Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Commentary

Impact of SARS-CoV-2 on hospital acquired infection rates in the United States: Predictions and early results

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The first case of SARS-CoV-2, also known as COVID-19, in the United States was reported on January 22, 2020,[1] and the disease continues to spread throughout the United States relatively quickly. Even before cases were confirmed in the US, many Infection Preventionists (IP) were involved in preparation activities for their facilities. As cases spread, and the disease came closer to home, most IP departments saw COVID-19 take over the majority of their daily activities. As IPs have managed preparedness and response for questions about the science of this disease, personal protective equipment, modes of transmission, and hundreds of details and minutia related to caring for these patients, there has been reduced time to focus on healthcare associated infection (HAI) surveillance and compliance with prevention bundles.

As a part of a series of waivers and exceptions to provide flexibility to healthcare providers responding to the COVID-19 crisis, CMS waived reporting requirements for HAIs through June 2020.[2] Many facilities will take advantage of those waivers, as they have not been able to proactively surveil their patient population for traditional IP concerns, such as central line associated blood stream infections (CLABSI), catheter associated urinary tract infections (CAUTI), surgical site infections (SSI), and *Clostridioides difficile* infection (*C. diff*). However, as the emergency needs of the pandemic wane, life will start to return to "normal" and the impact of the pandemic on HAIs will become clear. Using the experiences of hospitals in New York City, NY and St. Louis, MO, the authors offer commentary on the potential infection prevention impact of crisis care for COVID-19 and anticipated resulting impact on HAI rates.

CLABSI – INCREASES EXPECTED

The highest impact to HAI from COVID-19 is expected to be CLABSI rates, and 2 of our facilities have seen rates increases (comparing several months of COVID to rates the prior 15 months, Hospital A saw a 420% increase to rate = 5.38 cases per 1,000 central line days, while Hospital B saw a 327% increase to rate = 3.79 cases per 1,000 central line days). Several factors are expected to increase the number of CLABSI cases, while decreasing low-risk central line denominators, resulting in overall increases in rates and standardized infection rates. As stay at home orders proliferated around the country, many hospitals saw major decreases in overall census. Patients not coming to receive care are those that are lower acuity, such as those seeking elective procedures, and likely have a lower risk of developing bacteremia. This will result in a decrease of the central line denominator, and a shifting of the denominator toward high risk patients. Similar impact will likely be seen in the hospital-onset Methicillin resistant *Staphylococcus aureus* bacteremia rates.

COVID-19 patients are at higher risk of CLABSI for many reasons, including several related to the disease process and medical staff decision-making. The patients that require hospitalization have increased acuity and longer lengths of stay. There may be increased use of femoral lines for central access, as the insertion process is easier in patients presenting with overwhelming critical illness. Additionally, practitioners may believe it is safer than an insertion in the subclavian or internal jugular veins since the femoral site is away from the mouth and respiratory tract. COVID-19 also leads to an increased incidence of acute kidney injury,[3] requiring high numbers of patients to have central access for dialysis. There will be decreased provider focus on removing central lines, and likely a reluctance to try to manage patients with lower risk venous access, such as midlines or peripheral catheters.

Furthermore, several hallmarks of care of COVID-19 patients are important factors that increase risk of CLABSI. In order to minimize exposures of healthcare personnel to COVID-19, many facilities are limiting completion of imaging studies that may be deemed less critical. These missing imaging studies would have been important to support alternative HAI definitions (for example, lack of abdominal imaging to support an intraabdominal infection process). There have been good results with increasing oxygenation to patients through prone positioning.[4] However, the process to turn these patients can result in pulling, tugging and friction at central line insertion sites. Also as patients lay prone for many hours, there will be decreased visualization of the insertion site and other fluid buildup to compromise dressing integrity.[4]

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Several nursing-related practices will also have important impacts on CLABSI risk. Care staff are encouraged to batch their tasks to care for these patients to decrease use of personal protective equipment (PPE). This will lead to more tasks during each visit to the room and fatigue during these care visits could lead to rushing through important time-critical tasks, such as disinfecting needleless access devices. To further decrease the need to enter rooms, hospitals are trying innovative care configurations, such as moving medication pumps and dialysis machinery out of the patient care room and into hallways. These ideas also increase risk of CLABSI as they can lead to substandard IP practice (such as tubing laying on the floor, increasing risk of contamination) as well as other medication administration risks. In some cases where patient surges result in high numbers of critical care cases, there may be need to pull support staff from non-critical care areas where experience with high-risk central lines and CLABSI prevention practices may be lower.

It could be postulated that increased focus on hand hygiene in general will equate to lower infection rates. This may be true for control of cross contamination, as hand hygiene at the end of care during PPE removal will likely be most highly impacted. However, hand hygiene needs will be increased, and easier to miss, during those long episodes of patient care that have been batched into many tasks at one visit.

CAUTI – INCREASES POSSIBLE

Several similar factors may increase the number of CAUTI cases. Smaller increases were seen at our 2 facilities (Hospital A saw a 179% increase to rate = 1.31 cases per 1,000 urinary catheter days, while Hospital B saw a 57% increase to rate = 1.77 cases per 1,000 urinary catheter days). The same decrease in overall census will decrease lower acuity patients and urinary catheter denominators, with those excluded having a lower risk of developing urinary tract infection.

Although we have not seen as significant of increases in the immediate phase of cases, COVID-19 patient hospitalizations will have increased acuity and longer lengths of stay, overall increasing CAUTI risk compared to non-COVID-19 patients. Prone positioning increases risks of traumas with potential pulling and tugging during that process. Many nursing-related practice changes may also impact CAUTI, such as batch tasks of care with opportunity for poor hand hygiene compliance and pulled support staff where experience with CAUTI prevention practices may be lower. There will likely be reluctance to remove unnecessary urinary catheters in this patient population, as alternatives often require more time-intensive nursing practices which would increase room entry needs and PPE use.

SSI – DECREASES POSSIBLE

The impact of the COVID-19 impact on surgical site infections is relatively unknown, and the delayed nature of SSI surveillance prohibits availability of early results. In the short run, the major decrease in number of surgical procedures completed may lead to artificially lower SSI rates, as many facilities will report zero SSI. However, some urgent and emergency cases will still be completed, and they will be at higher risk of SSI; in the setting of a majorly decreased denominator, even one SSI will result in an artificially high SSI rate.

The lower case volume during the heart of the pandemic and even the slow rate at which elective procedures are added back into hospitals as the pandemic wanes should facilitate conditions to maximize prevention for SSI. Fewer cases per day decreases the need for strong focus on throughput and room turnover. With a relaxed schedule comes sufficient time to address critical infection prevention steps, such as careful set-up of the sterile field, correct application of surgical skin prep, and proper between-case cleaning of the environment.

ADDITIONAL INFECTIONS OF INTEREST

C. difficile and other Multi-Drug Resistant Organisms: Our facilities have seen a small decrease in *C. diff* (Hospital A saw a 51% decrease to rate = 0.61 cases per 10,000 patient days, while Hospital B saw a 45% decrease to rate = 1.07 cases per 10,000 patient days). The possibility of SARS-CoV-2 contact transmission necessitating focus on environmental cleaning will have the added benefit of decreasing other organisms spread via contact transmission. Facilities are focusing on hand hygiene and environmental cleaning, assuming there are not major supply chain barriers to sourcing appropriate disinfectants. If facilities have additional environmental cleaning modalities, such as ultraviolet lights or vaporized hydrogen peroxide machines, there will likely be increased utilization. Healthcare facilities outside of "hotspot" areas will see overall decreased census, which decreases semi-private room utilization and overcrowding that contribute to contact transmission. Those same facilities many choose to encourage staff that are less busy to fill spare time with increased environmental cleaning of both public-facing and patient care areas, including ancillary areas and waiting rooms. However, some PPE conservation practices may be concerning for increase in spread, such as reuse of isolation gowns, patient, and staff cohorting and decreased focus on contact isolation precautions in lower risk patients (colonization, past history of active infection). It remains to be seen if the increases in horizontal strategies will mitigate this decrease in vertical strategies.

Ventilator associated events, including pneumonia: The recent combination of ventilator associated conditions (VAC) and infection-related VAC and possible into one tiered definition may lead to an interesting juxtaposition: we anticipate an increase in numbers of VAC, but the number of cases that go to on meet the definition of pneumonia is unclear. The earlier intubation and subsequent worsening respiratory status of this disease process results in increasing ventilator settings that will trigger the criteria for VAC.[5] However, early data on bacterial superinfection of these patients is conflicting, while there seems to be general awareness that antibiotics are not a key to helping with patient recovery.[6] Less antibiotic use will prevent VAC cases from moving to the infection-related VAC tier of the definition, and may have the added benefit of decreasing *C. difficile* cases as well. Still, prolonged ventilation will increase risk of other bacterial infections. There is an increase in ventilator day denominators due to COVID-19 because aggressive ventilator weaning may be delayed early in the disease process to prevent re-intubation. However, providers and patient families have increased awareness of the high mortality of this disease, and this may result in reluctance to move to tracheostomy for long-term ventilation, which will prevent excessively prolonged ventilator days in some patients.

Hospital-acquired COVID-19: Two new metrics that require monitoring are patients with hospital-acquired COVID-19 infection and healthcare personnel with occupationally-acquired COVID-19. These definitions have not yet been well defined as researchers are still learning more about COVID-19 epidemiology, including the impact of universal masking and/or eye protection, asymptomatic carriage,[7] the prolonged incubation period, and the inability to know if an employee was infected at work or through community exposure. Determining these definitions, particularly that of HAI COVID-19, should be a priority for the infection prevention field. In the meantime, the intensive focus on PPE, including the newest statements by regulatory bodies that require universal masking,[8] should result in decreased transmission risk within healthcare facilities.

WHERE DO WE GO FROM HERE?

Infection Preventionists should take action now to prevent some of these anticipated health outcomes, and sustain factors that would help decrease other infections. IPs should pay critical attention to the innovative care configurations that are being used, and be part of decision-making and risk mitigation strategies for these processes. There needs to be a continued focus on the 5 moments of hand hygiene, particularly moments 2 (before clean/aseptic tasks) and 3 (after blood/body fluid risk).[9] IPs should encourage continual focus on proven best practices for CLABSI and CAUTI prevention, both for seasoned critical care and newer cross-trained staff. In addition, environmental rounding in operating rooms/ procedural areas or ancillary areas, and performing an IP observation of invasive procedures should be prioritized. During this time, IPs should remind staff of critical infection prevention practices and to continue intensive cleaning initiatives.

As the pandemic continues, changes in HAI rates are anticipated. Patients will start to present to the hospital after delaying crucial primary and preventative care visits, such that higher acuity in non-COVID-19 patients should be expected. Increased acuity is expected to result in increased CLABSI and CAUTI rates. Patients selected for the first waves of nonemergent surgeries will likely be at higher infection risk, and staff may need to increase focus on OR throughput as schedules ramp up, both of which may lead to increased SSI rates. Further study will be needed to evaluate the specific impact that all of the discussed factors will have on healthcare-acquired infection rates. The field of Infection Prevention will continue to be an essential need for patient safety.

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