Clostridium difficile Infection Rates Reduced at a Health Care System after Restriction of Respiratory Fluoroquinolones

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Abstract

Fluoroquinolones are one of the most commonly prescribed antibiotic classes in the United States and up to 81% of inpatient utilization has been deemed inappropriate [1,2]. Inappropriate use is especially concerning when considering a known adverse consequence of fluoroquinolone utilization is Clostridium difficile infection (CDI) [3-6]. Previous studies have shown that reducing inappropriate respiratory fluoroquinolone use may reduce CDI rates [7,8].

Wenisch JM et al. performed a single center study evaluating the effect of moxifloxacin restriction and found a decrease in the incidence of CDI (59±3 to 32±3 cases per month) as well as moxifloxacin utilization (1,038±109 defined daily doses (DDD)/month to 42±10 DDD/month) [7]. However, this study reported that the sharp decline in moxifloxacin use was partially replaced by levofloxacin use. Additionally Sarma JB et al. conducted a 2-step fluoroquinolone restriction initiative in two hospitals, which decreased fluoroquinolone use from 10-15 to 5 DDD/100 observed bed days (OBDD) [8]. A removal of fluoroquinolone stock on hospital floors further reduced fluoroquinolone use to 0-2 DDD/100 OBD.

This restriction correlated with a significant reduction in CDI cases (rate ratio (RR): 0.332; 95% confidence interval (CI): 0.240-0.460 and RR: 0.394; 95% CI: 0.199-0.781, respectively). Of note, the formulary fluoroquinolones in this study were ciprofloxacin and levofloxacin, thus a trial evaluating the effect of a respiratory fluoroquinolone restriction program at a health care system was lacking in the literature.

In our recently published study, we aimed to determine the impact of respiratory fluoroquinolone restriction on utilization, appropriateness of quinolone-based therapy, and CDI rates within a health care system [9].

The respiratory fluoroquinolone restriction program included the development of restriction criteria and implementation of restriction. Of note, moxifloxacin remained the health care system's formulary respiratory fluoroquinolone throughout the study period. The Antimicrobial Stewardship Committee collaborated with medical directors of critical care at each of the four hospitals to develop restriction criteria. Implementation consisted of two phases: education and implementation of restriction criteria at order verification. The first phase consisted of prescriber education through presentations and emails to key stakeholders as well as pharmacist education via electronic competency.

Both phases of implementation were successful at significantly reducing respiratory fluoroquinolone utilization as well as CDI rates. Utilization was reduced by 48% after clinician education and 88% following implementation of restriction criteria. The respiratory fluoroquinolone restriction program included the development of restriction criteria and implementation of restriction. Of note, moxifloxacin remained the health care system's formulary respiratory fluoroquinolone throughout the study period. The Antimicrobial Stewardship Committee collaborated with medical directors of critical care at each of the four hospitals to develop restriction criteria. Implementation consisted of two phases: education and implementation of restriction criteria at order verification. The first phase consisted of prescriber education through presentations and emails to key stakeholders as well as pharmacist education via electronic competency.

Both phases of implementation were successful at significantly reducing respiratory fluoroquinolone utilization as well as CDI rates. Utilization was reduced by 48% after clinician education and 88% following implementation of restriction criteria. When comparing the four intervention hospitals' monthly mean utilization with days of therapy (DOT)/1,000 patient days (PD), respiratory fluoroquinolone use decreased from 41±4.4 DOT/1,000 PD pre-intervention to 21.5±6.4 DOT/1,000 PD (p=0.023) after education. Use was further reduced to 4.8±3.6 DOT/1,000 PD (p<0.0001) after the implementation of the restriction criteria at order verification. Mean monthly CDI cases also decreased by approximately 50% from pre-intervention to post-restriction.

In addition to overall moxifloxacin use, there was a 48% reduction in the number of patients who received at least one dose of moxifloxacin (p<0.001). When evaluating multiple doses, 82% in the pre-intervention versus 26% in the post-restriction groups received two or more doses of moxifloxacin (p<0.001). Accordingly, appropriate use of a respiratory fluoroquinolone for patients who received 2 or more doses of moxifloxacin increased from 35% pre-intervention to 72% post-restriction (p<0.001). As expected, there was a significant
reduction in the annual acquisition cost for moxifloxacin in the health care system ($123,882 pre-intervention to $12,273 post-restriction, p=0.002).

This study is unique in that it has shown the beneficial effect of a respiratory fluoroquinolone restriction program on utilization, appropriateness of quinolone-based therapy, and CDI rates within a health care system. Additionally, this study exemplifies the importance of collaboration and communication with key stakeholders as well as education for a successful antimicrobial stewardship initiative. Restriction significantly reduced CDI rates across multiple hospitals despite relatively low baseline rates. The program also demonstrated significant improvement in appropriate respiratory fluoroquinolone utilization which may have further antimicrobial stewardship implications.

References
1. Linder JA, Huang ES, Steinman MA, Gonzales R, Stafford RS (2005) Fluoroquinolone prescribing in the United States: 1995-2002. Am J Med 118: 259-268.
2. Werner NL, Hecker MT, Sethi AK, Donskey CJ (2011) Unnecessary use of fluoroquinolone antibiotics in hospitalized patients. BMC Infect Dis 11: 187.
3. Bignardi GE (1998) Risk factors for Clostridium difficile infection. J Hosp Infect 40: 1-15.
4. McCusker ME, Harris AD, Perencevich E, Roghmann MC (2003) Fluoroquinolone use and Clostridium difficile-associated diarrhea. Emerg Infect Dis 9: 730-733.
5. Slimings C, Riley TV (2014) Antibiotics and hospital-acquired Clostridium difficile infection: update of systematic review and meta-analysis. J Antimicrob Chemother 69: 881-891.
6. Dial S, Kezouh A, Dascal A, Barkan A, Suissa S (2008) Patterns of antibiotic use and risk of hospital admission because of Clostridium difficile infection. CMAJ 38: S341-S345.
7. Wenisch JM, Equiluz-Bruck S, Fudel M, Reiter I, Schmid A, et al. (2014) Decreasing Clostridium difficile infections by an antimicrobial stewardship program that reduces moxifloxacin use. Antimicrob Agents Chemother 58: 3079-5083.
8. Sarma JB, Marshall B, Cleeve V, Tate D, Oswald T, et al. (2015) Effects of fluoroquinolone restriction (from 2007 to 2012) on Clostridium difficile infections: interrupted time-series analysis. J Hosp Infect 91: 74-80.
9. Shea KM, Hobbs ALV, Jaso TJ, Bisett JD, Cruz CM, et al. (2017) Effect of a health care system respiratory fluoroquinolone restriction program to alter utilization and impact rates of Clostridium difficile infection. Antimicrob Agents Chemother 61: e00125-17.