Improving Acid Suppression Therapy to Reduce Hospital-Onset *C. difficile* infection (HO-CDI): Impact of a Novel Analytic Application

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ABSTRACT

Background: Proton pump inhibitors (PPIs) are among the most widely used classes of drugs, especially in the elderly, who are also at higher risk for CDI. Acid suppression therapy, especially using PPIs, has been shown to increase the risk of CDI. As part of an institutional effort to reduce HO-CDI, we developed an analytic application to support CDI prevention efforts, including PPI stewardship.
Methods: We conducted this study in a 2-hospital, >1100-bed community-based academic healthcare system in northern Delaware. We created a CDI-specific analytic application using the Health Catalyst analytics platform, over the existing data warehouse (Cerner), using 2016-2018 data. The application refreshes daily and is able to provide near real-time patient data, including PPI and antibiotic use. We aimed to describe PPI utilization patterns, calculate risk associated with PPI use adjusted for other risk factors for CDI, and measure the effect of interventions to decrease PPI use.
Results: Among 133,592 total inpatient encounters from 1/1/16 – 4/22/18, 39,156 (29%) received PPIs and 1146 (0.9%) had a positive PCR result for *C. diff*. Among the *C. diff* positive encounters, PPIs were used in 486 (42%), with an adjusted OR of 2.1 (95% CI 1.7-2.6). Of encounters involving high risk antibiotics who had a positive *C. diff* PCR, 52% were receiving PPIs. The in-patient services most likely to prescribe PPIs were internal medicine, gastroenterology and general surgery. Targeted chart review indicated that most inpatients receiving PPIs lacked an identified upper gastrointestinal (GI) disorder, and 37% were on the same PPI as outpatients prior to admission. Duration of therapy varied widely, but PPI courses were longer in patients diagnosed with CDI.
Conclusion: A novel application using existing health record data confirmed the increased risk of CDI associated with PPI use, and identified important opportunities to decrease HO-CDI by limiting such use. Using this analytics platform provides near real-time data and will support rapid cycle improvements and allow for early evaluation of CDI interventions.

INTRODUCTION

Acid suppression therapy is common in hospitalized patients and contributes to the development of CDI. PPIs are among the most widely used classes of medication. They are frequently used in the elderly, as well as oncology and intensive care populations who are also at risk for CDI.

STUDY AIM

Describe the use of a novel data analytic application developed for C. diff-specific institutional data in order to:

1. Assess PPI utilization patterns
2. Calculate attributable risk for development of CDI
3. Inform the development of interventions to improve PPI stewardship

METHODS

Setting: 2-hospital, >1100-bed community-based academic healthcare system in northern Delaware.

Tool: A CDI-specific analytic application using the Health Catalyst analytics platform, built over the existing data warehouse (Cerner), using 2016-2018 data (Figure 1). Application refreshes daily and is able to provide near real-time patient data, including PPI and antibiotic use.

Improvements: Based on data generated by the app, several interventions were introduced over the last year:

- Education of C. diff Steer Committee based on findings of CID article[1]
  - Found 44% increased risk for CDI associated with PPI use
- ASP meeting with GI Section to prioritize patients needing PPI
- Targeted chart review which indicated that most inpatients receiving PPIs lacked an identified upper GI disorder
  - 37% were on the same PPI as outpatients prior to admission
- ASP meeting with Emergency Medicine, Critical Care, Hospitalists, floor-based Pharmacists and Ambulatory sites
- Chair of Department of Medicine wields influence
- ASP quarterly meeting with larger audience

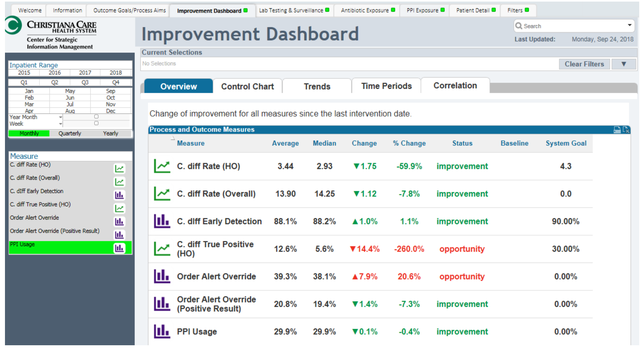

Figure 1. Screen shot of Health Catalyst C. diff app dashboard

RESULTS

- Among 133,592 total inpatient encounters 1/1/16 – 4/22/18
  - 39,156 (29%) had received PPIs
  - 1146 (0.9%) had a (+) PCR result for *C. diff*
- Of *C. diff* positive encounters, PPIs were used prior to (+) C. diff PCR in 486 (42%)
  - Adjusted OR of 2.1 (95% CI 1.7-2.6)
- Of patients on high risk antibiotics who had (+) *C. diff* PCR, 52% had received PPIs

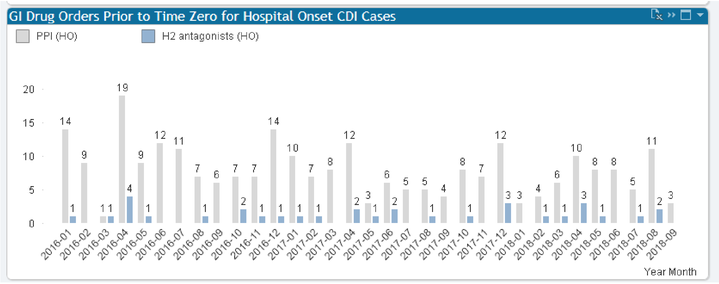

Figure 2. PPI and H2 blocker use prior to positive C. diff PCR, by month

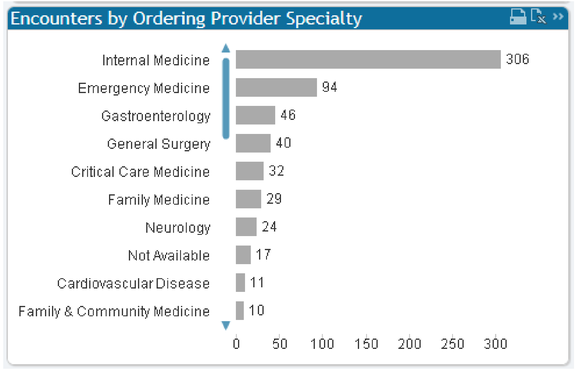

Figure 3. PPI use prior to positive C. diff PCR, by specialty

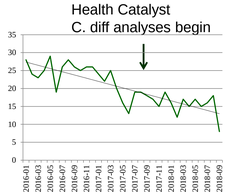

Figure 4. Encounters with PPI administered prior to (+) C. diff PCR

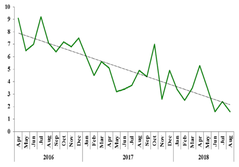

Figure 5. Rates of HO-CDI (per 10,000 patient days)

Figure 6. Health Catalyst calculation of coefficient of correlation between PPI use and C. diff rates.

DISCUSSION

A novel application using existing health record data confirmed the increased risk of CDI due to PPI use, and identified important opportunities to decrease HO-CDI by limiting such use. Using this analytics platform provides near real-time data, supports rapid cycle improvements and allows for early evaluation of CDI interventions. Preliminary data show improvement in PPI use at our institution. HO-CDI rates have also improved, associated with multiple interventions.

REFERENCES

(1) Watson T, Hickok J, Fraker S, Korwek K, Poland RE, Septimus S. Evaluating the Risk Factors for Hospital-Onset *Clostridium difficile* Infections in a Large Healthcare System. Clin Infect Dis 2018;66:1957-59.