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A seven-year review of hospital-onset *Clostridioides difficile* infection reduction and the case for a multidisciplinary taskforce approach



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Abstract

Background: Hospital-onset *Clostridioides difficile* infection (HO-CDI) is a life-threatening disease that can prolong and complicate a patient's hospitalization. To reduce HO-CDIs and ensure positive health outcomes with reduced cost, utilization of a multi-disciplinary taskforce (MDT) is key to identify gaps, develop action plans, and implement and review interventions in the most efficient and effective manner.

Methods: Over the course of seven years, two rounds of interventions were executed consecutively across a nine-hospital healthcare system to reduce HO-CDI events. The first round (Round 1) driven solely by the Infection Prevention (IP) department spanned four years and consisted of three phases of interventions. The second round (Round 2) led by an MDT was comprised of ten disciplines and likewise had three phases of interventions. Timespan and interventions varied between all phases. Data reported to National Healthcare Safety Network (NHSN) was used for statistical analysis. Intervention effectiveness of each phase was measured using a 2x3 Chi-square test, and a 2x2 Chi-square test was used to compare the IP-only versus the MDT approach styles.

Results: Throughout the seven-year process improvement endeavor, the MDT approach style demonstrated by Round 2 revealed higher efficiency and effectiveness with HO-CDI reduction accounting for 33.7% (268/795, $p < .001$) total events reported to NHSN compared to events from Round 1. Furthermore, Phase 3 of Round 2 showed most successful, accounting for only 6.3% (11/175, $p < .02$) of all interventions from both rounds.

Conclusion: From the start of the MDT to its end, the healthcare system observed an overall HO-CDI reduction of 81.6%. The review of this healthcare system's process improvement course to reduce HO-CDIs reveals utilization of a MDT approach allows for key stakeholders to participate in decision-making, consequently reinforcing ownership of interventions at each phase across the board for a more efficient and effective implementation to sustainable positive results.

Introduction

Clostridioides difficile (*C. diff*) is a spore-forming bacteria that can cause life-threatening diarrhea. According to the Centers for Disease Prevention and Control (CDC) 2019 Antibiotic-Resistant Threats report, *C. diff* affects thousands of people every year and is the most common healthcare-associated infection.² Two methods of *C. diff* acquisition during hospitalization include via fecal-oral transmission or gut dysbiosis primarily from antibiotic use in those previously colonized with *C. diff*.¹ Patients who acquire a hospital-onset *C. diff* infection (HO-CDI) suffer physically, mentally, and financially due to extended length of hospitalization. Attributable costs due to HO-CDI ranges from \$14,257 to \$21,792 within five years after the initial diagnosis.⁴

To ensure positive health outcomes and reduce costs, a multidisciplinary taskforce (MDT) was formed. Multidisciplinary teamwork, also referred to as inter-disciplinary or multi-professional teamwork, is the collaborative process of individuals from various backgrounds who pool their knowledge and expertise together to achieve a joint or unified goal.^{3,5} The aim for our MDT was to reduce and sustain the HO-CDI standardized infection ratio (SIR) to less than 0.50 for the healthcare system by employing a strategic approach that allowed for identification of the most effective intervention(s) during the process improvement period.

Methodology

In 2015, the Infection Prevention (IP) department began a system-wide process improvement (PI) effort to reduce HO-CDI events. Prior to employing interventions, the healthcare system used one molecular test for all *C. diff* testing and followed standard contact precautions for patients who tested positive. Over the next 4 years, IP-driven interventions were rolled-out in three separate phases. The period consisting of IP-driven interventions will be referred to as Round 1. Following the third phase of Round 1, a multi-disciplinary taskforce (MDT) was formed in July 2019. The MDT consisted of ten disciplines to ensure any unforeseen gaps were identified and likewise rolled-out interventions in three phases. The MDT period of

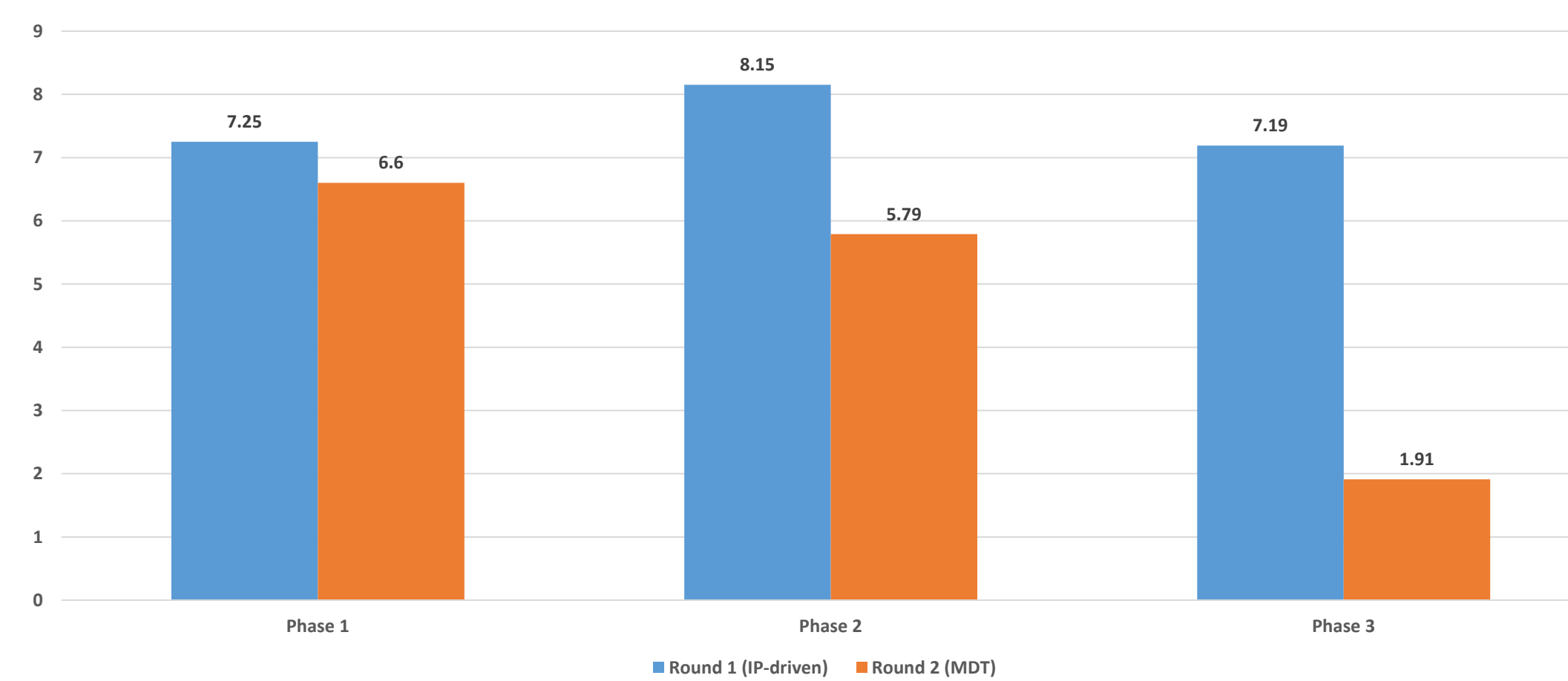
Results

NHSN HO-CDI event data was collected between quarter 3 of 2015 (2015Q3) through quarter 2 of 2022 (2022Q2). Round 1 lasted a total of four years and consisted of 527 total events. From the start of Round 1 to the start of Round 2, the overall rate per 10,000 patient days increased by 2.4%, demonstrating no change during the 4-year period. Round 2 lasted three years with a total of 268 events. From its start in 2019Q3 to its dissolution in 2022Q2, Round 2 experienced an overall rate reduction of 81.6%.

Throughout the seven-year process improvement endeavor, the MDT approach style demonstrated by Round 2 revealed higher efficiency and effectiveness with HO-CDI reduction accounting for 33.7% (268/795, $P < .001$) events reported to compared to events from Round 1. The final intervention went into effect starting the beginning of 2021Q2 (Phase 3), which led to a remarkable change in event and rate reduction. Comparing mean HO-CDI events, Phase 3 of Round 2 showed most successful of all phases, accounting for only 6.3% (11/175, $P = .02$) from both rounds.

MDT participation by discipline varied. Infection Prevention, build analysts from the electronic medical record (EMR) software, and Health Informatics demonstrated 100% participation by attendance to meetings and brain-storming sessions. Clinical education participated the least with a mean attendance of 52.4% for all three phases. The MDT's overall attendance by phase was 82.1%, 84.3%, and 87.5%, respectively, showing a steady increase between each phase. The overall mean of participation by profession was 84.6%.

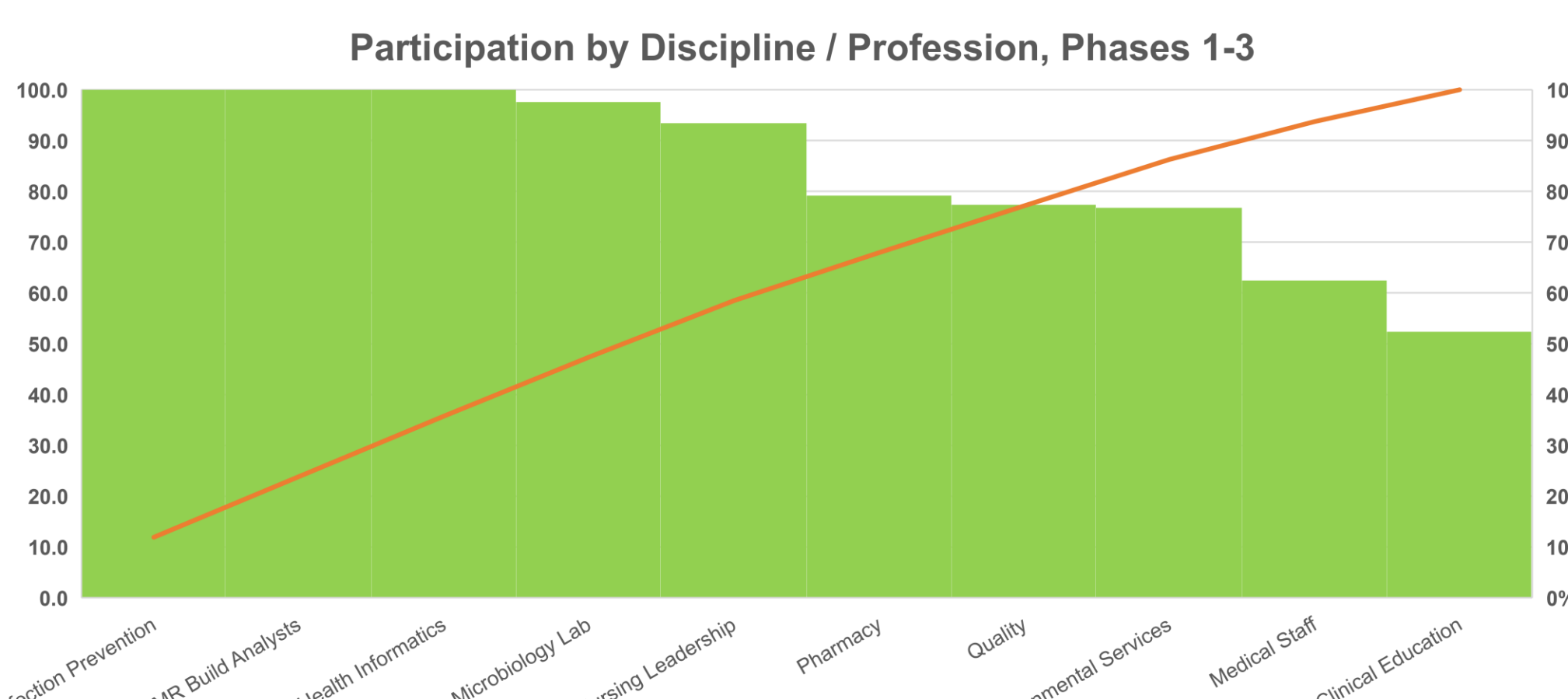
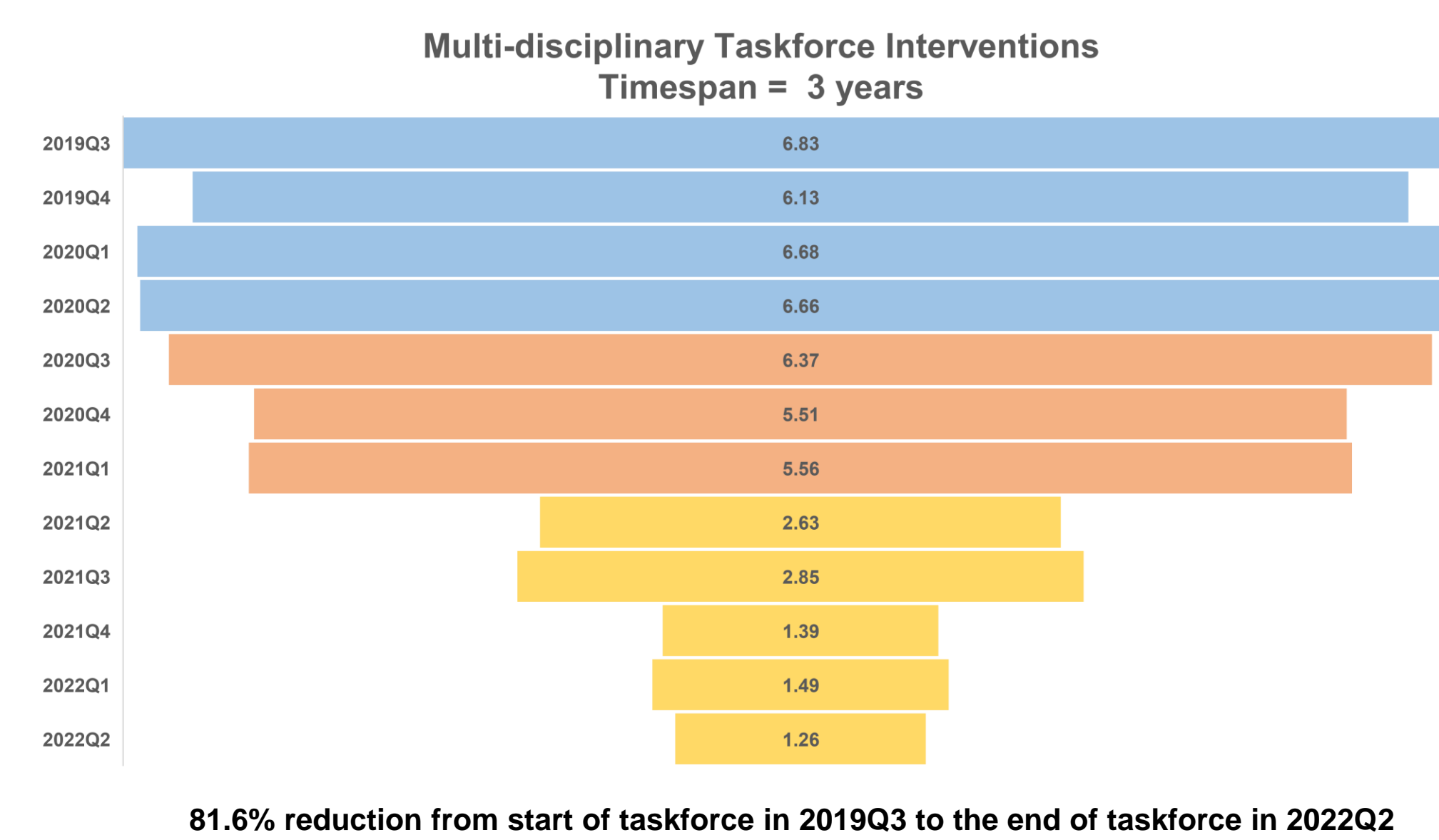
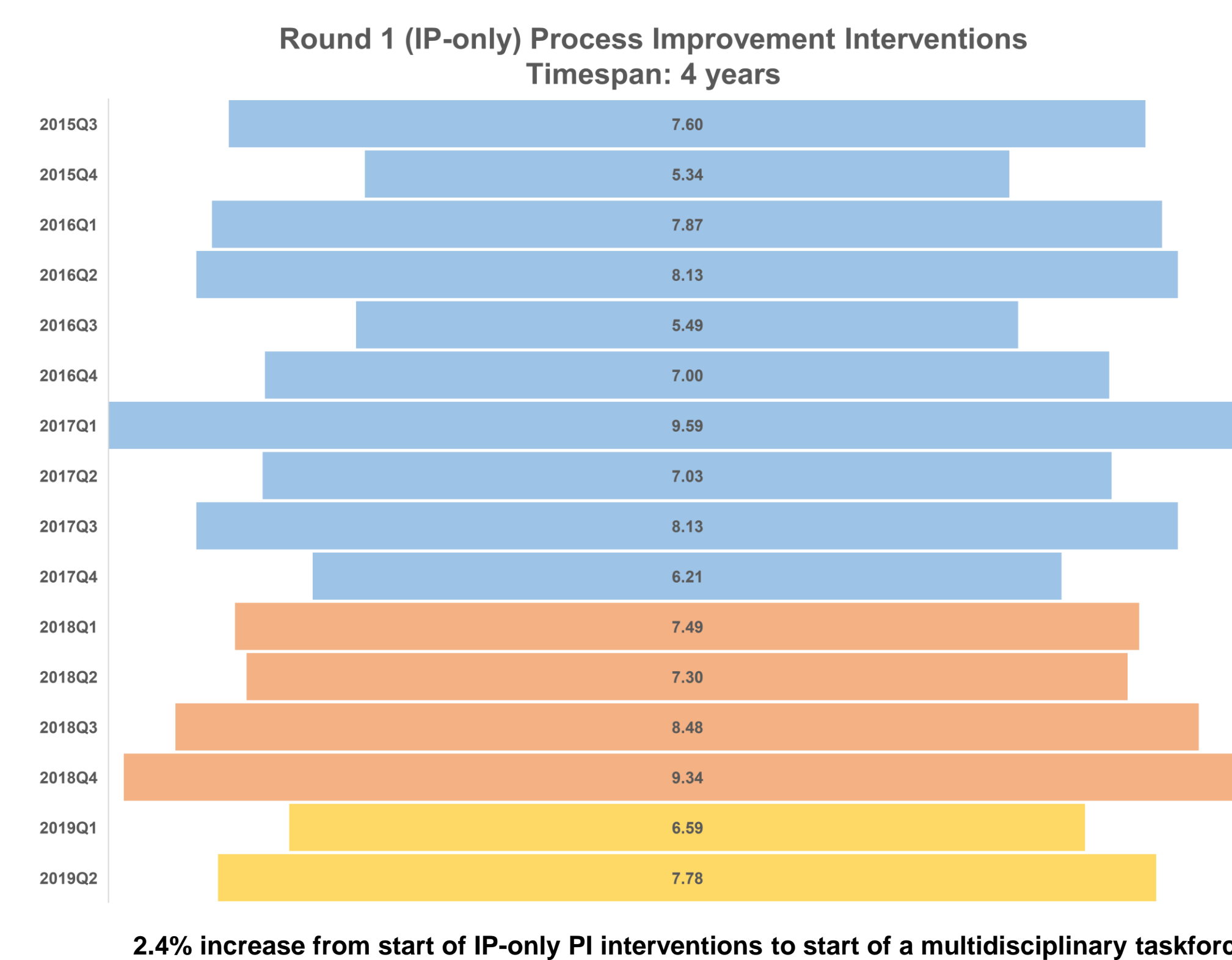
Effectiveness of Interventions
Comparison by mean rate (per 10,000 patient days)
Round 1 versus Round 2



Round Type	Phase 1 Intervention	Phase 2 Intervention	Phase 3 Intervention
Round 1 (IP-driven)	Development and use of Enhanced Contact Precautions (hand wash with soap and water and use bleach-based product for disinfecting surfaces)	IP performs root cause analysis (RCA) and reviews RCA with unit leader (dependence on unit leader to educate staff)	Go-live of new 2-step <i>C. diff</i> toxin EIA/molecular test; Mass education of screening and testing algorithm to nursing and medical staff
Round 2 (MDT)	Build <i>C. diff</i> screening and testing algorithm into electronic medical record (EMR)	Hide <i>C. diff</i> result on molecular panel and use only 2-step <i>C. diff</i> toxin EIA/molecular test	Reverse 2-step test to molecular/toxin EIA format and go-live of new test method

interventions will be considered Round 2. Plan/Do/Study/Act (PDSA) was utilized to evaluate interventions during each phase of Round 2. Timespan and interventions varied between both rounds and all phases within each round.

Data reported to National Healthcare Safety Network (NHSN) was used for statistical analysis. Intervention effectiveness of each phase was measured using a 2x3 Chi-square test, and a 2x2 Chi-square test was used to compare the IP-only versus the MDT approach styles. Discipline participation was also tracked during Round 2 to provide an account of contributions to the PI project.



Discussion

The IP-driven interventions in Round 1 included development and implementation of Enhanced Contact Precautions in Phase 1, performance of root cause analysis and case review with nursing managers in Phase 2, and the go-live of a new 2-step *C. diff* toxin enzyme immunoassay (EIA)/molecular testing method that was coupled with mass education of the screening and testing algorithms in Phase 3. The mass education was difficult to disseminate system-wide due to revolving staff changes within the healthcare system.

Upon the MDT's formation in July of 2019, it was clear to the team that the first phase of interventions would involve building the screening and testing algorithms into the electronic medical record (EMR) using clinical decision support. During Phase 1, a 30, 60, and 90-day review was performed to identify gaps and issues in the screening and lab ordering processes. The MDT utilized the PDSA evaluation model during the incremental reviews prior to moving onto a new intervention. In Phase 2, the MDT agreed that having 2 *C. diff* testing options was problematic to following good diagnostic stewardship and chose to pursue hiding the *C. diff* result from the gastrointestinal biofire stool panel. Key MDT members met with laboratory leadership and were able to demonstrate cost savings and proper diagnostic and antimicrobial stewardship benefits from offering the 2-step *C. diff* test only, which provided differentiation between toxigenic *C. diff* colonization versus active toxin production.

Although the initial 2-step test chosen was the most affordable option, its reflex portion was molecular-based. This affected the standardized infection ratio (SIR) value for our hospitals despite seeing a reduction in HO-CDI events. The MDT members chose to reverse the testing method with reflex to toxin EIA. The reversal dramatically reduced not only the SIR values but also reported events. The MDT goal to obtain a system-wide SIR value of less than 0.50 and sustain that goal for one year was met following the Phase 3 intervention.

Conclusion

To our knowledge no previous study has been able to compare strategy types and interventions for HO-CDI event reductions. The collaborative efforts of an MDT for PI projects is known to be highly effective in producing positive results. Participation among key stakeholders is key to moving the project forward in an efficient fashion. From the start of the MDT in 2019Q3 to the implementation of the final and most successful intervention in 2021Q2, two years had lapsed. While our initial focus was on the system's larger, urban hospitals, the MDT observed the smaller community hospitals experiencing an increase in HO-CDI events. An oversight we realized during Phase 3 was the unintentional exclusion of our community hospitals and other hospital partnerships that had been negatively impacted by the interventions. Key stakeholders from these locations were promptly oriented into the MDT to assist with educational and communication efforts in their respective hospitals. By these efforts, the community hospitals that were experiencing a rise in events were able to reverse course to sustainable low rates and SIRs.

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Disclosure statement: Nothing to disclose