations and information are relayed to clinicians and employees in a timely manner is critical in the ability of an organization to respond to this health care crisis. Responses to the pandemic from an IT standpoint have been described in acute care settings through the use of documentation templates, orders sets, decision trees, reporting and analytic dashboards, and increased use of telemedicine.[4,5,9] Many of these examples are applicable to postacute care settings such as an IRF.

Decision support played a key role in the organization's response to the pandemic. Decision support aided clinicians in providing care through the use of standardized order sets, summary dashboards. and alerts. Standardized order sets aid clinicians in ensuring they were ordering the most current diagnostic tests and precautions for patients in different scenarios such as a clinical suspicion based on symptoms or transfer to a dedicated unit for treatment of COVID-19 as well as for routine care such as admission screening. In addition, the ability to update order sets to reflect new recommendations and guidelines automatically provides clinicians with the latest updates the next time they place orders. The addition of isolation status to the physician rounding report is especially useful for providers not familiar with certain patients. Through the use of summary dashboards and screen, key information is readily visible, and clinicians can

more easily identify suspected or confirmed cases of COVID-19 to ensure they are using the appropriate PPE when treating these patients and provide the necessary interventions. The employee intranet was shown to be an effective way to disseminate information to employees. The overall increase in page views when compared to the prior year demonstrates the effectiveness of the employee intranet site in disseminating information.

Critical in implementing decision support is the close coordination between IT and clinicians. This was crucial in the initial response as many EHRs had not yet developed specific content to address COVID-19. An incident command center including key members of infection prevention staff, leadership, and support services such as IT was activated. When issues required IT involvement, the chief medical information officer (CMIO), vice president of technology, and appropriate information systems managers were quickly involved to allocate technology resources to address COVID-19 related issues to ensure changes in processes and guidelines were properly supported by IT. To facilitate rapid implementation of technology and EHR changes, IT personnel were allotted dedicated time to focus on COVID-19 technology and IT change management prioritized COVID-19 related issues. The IT analysts worked closely with members of infection prevention, key clinical champions, and the CMIO to evaluate the impact of any IT changes on clinician workflow, ensure changes were tested and correctly implemented, and assist in communicating new IT changes to the clinical staff.

Clinician input is also critical to ensure that decision support is implemented in an effective manner that is not disruptive to clinician workflow. Close communication with clinical staff following implementation provides user feedback to guide further decision support changes by IT. Clinician feedback was used to alter alerts and order set changes. Some examples of this include clinician request to create an alert as to the hours when COVID-19 antigen test was available and the addition of patient care and diagnostic test orders that were frequently ordered separately from the newly created order sets. Clinicians also requested the addition of the isolation status to rounding reports for easier identification of patients with COVID-19. Another critical factor is the support of senior leadership to provide the appropriate IT and infection prevention resources to assess the current status, make recommendations, and implement changes.

More important, the decision support tools developed as a response to COVID-19 can be applied to future health care crises as well as normal processes for quality improvement and change management. IT resources can deploy similar changes for other applications now that there is a prior example of implementation. The collaboration between IT, clinical staff, and leadership closely resembles the interdisciplinary cooperation seen with an inpatient rehabilitation team. Use of this

approach greatly enhances an organization's ability to implement decision support tools in a changing health care environment.

## CONCLUSION

Decision support tools are a critical strategy in response to the COVID-19 pandemic in an IRF. The ability of decision support to aid in presenting updated information regarding best practices for patient care and to provide timely information updates to revised processes and procedures to employees greatly aids an IRF in its ability to adapt to the COVID-19 pandemic. The use of decision support to supplement an organization's rapid response can applied to future health care crises and emergencies.

### ORCID
*Mark E. Huang* https://orcid.org/0000-0001-5788-0975

### REFERENCES

1. Griffin KM, Karas MG, Ivascu NS, Lief L. Hospital preparedness for COVID-19: a practical guide from a critical care perspective. *Am J Respir Crit Care Med*. 2020;201(11):1337-1344.
2. Osheroff J, ed. Improving Outcomes with Clinical Decision Support: An Implementer's Guide. Second Edition. Chicago, IL: Health Information Management System Society (HIMSS); 2011.
3. Shoolin JS. Clinical decision support and the electronic health record-applications for physiatry. *PM R*. 2017;9(5S):S34-S40.
4. Reeves JJ, Hollandsworth HM, Torriani FJ, et al. Rapid response to COVID-19: health informatics support for outbreak management in an academic health system. *J Am Med Inform Assoc*. 2020;27(6):853-859.
5. Grange ES, Neil EJ, Stoffel M, et al. Responding to COVID-19: the UW medicine information technology services experience. *Appl Clin Inform*. 2020;11(2):265-275.
6. Iba T, Levy JH, Levi M, Thachil J. Coagulopathy in COVID-19. *J Thromb Haemost*. 2020;18(9):2103-2109.
7. Carda S, Invernizzi M, Bavikatte G, et al. COVID-19 pandemic. What should physical and rehabilitation medicine specialists do? A clinician's perspective. *Eur J Phys Rehabil Med*. 2020;56(4):515-524.
8. Centers for Disease Control and Prevention. *Duration of Isolation and Precautions for Adults with COVID-19*. 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html. Accessed October 2, 2020.
9. Deeds SA, Hagan SL, Geyer JR, et al. Leveraging an electronic health record note template to standardize screening and testing for COVID-19. *Healthc (Amst)*. 2020;8(3):100454.