Improving Healthcare Value: Effectiveness of a Program to Reduce Laboratory Testing for Non-Critically-Ill Patients With COVID-19

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Avoiding routine, repetitive inpatient laboratory testing is a *Choosing Wisely*® recommendation, with benefits that may be even more pronounced in the setting of the COVID-19 pandemic, considering the need to limit unnecessary exposure, use of personal protective equipment, and laboratory resources. However, the COVID-19 pandemic presented a unique challenge: how to efficiently develop and standardize care for a disease process that had yet to be fully characterized. This article describes the development of a local committee to critically review evidence-based practices, reach consensus, and guide practice patterns, with the aim of delivering high-value care. Following the local introduction of recommendations and electronic health record order sets, non-critically-ill COVID-19 patients at our hospital had more inpatient days where they did not receive laboratory tests, achieving sustained special cause variation on statistical process control charts. The principles of *Choosing Wisely*® can be applied even within novel and rapidly evolving situations. *Journal of Hospital Medicine* 2021;16:495-498. © 2021 Society of Hospital Medicine

The COVID-19 pandemic posed an unprecedented challenge to our current healthcare system—how to efficiently develop and standardize care for a disease process yet to be fully characterized while continuing to deliver high-value care. In the United States, many local institutions developed their own practice patterns, resulting in wide variation.

The Society of Hospital Medicine's *Choosing Wisely*® recommendations include avoiding repetitive routine laboratory testing.[1] In the setting of the early stages of the COVID-19 pandemic (particularly before vaccines were broadly available), the benefits of avoiding routine repetitive testing may have been more pronounced considering the need to limit unnecessary healthcare professional exposure to infected individuals and to conserve resources, including personal protective equipment (PPE) and laboratory resources.[2]

In April 2020, at Dell Seton Medical Center (DSMC) at the University of Texas at Austin, we created a Therapeutics and Informatics Committee to critically review evidence-based practices, reach consensus, and guide practice patterns, with the aim of delivering high-value care. This brief report aims to evaluate the effectiveness of standardized electronic health record (EHR) order sets in appropriately decreasing lab testing for non-critically-ill hospitalized COVID-19 patients.

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Published online first July 21, 2021.

Find additional supporting information in the online version of this article.

Received: January 15, 2021; **Revised:** May 3, 2021; **Accepted:** May 4, 2021

© 2021 Society of Hospital Medicine DOI 10.12788/jhm.3649

METHODS

Study Design and Setting

We followed SQUIRE guidelines for reporting this quality improvement intervention.[3] Using retrospective chart review, we analyzed laboratory ordering patterns for COVID-positive patients at a single safety net academic medical center in Austin, Texas. Data were abstracted using a custom SQL query of our EHR and de-identified for this analysis. Our internal review board determined that this project is a quality improvement project and did not meet the criteria of human subjects research.

Study Population

All adult (age ≥18 years), non-intensive care unit (ICU), COVID-positive patients with an observation or inpatient status discharged between March 30, 2020, and March 7, 2021, were included in the analysis. Patients were excluded if they were ever transferred to an ICU. COVID-positive status was confirmed via a positive polymerase chain reaction (PCR) test for SARS-CoV-2.

Intervention

In April 2020, we created a Therapeutics and Informatics Committee, an interprofessional group including hospitalists, infectious disease, pulmonary and critical care, pharmacy, hospital leadership, and other subspecialists, to iteratively evaluate evidence and standardize inpatient care. This committee was created in response to the COVID-19 pandemic and has been uniquely focused on COVID-19-related care.

On April 30, 2020, the committee met to evaluate routine laboratory tests in patients with COVID-19. Prior to this meeting, there was a clinical order set (Cerner "powerplan") in the EHR

that included daily laboratory tests, and individual provider ordering practices were heterogeneous, with a strong predilection for ordering an array of inflammatory markers with unclear clinical benefit and high cost. The committee's consensus recommendation at that meeting was that patients admitted to the floor did not require routine daily laboratory tests. Complete blood count (CBC), complete metabolic panel (CMP), D-dimer, and troponin were among the labs recommended to be obtained no more frequently than every other day. The committee believed that reducing unnecessary labs would improve value without compromising patient care. These lab ordering practices were incorporated into a customized COVID-19 EHR order set that could be shared among providers, but are not discoverable using the search feature until they are formally built by the informatics team. Changes to the order sets were communicated through multiple platforms and widely adopted by frontline providers.

The committee revisited laboratory ordering practices on June 25, 2020, making the recommendation to further discontinue trending troponin levels and reduce the amount of baseline labs, as they were contributing little to the clinical gestalt or changing management decisions. The customized EHR order sets were updated to reflect the new recommendations, and providers were encouraged to adopt them.

Although direct feedback on ordering practices can be an effective component of a multipronged intervention for decreasing lab usage,[4] in this particular case we did not provide feedback to physicians related to their lab usage for COVID-19 care. We provided education to all physicians following each local COVID management consensus guideline change through email, handbook-style updates, and occasional conferences.

Measures and Analysis

The main process measure for this study was the mean hospitalization-level proportion of calendar hospital days with at least one laboratory result for each of four separate lab types: white blood cell count (WBC, as a marker for CBC), creatinine (as a marker for chemistry panels), troponin-I, and D-dimer. First, individual hospitalization-level proportions were calculated for each patient and each lab type. For example, if a patient with a length of stay of 5 calendar days had a WBC measured 2 of those days, their WBC proportion was 0.4. Then we calculated the mean of these proportions for all patients discharged in a given week during the study period for each lab type. Using this measure allowed us to understand the cadence of lab ordering and whether labs were checked daily.

Mean daily lab proportions were plotted separately for CBC, chemistry panel, troponin I, and D-dimer on statistical process control (SPC) charts. The baseline period used for all SPC charts included the calendar weeks March 30, 2020, through June 1, 2020. The Montgomery rules were used for determining periods of special cause variation.

RESULTS

A total of 1,402 non-ICU COVID-positive patients were discharged between March 30, 2020, and March 7, 2021, from our hospital, with a median length of stay of 3.00 days (weekly discharge data are shown in the Figure). The majority of patients were Hispanic men, with a mean age of 54 years (Appendix Table).

To assess intervention fidelity of the order sets, we performed two random spot checks (on May 15, 2020, and June 2, 2020) and found that 16/18 (89%) and 21/25 (84%) of COVID admissions had used the customized order set, supporting robust uptake of the order set intervention.

Mean daily lab proportions for each of the four lab types—chemistry panels, CBCs, D-dimer, and troponin—all demonstrated special cause variation starting mid June to early July 2020 (Figure). All four charts demonstrated periods of four points below 1-sigma and eight points below the center line, with troponin and D-dimer also demonstrating periods of two points below 2-sigma and one point below the lower control limit. These periods of special cause variation were sustained through February 2021. This represents a significant increase in the number of days that these hospitalized patients did not have these labs drawn.

We evaluated the proportion of all COVID-19 patients who spent time in the ICU over the entire study period, which remained consistent at approximately 25% of our hospitalized COVID-19 population. On a SPC chart, there was no evidence of change in ICU patients following our intervention.

DISCUSSION

Non-critically-ill COVID-19 patients at our hospital had more inpatient days where they did not receive specific laboratory tests following the introduction of locally developed, standardized recommendations and an electronic order set. These data show sustainability and endurance of this intervention through both our summer and winter surges, and the association did not correlate directly with significant changes in the number of COVID-19 patient discharges, supporting that its impact is independent of case volume.

Whereas *Choosing Wisely*® recommendations have been traditionally based on well-established common areas of overuse, this example is unique in showing how these same underlying principles can be applied even in unclear situations, such as with the COVID-19 pandemic. Through multidisciplinary review of real-time evidence and accumulating local experience, the Therapeutics and Informatics Committee at our hospital was able to reach consensus and rapidly deploy an electronic order set that was widely adopted. Eventually, the order set was formally adopted into our EHR; however, the customized COVID-19 order set allowed rapid improvement and implementation of changes that could be shared among providers. As confirmed by our spot checks, this order set was widely used. The order set bolstered the effect of our Therapeutics and Informatics Committee, which served as our platform to disseminate consensus recommendations and build them into clinical workflows.

There are several limitations to this brief analysis. First, we were unable to assess patient outcomes in response to these changes, mostly due to multiple confounding variables

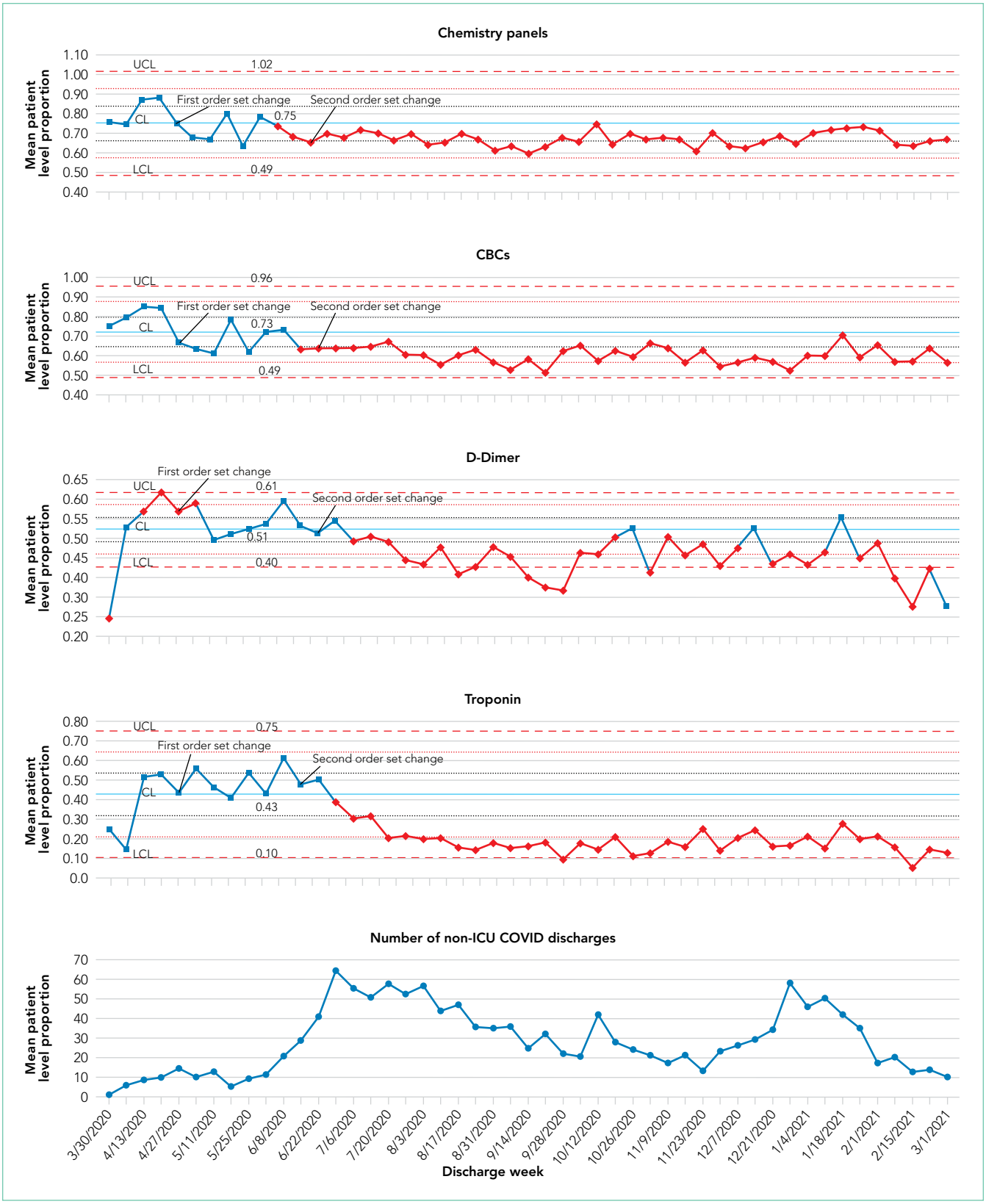

FIG. Statistical Process Control Charts of Lab Usage Over Time for Non-Critically Ill COVID-19 Inpatients. These statistical process control charts (SPCs) show the mean patient-level proportion of calendar hospital days with at least one laboratory result for each of four separate lab types: chemistry panels, complete blood counts (CBCs), D-dimer, and troponin-I, shown with lower control limits (LCL) and upper control limits (UCL). The baseline period used for all SPC charts was the calendar week March 30, 2020, through March 7, 2021. The Montgomery rules were used for determining periods of special cause variation. Special cause variation is illustrated on each chart using red diamonds, and normal variation is illustrated using blue squares. The number of all non-ICU COVID discharges at our hospital plotted each week over time is also shown.

throughout this time period with rapidly shifting census numbers, and the adoption of therapeutic interventions, such as the introduction of dexamethasone, which has shown a mortality benefit for patients with COVID-19. However, we have no reason to believe that this decrease in routine laboratory ordering was associated with adverse outcomes for our patients, and, in aggregate, the outcomes (eg, mortality, length of stay, readmissions) for COVID-19 patients at our hospital have been better than average across Vizient peer groups.[6] Prior studies have shown that reduced inpatient labs do not have an adverse impact on patient outcomes.[7] Furthermore, non-ICU COVID-19 is generally a single-organ disease (unlike patients with critical illness from COVID-19), making it more likely that daily labs are unnecessary in this specific patient population. There was no increase in the proportion of COVID-19 ICU patients following our intervention.

In conclusion, the principles of *Choosing Wisely*® can be applied even within novel and quickly evolving situations, relying on rapid and critical review of evidence, clinician consensus-building, and leveraging available interventions to drive behavior change, such as shared order sets.

Disclosures: The authors have nothing to disclose.

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