Journal of Infectious Diseases and Therapy
ISSN: 2332-0877

Hobbs and Shea, J Infect Dis Ther 2017, 5:4
DOI: 10.4172/2332-0877.1000328

Short Communication OMICS International

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

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Received date: July 18, 2017; **Accepted date:** August 02, 2017; **Published date:** August 07, 2017

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. Our study, recently published in Antimicrobial Agents of Chemotherapy, aimed to determine the impact of respiratory fluoroquinolone education and restriction on utilization, appropriateness of quinolone-based therapy, and CDI rates within a health care system. 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. Mean monthly CDI cases also decreased by approximately 50% from pre-intervention to post-restriction.

Keywords: Respiratory fluoroquinolone; *Clostridium difficile* infection; Antimicrobial stewardship

Short Communication

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 inpatient 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 (OBD) [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. 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. CDI rates decreased from 4 cases/10,000 PD pre-intervention to 3.4 cases/10,000 PD after education and to 2.2 cases/10,000 PD after restriction (p=0.044). Of note, the utilization rates of other commonly used intravenous antibiotics did not change during the study period.

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.

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