



## Major Article

## Impact of COVID-19 on an infection prevention and control program, Iowa 2020–2021



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## A B S T R A C T

**Background:** The COVID-19 pandemic has affected infection prevention and control (IPC) programs worldwide. We evaluated the impact of COVID-19 on the University of Iowa Hospitals & Clinics IPC program by measuring the volume of calls to the program, changes in healthcare-associated infection rates, and team member perceptions.

**Methods:** We retrieved the IPC call log and healthcare-associated infection trends for 2018–2020. We defined 2 periods: pre-COVID-19 (2018–2019) and COVID-19 (January–December 2020). We also conducted one-on-one interviews and focus group interviews with members of the IPC program and describe changes in their working conditions during the COVID-19 period.

**Results:** A total of 6,564 calls were recorded during 2018–2020. The pre-COVID-19 period had a median of 71 calls and/or month (range: 50–119). During the COVID-19 period, the median call volume increased to 368/month (range: 149–829), and most calls were related to isolation precautions (50%). During the COVID-19 period, the central line-associated bloodstream infection incidence increased significantly. Infection preventionists reported that the ambiguity and conflicting guidance during the pandemic were major challenges.

**Conclusions:** Our IPC program experienced a 500% increase in consultation requests. Planning for future bio-emergencies should include creative strategies to increase response capacity within IPC programs.

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## BACKGROUND

Infection prevention and control (IPC) programs are essential to prevent health care-associated infections (HAI) and improve patient safety.<sup>1–4</sup> Although HAI surveillance is a primary responsibility for IPC programs, they are also responsible for outbreak investigation, infection control data analysis, policy writing, education, and collaboration with other departments. Additional responsibilities include

optimizing health care personnel (HCP) HAI awareness, monitoring hand hygiene practices, and occupational health consultation.<sup>5,6</sup>

Emerging pathogens and pandemics contribute additional responsibilities requiring preparedness efforts and frequent consultation as recommendations continuously evolve. The role of IPC in preventing disease transmission has been emphasized during recent pandemics.<sup>7</sup> The coronavirus disease 2019 (COVID-19) pandemic has affected healthcare systems worldwide and IPC program efforts were diverted to focus on pandemic management.<sup>8</sup>

Few studies have addressed IPC workload, consultation calls, and the impact of the COVID-19 pandemic on IPC programs.<sup>9</sup> Here, we describe the volume and characteristics of IPC consultation calls before and during the COVID-19 pandemic. We also described how

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the COVID-19 pandemic influenced HAI trends, and how it affected IPC workload and program organization.

## METHODS

### *Settings and design*

The University of Iowa Hospitals & Clinics (UIHC) is an 811-bed tertiary care center with over 200 outpatient clinics. More than 36,000 patients are admitted each year. IPC program efforts at UIHC began in 1969.<sup>10</sup>

### *IPC program at UIHC*

The IPC program is an integral part of the Quality Improvement Program. It is led by a hospital epidemiologist, 2 associate hospital epidemiologists, and a lead infection preventionist (IP). IPC works with an institution-wide Infection Control Work Group, which reports to the Quality and Safety Subcommittee. The IPC had 7 IPs and one administrative support staff member in the pre-COVID-19 period. Support is also provided by 2 data analysts. IPs have diverse relevant backgrounds including nursing, physicians, and other advanced training (Ph.D. [Biological Sciences], and M.S. [Infectious Disease Epidemiology]).<sup>1</sup>

### *IPC program consultation calls*

The IPC program covers a 24/7 pager/phone line to address urgent infection prevention issues and questions. The IPs record call characteristics in the IPC call log. Date/time of consultation, requesting service, and the reason for phone consults were recorded in our electronic database. IPs document the consult recommendation and time needed for consult resolution.

We categorized the calls into working hours calls (8:00 AM–4:59 PM) and after-work calls (5:00 PM–7:59 AM). The sources of calls were classified into inpatient, outpatient, laboratory, department of public health external requests (calls from the department of public health and other medical centers), employee health (including employee health clinic and employee concerns), environmental/engineering, and others. Reasons for consultation were classified into the following categories: surveillance, isolation precautions, results and testing (including questions about indication or timing for testing and information regarding lab results), exposures (including HCPs and non-HCPs exposures), environmental (including disinfection, cleaning, and construction), and outside requests (such as calls from the department of public health or other medical centers about infection prevention issues). Calls concerning specific infections were categorized into gram-positive organisms, gram-negative organisms, tuberculosis, *Clostridioides difficile*, influenza, varicella, hepatitis viruses, other viruses, emerging infections (eg, Zika virus, Ebola virus, Middle East Respiratory Syndrome (MERS)), and COVID-19. We retrospectively obtained call data from the IPC call log. We defined calls during 2018–2019 as the pre-COVID-19 period and calls during January–December 2020 as the COVID-19 period.

### *Incidence of HAIs*

We monitored changes in the incidence of the following HAIs: central line-associated bloodstream infections (CLABSI) per 1,000 central line-days, catheter-associated urinary tract infections (CAUTI) per 1,000 catheter-days, and *Clostridioides difficile* infections (CDI) per 10,000 patient-days. We calculated the incidence of each HAI using the National Healthcare Safety Network (NHSN) calculation method.<sup>11</sup>

### *Qualitative analysis and interviews*

In-person one-on-one interviews and one semi-formal focus group were conducted. The questions asked during each round of interviews were informed by data and extant research. For one-on-one interviews, open-ended questions were used to investigate IPC responses to the global health crisis and the effects of mobilizing in response to the pandemic. The group interview/focus group was organized around semi-structured, open-ended questions that were developed during the one-on-one interview phase. Our interviewer (CM) digitally recorded and transcribed both the one-on-one interviews and focus group.

### *Outcomes and statistical analysis*

We investigated: (1) the trend of IPC consultation calls prior to and during the COVID-19 period, (2) IPC call characteristics, (3) the impact of the COVID-19 pandemic on HAIs, and (4) the experience of IPs during the COVID-19 pandemic. We present results as frequencies and percentages. We used interrupted time-series analysis to evaluate the impact of COVID-19 on HAIs. The monthly incidence of CLABSI, CAUTI, and CDI was analyzed for differences before and during the COVID-19 pandemic. Statistical significance was set at 0.05. All statistical analyses were performed using Stata Statistical Software: Release 16 (College Station, TX: StataCorp LLC). This study was approved by the Institutional Review Board of the University of Iowa.

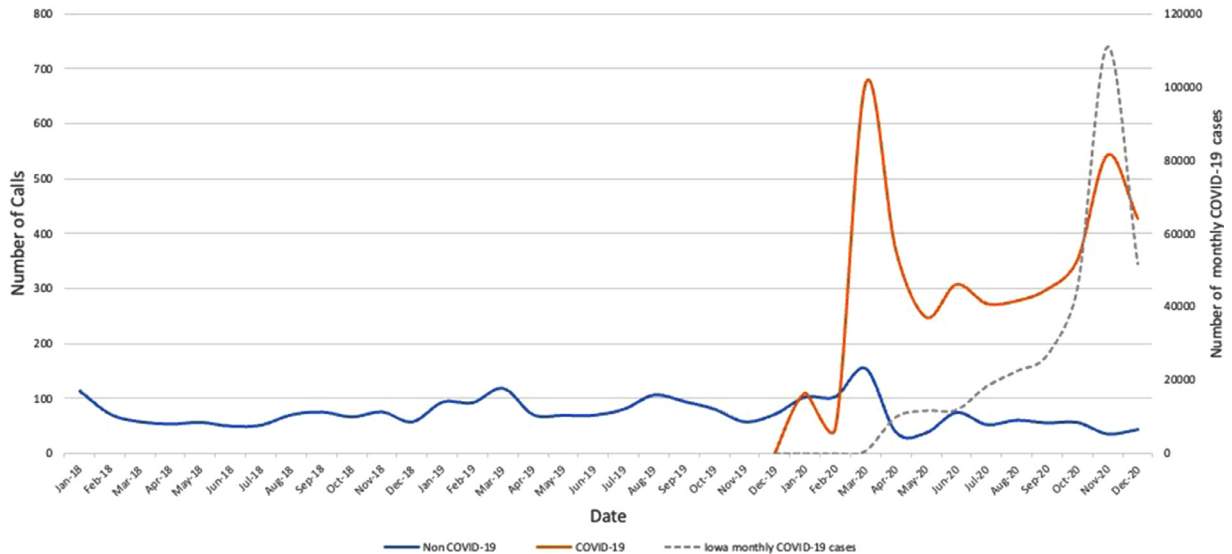
## RESULTS

### *Calls during the pre-COVID-19 period (2018–2019)*

A total of 1,817 calls were recorded during 2018–2019. The median was 71/month (range, 50–119). The mean time spent responding was 10 minutes (range, 2–720). The majority of calls were during working hours (93%). The most frequent call sources were inpatient units (50%), department of public health (20%), laboratory (9%), outpatient clinics (7%), employee health (4%), environmental and engineering services (3%) and other healthcare facilities (3%). Most calls were regarding isolation and precautions (42%), followed by outside requests (22%), exposures (13%), result/testing (10%), environmental and construction calls (9%), travel (2%) and surveillance (0.7%). The most frequent infection-related calls were related to tuberculosis (17%), gram-negative organisms (14%), viruses other than influenza (11%), influenza (9%), pests (7%), *Clostridioides difficile* (6%), varicella (4%), and emerging infections (eg, Zika virus, Ebola virus, and MERS) (3%).

### *Calls during the COVID-19 period (2020)*

A total of 4,745 calls were recorded during January–December 2020. Median monthly call volume increased to 368/month (range, 149–829) (Fig 1). Most calls (83%) were COVID-19 related. The median number of monthly COVID-19 calls was 302 (range, 45–674). The median number of monthly non-COVID-19 calls decreased from 71 in the pre-COVID-19 period to 56 (range 36–155) during the COVID-19 period. Of the 4,745 calls received, 3,224 (68%) had a documented call time, and calls received during working hours represented 83%. The mean time required to respond to each question was 10 minutes (range, 1–480). The most frequent call sources were inpatient units (57%), outpatient clinics (16%), public health (5%), and employees (5%). Most calls were concerning isolation and precautions (50%), COVID-19 testing (20%), exposure (9%), and environmental and construction calls (3%). Tuberculosis (13%) and gram-negative organisms (9%) remained the most common non-COVID-19 infection-related calls. Calls about tuberculosis, influenza, and *Clostridioides difficile*



**Fig 1.** Monthly number of calls to the Infection and Control Program at The University of Iowa Hospitals & Clinics 2018-2020. Blue (non-COVID-19), orange (COVID-19), and grey (Number of monthly COVID-19 cases in Iowa).

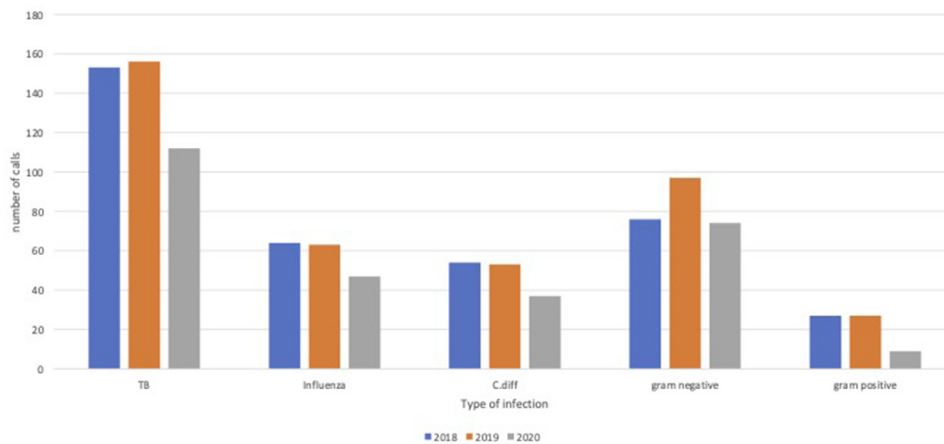
dropped by 20%-25% compared to the pre COVID-19 period (Fig 2). The biggest surges in calls during the COVID-19 period were at the beginning of the pandemic (March 2020) and during the hospital peak COVID-19 census (November 2020).

*Impact of COVID-19 on HAIs*

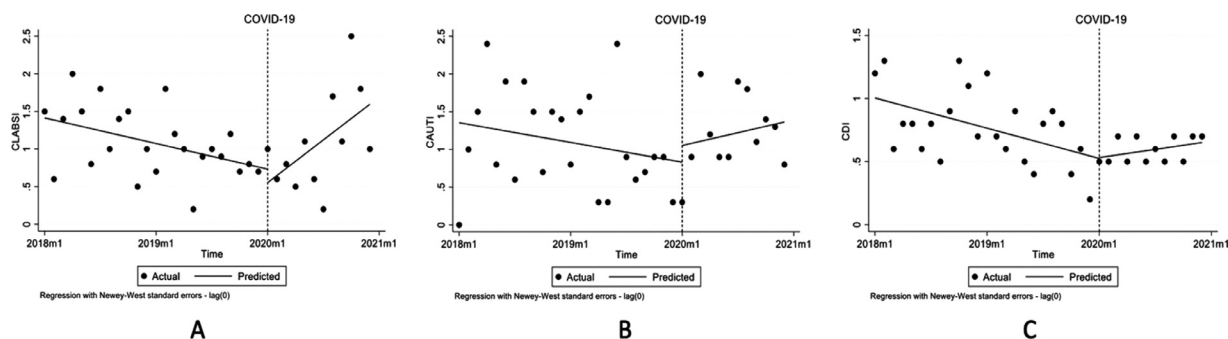
During the pre-COVID-19 period, the CLABSI incidence ranged from 0.7-1.4 per-1,000 central line-days. While the CLABSI incidence decreased in the first 6 months of the pandemic, it subsequently increased to 1.8/1,000 central line-days around the peak of COVID-19 hospital census ( $P = .04$ ) (Fig 3A). The CAUTI incidence during pre-COVID-19 period fluctuated between 0.8-1.7/1,000 catheter days. The impact of COVID-19 on CAUTI incidence (0.6-1.6/1,000 catheter days) during the COVID-19 period was not statistically significant ( $P = .54$ ) (Fig 3B). The incidence of CDI ranged from 0.6-1.0/10,000 patient-days before the pandemic, and 0.4-0.6/10,000 patient-days during the COVID-19 pandemic ( $P = .11$ ) (Fig 3C).

*IPC program adaptation during to COVID-19*

The IPC program consisted of 7 IPs when the pandemic started. The first COVID-19 calls were related to students recently returning from China. They sought guidance related to quarantine and physicians sought personal protective equipment (PPE) guidance. Early in the pandemic (January-March 2020), the process for COVID-19 testing involved approval from the Iowa Department of Public Health (IDPH). The IPC program served as the conduit between clinicians and IDPH. The first solution to the increase in calls was to transition from a 7 days/week call schedule to assigning 12-hour blocks of calls. This scheduling change allowed us to designate an IP to night calls, permitting the team to have rest intervals. Also, we established a call center and trained staff volunteers from the departments of Nursing, Quality Improvement, and Research to help answer daytime calls. In addition, calls from the public were being routed to the IPC team. To assist with public calls, we developed a frequently asked questions document, and our internal Integrated Call Center stepped in to assist community callers with answers. In April, 2 IPs (Full Time Equivalent) requests were submitted and approved. By June 2020, the IPC



**Fig 2.** Volume of non-COVID-19 calls to the IPC program at the University of Iowa Hospitals and Clinics during 2018-2020: Non-COVID-19 calls per type of infection. Abbreviations: TB, tuberculosis; C.diff, Clostridioides difficile.



**Fig 3.** Time series analysis for the impact of COVID-19 on the incidence HAIs at the University of Iowa Hospitals & Clinics during 2018–2020. (A) CLABSI rate ( $P$ -value = .04). (B) CAUTI rate ( $P$ -value = .54). (C) CDI ( $P$ -value = .11).

program grew from a team of 7 to 9. Several initiatives were implemented during this time: COVID-19 preprocedural, admission, and every 5 days serial testing. We reviewed all inpatients with a positive COVID-19 test and developed protocols to assess the need for isolation and templates to enter notes in the medical record for consistent communication. We also began using cycle threshold (Ct) values paired with the assessment of symptoms and serology to evaluate the need for isolation precautions. Ct values were only available to IPC members, requiring us to be consulted when patients were positive for COVID-19 and asymptomatic. In addition, an alert was built into the electronic medical record to assist clinical staff with determining next steps to evaluate the need for isolation precautions. The IPC team was responsible for in-hospital contact tracing for patients and visitors, but a designated occupational health team was developed in August 2020 for contact tracing for HCPs.

We also managed outbreak situations, developed safe practices to extend PPE use, and designed reusable isolation gowns that eventually were manufactured locally. In addition, the team rounded daily on inpatient units assisting with timely infection prevention problem solving, identifying safety issues, and supporting patient care staff. We also managed supply chain issues with surface disinfectants and PPE, and continued HAI surveillance activities while managing the increased call volumes.

#### Qualitative analysis and interviews

Nine IPs participated in both one-on-one interviews and a group meeting. The IP team reported being confronted with ambiguity and uncertainty early on in the pandemic. They discussed the unknowns in terms of durations of the pandemic and local, state, or national surges, the consequent duration of the mobilization of resources in response to the pandemic, the uncertain nature of indicators, contagiousness, treatment, diagnosis and testing, and guidance on mitigation of the virus, the ambiguity of changing guidelines and recommendations from trusted institutions of expertise like the Centers for Disease Control and Prevention and the World Health Organization, and uncertainty as to which advisements take precedence when there were conflicting perspectives and recommendations. In addition, despite praising leadership for the direction given, the team detailed experiencing uncertainty around the prioritization of work, the balance between routine activities and projects and the new work as a front-facing rapid response central hub of COVID-19 inquiries.

#### DISCUSSION

This study demonstrates a substantial increase in IPC consultation call volumes, especially during the beginning and peak of the COVID-19 pandemic. During the COVID-19 period, calls unrelated to COVID-19 decreased. CLABSI incidence increased during the COVID-19

period, while CAUTI and CDI incidence were not significantly impacted. IPs, who play a critical role in this pandemic, experienced multiple challenges: increased workload, competing priorities, and constant change.

During the pandemic, IPC program consultation calls increased significantly and the reasons for the calls were primarily associated with COVID-19. Therefore, IPC program efforts might have been directed toward the COVID-19 response preferentially, which may have negatively affected efforts for traditional infection control and prevention measures not associated with COVID-19. Previous studies reported a wide variation in hospital staffing for IPs and hospital epidemiologists.<sup>12</sup> The lack of guidelines for staffing became a more crucial issue as the COVID-19 pandemic overstretched healthcare systems.<sup>13</sup> The diversion of time away from other infection prevention activities because of increased IPC program calls may have had negative consequences and should be balanced with pandemic responsibilities. In our experience, proactive preparedness and planning of the IPC program helped to accommodate the surge of COVID-19 calls during the pandemic.

In the last decade, there have been noticeable transformative changes in the healthcare setting which rapidly resulted in an expanded IPC program scope of responsibilities.<sup>14</sup> While surveillance is a core responsibility of IPC programs, consuming almost 40–45% of IP time, surveillance issues represented less than 1% of IPC program calls in our study.<sup>12</sup> The most frequent reason to consult the IPC program was concerns regarding isolation precautions and PPE before and during the COVID-19 period. We found that calls concerning gram negative organism were more than gram positive organisms which may be because we have a policy of no contact precautions for methicillin-resistant *Staphylococcus aureus* and vancomycin resistant enterococcus colonization or infection. Remarkably, calls from the department of public health decreased during the pandemic (by 75%), which may be due to the allocation of public health efforts and resources to the pandemic response. We documented a decline in non-COVID-19 consultation calls to the IPC program during the COVID-19 pandemic. This decline in communication regarding non-COVID-19 issues may reflect a decline in HAI prevention efforts during the period, potentially leading to an increase in HAI incidence.

Data on the impact of COVID-19 on HAIs are limited and widely variable. Cole et al. reported an increase in health care workers' compliance with infection control precautions, leading to a decrease in multidrug-resistant organism infections in their health care facility during the pandemic.<sup>15</sup> However, previous studies found that COVID-19 negatively impacted HAI's and led to multidrug-resistant organism in-hospital outbreaks.<sup>16–19</sup> Recently, the Centers for Disease Control and Prevention National Healthcare Safety Network reported an increase in the CLABSI Standardized Infection Ratio (SIR) by 28% compared to the same period in 2019.<sup>20</sup> A multicenter study found that CLABSI events significantly increased during the COVID-19 pandemic,

while CAUTI events were less impacted.<sup>21</sup> This was consistent with the findings of our study. We found that CLABSI incidence during the COVID-19 pandemic was impacted the most during the end of 2020. Improper use of PPE (eg, improper use of gloves due to the fear of contamination), and decrease hand hygiene compliance among HCPs potentially increased the risk of transmission of specific pathogens.<sup>22–24</sup> An increased rate of blood culture contamination during the pandemic may contribute to increased CLABSI rates.<sup>25</sup>

Despite concerns of worsening HAI incidence during the pandemic, a substantial reduction in healthcare-associated CDI and respiratory viral infections were reported.<sup>26,27</sup> Ponce-Alonso et al. reported a significant reduction in CDI (~ 70%) in the context of no reduction in antimicrobial utilization. Strict adherence to PPE since the beginning of the pandemic was speculated as the main reason for this decline. They concluded their extraordinary reinforcement of all infection control measures, including patient isolation, universal PPE, and a reduction in patient visits.<sup>26</sup> In our experience, the incidence of healthcare-associated CDI decreased over the pandemic period; however, it was not statistically significant. Another factor that may have helped reduce the healthcare-associated CDI rate at our institution was a diagnostic stewardship initiative implemented at the end of 2019.

A substantial increase in the workload, and insufficient PPE were major challenges for IPC programs during the pandemic.<sup>28</sup> Also, rapidly changing and conflicting guidelines by different authorities was another challenge preventing the IPC program from implementing the best evidence-based practices regarding COVID-19.<sup>29</sup> Rebmann et al. reported that IPs believed that frequent changes in protocols, staff turnover, and limited resources contributed to increasing HAIs rate.<sup>29</sup> They also reported that increased workload may indirectly impact the rate of HAI because of less attention to observations and inaccurate surveillance. The IPs reported that rapidly evolving changes, and conflicting guidelines and recommendations regarding COVID-19 related IPC practices were a major challenge.

There are several limitations to this study. First, we described IPC program calls in a single academic center, and it may not be generalizable. Variations in call documentation, accuracy, and different call sources might be another potential limitation. Not all consults arrive via phone calls. Nevertheless, we are among the first in describing the trends and characteristics of IPC program consultation calls before and during the COVID-19 pandemic. We did not investigate incidence rates of other infections such as methicillin-resistant *Staphylococcus aureus* and other multidrug-resistant pathogens, ventilator-associated pneumonia, or surgical site infections. The IPs experience described here was based on a single center and the data reflects their retrospective accounts which may not be generalizable to IPs in other centers.

## CONCLUSION

In addition to supporting a proactive COVID-19 response, our IPC program experienced a substantial increase in consultation requests during the COVID-19 period. Most calls were regarding COVID-19 related issues, and we observed a decline in communication regarding non-COVID-19 issues. This may reflect less frontline emphasis on HAI prevention. As the COVID-19 pandemic transitions to endemicity, IPC programs should be strengthened by ensuring adequate staffing, compensation, and creative work modalities.

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