6-2016

# Impact of a Hospital's Antibiotic Stewardship Team on Fluoroquinolone Use at a Long- Term Care Facility

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## Publication Information

Rahme, Christine L.; Jacoby, Helen M.; and Avery, Lisa M. (2016). "Impact of a Hospital's Antibiotic Stewardship Team on Fluoroquinolone Use at a Long- Term Care Facility." *Annals of Long-Term Care: Clinical Care and Aging* 24.6, 13-20.

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## Abstract

The primary objective of this study was to assess whether a hospital-based antimicrobial stewardship team (H-AST) from an unaffiliated hospital could decrease inappropriate fluoroquinolone use at a local, long-term care facility (LTCF). The H-AST created a multi-faceted intervention campaign that included antibiogram development, provider and family education, and a telephone hotline. Pre- and post-intervention mean defined daily doses per 1000 resident days for antimicrobials were calculated to determine the impact of the campaign. The campaign resulted in a 38.70% decrease in ciprofloxacin utilization, a 16.20% decrease in total FQ consumption, and an 11.68% in total antibiotic consumption. In addition, during the study period the rate of *Clostridium difficile* infection decreased by 19.47%. Collaboration with a H-AST had a positive impact on antibiotic prescribing at this LTCF.


## Disciplines

Pharmacy and Pharmaceutical Sciences


## Comments

This article was originally published in A*nnals of Long-Term Care: Clinical Care and Aging.* 2016;24(6):13-20. © 2016 HMP.

It can also be viewed on the publisher's website: https://www.managedhealthcareconnect.com/articles/impact-hospitals-antibiotic-stewardship-team-fluoroquinolone-use-long-term-care-facility

# Impact of a Hospital's Antibiotic Stewardship Team on Fluoroquinolone Use at a Long-Term Care Facility

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**Disclosures:**
Drs Rahme, Jacoby, and Avery received research grants from the Care Fusion corporation.

**Acknowledgments:**
We would like to thank Omnicare Pharmacy for providing the purchasing data, Vicky Lyman for helping with infection rate data and coordinating in-services and educational programs, and Karen Whalen and Kelly Conn for manuscript review.

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**Abstract:** The primary objective of this study was to assess whether a hospital-based antimicrobial stewardship team (H-AST) from an unaffiliated hospital could decrease inappropriate fluoroquinolone use at a local, long-term care facility (LTCF). The H-AST created a multi-faceted intervention campaign that included antibiogram development, provider and family education, and a telephone hotline. Pre- and post-intervention mean defined daily doses per 1000 resident days for antimicrobials were calculated to determine the impact of the campaign. The campaign resulted in a 38.70% decrease in ciprofloxacin utilization, a 16.20% decrease in total FQ consumption, and an 11.68% in total antibiotic consumption. In addition, during the study period the rate of *Clostridium difficile* infection decreased by 19.47%. Collaboration with a H-AST had a positive impact on antibiotic prescribing at this LTCF.

**Key words:** fluoroquinolones, antibiotic stewardship, infectious diseases

**Citation:** *Annals of Long-Term Care: Clinical Care and Aging*. 2016;24(6):13-20.
Received December 10, 2015; accepted February 1, 2016.

The steadily increasing rate of antimicrobial resistance is a major concern in the health care community. In order to combat this threat, hospitals across the nation have successfully implemented antibiotic stewardship teams (ASTs). These programs have improved treatment outcomes, limited antimicrobial resistance, and decreased the rates of adverse drug events.[1] The principles of successful ASTs have contributed to the creation of the White House's National Action Plan for Combating Antibiotic-Resistant Bacteria, which focuses on improving stewardship in health care settings, including long-term care facilities (LTCFs). In combination with the Centers for Disease Control (CDC), Centers for Medicare/Medicaid Services (CMS), and Agency for Healthcare Research and Quality (AHRQ), the National Action Plan, which will be executed over 5 years, includes implementing antibiotic stewardship programs in LTCFs to decrease the overuse and misuse of antimicrobial agents, which result in antibiotic resistance and adverse effects including *Clostridium difficile* colitis.[2]

Antimicrobial agents account for 40% of prescribed medications in LTCFs. Additionally, 25–75% of systemic antimicrobial use in LTCFs is reportedly inappropriate.[3] In the geriatric population, the most common infections include urinary tract infection (UTI), skin and soft tissue infection (SSTI), and respiratory tract infection (RTI). Asymptomatic bacterial colonization may result in inappropriate diagnosis of one of these infections, leading to treatment with broad-spectrum antimicrobials such as fluoroquinolones. This class of antimicrobials has been associated with an increased risk of *Clostridium difficile* infection (CDI) and multidrug resistant organisms (MDRO).[4, 5] One

commonly employed initiative to decrease CDI rates in hospitals is to restrict the use of the fluoroquinolone class of antimicrobials.

With the current lack of antimicrobial stewardship programs in LTCFs, hospital-based antimicrobial stewardship teams (H-ASTs) have the opportunity to improve antimicrobial use through collaboration with a local LTCF. Residents in LTCFs act as reservoirs for MDRO and CDI, and approximately 20% of hospital admissions are preceded by a LTCF transfer or result in a LTCF admission upon discharge.[6] The transfer of LTCF patients to emergency departments and hospitals contributes to the spread of resistance in both institutions.[7] Hospital initiatives to decrease the incidence of CDI should take into account this patient sharing. Extending hospital initiatives to a LTCF that commonly transfers patients to that hospital may have a positive effect at both institutions. This study assessed the effect of a H-AST on the use of fluoroquinolones, overall antibiotic consumption, and CDI rates at a neighboring, unaffiliated LTCF.

The primary objective of this study was to decrease inappropriate fluoroquinolone use in a LTCF through education and open lines of communication between the H-AST and LTCF. Secondary outcomes included decreasing overall antibiotic use in the LTCF by decreasing the treatment rates of UTI, RTI, and SSTI, and reducing the rate of CDI. To achieve these goals, the H-AST created a multi-faceted intervention campaign which included four major initiatives: 1) creation of a LTCF urinary antibiogram; 2) an educational in-service for providers on appropriate treatment of UTI, SSTI and RTI; 3) an educational event specific for family members discussing the risks of overusing antimicrobial agents; and 4) a telephone hotline for the LTCF to contact the H-AST for questions. Pre- and post-intervention mean dail defined dose (DDD) per 1000 resident days (RD) data for antimicrobials were calculated to determine the impact of the campaign.

## Methods

A memorandum of understanding was created between a 431-bed community teaching hospital and a 520-bed, long-term, skilled nursing facility. The LTCF medical director, nursing manager, and infection prevention nurse collaborated with the H-AST, consisting of infectious disease physicians, an infectious disease pharmacist, a clinical pharmacist, the director of pharmacy, the microbiology manager, and the infection prevention manager.

The reference microbiology laboratory provided data on urinary pathogen sensitivities from January 2013 to September 2013 based on Clinical and Laboratory Standards Institute (CLSI) standards.[8] The three most commonly isolated urinary pathogens were *Escherichia coli*, *Klebsiella pneumonia,* and *Proteus mirabilis*. The antibiogram was distributed to the providers via email highlighting the *Escherichia coli* ciprofloxacin sensitivity of 56% (**Figure 1**). This data was also incorporated into the educational campaign.

The education campaign focused on creating treatment guidelines for the three most common disease states that affect LTCF residents: UTI, SSTI, and RTI. Supporting literature was collected and antibiotic treatment recommendations were made based on evidence-based medicine, antibiogram results, antimicrobial risk of developing CDI, and incidence of adverse effects in the LTCF population. A pocket card outlining the recommendations was developed for each disease state (**Figure 2**). In addition, a 60-minute presentation summarizing treatment recommendations was prepared. Highlights of the presentation included the rationale for not treating asymptomatic UTI, avoiding the use of fluoroquinolones empirically for UTIs based on antibiogram data, differentiating between viral and bacterial respiratory infections, discouraging the use of fluoroquinolones for empiric treatment of SSTI, and recommending length of antimicrobial therapy for these infections. In addition, common causes of altered mental status in the elderly and risk factors for the development of CDI were reviewed. The presentation, which was given by an infectious disease physician, was attended by LTCF physicians, nurse practitioners, physician assistants, consultant pharmacists, and administrators. At the conclusion of the educational program, the providers were given a telephone number for both the infectious diseases physician on call and the antibiotic stewardship pharmacist. They were

| Organism | Cipro | Levo | Gentamicin | Tobramycin | Doxycycline | Bactrim | Nitrofurantoin |
|---|---|---|---|---|---|---|---|
| ***E Coli*** n = 80 | 56 | 56 | 84 | 92 | 83 | 69 | 89 |
| ***Proteus*** n = 29 | 55 | 55 | 90 | 95 | 0 | 76 | 0 |

**Figure 1.** Urinary Tract Pathogen Antibiogram for Long-Term Care Facility

| Criteria for Treatment of a Symptomatic UTI | Bacteriuria |
|---|---|
| **Symptoms of a UTI plus Pyuria plus A Positive Urine Culture**<br><br>**Symptoms of a UTI:**<br>-Fever and/or Chills<br>-Otherwise unexplained abrupt change in mental status<br>**-New or increased**<br>• Incontinence<br>• Flank pain<br>• Burning or pain during urination<br>• Frequency<br>• Urgency | **Definition:**<br>Significant bacteria in the urine **without** any signs or symptoms of a urinary tract infection |
| **Keep in Mind:** Most elderly patients have chronic urinary symptoms such as incontinence, nocturia, frequency and/or urgency. In order to be a symptom of a UTI these must **change from baseline!** | |

| Empiric Antibiotic Choice: | | |
|---|---|---|
| Nitrofurantoin (*if on Warfarin*) or Bactrim (*if not on Warfarin*) | | |
| **Streamlined Antibiotic Choices:** | | |
| | *E. Coli* | Proteus |
| **1st line** | Bactrim | Bactrim |
| **2nd line** | Nitrofurantoin | |
| **3rd line** | Doxycycline | |

**Women with no catheter:**
7 days or
10-14 days
*if severe infection*

**Men with no catheter:**
10-14 days

| Dosing Regimens | Renal Function (CrCl) | | | | MIC | |
|---|---|---|---|---|---|---|
| | ≥60 ml/min | 30-59 ml/min | 15-29 ml/min | <15 ml/min | *E Coli* | Proteus |
| Bactrim | 1 DS tab BID | | 1 DS tab qday | Do not use | 69 | 76 |
| Nitrofurantoin | 100 mg BID | Do not use if CrCl <40 ml/min | | | 89 | 0 |
| Doxycycline | 100mg BID | | Do not use | | 83 | 0 |

**Figure 2.** Prescriber Pocket Guide for Urinary Tract Infection
Abbreviations: UTI, urinary tract infections; DS, double strength; BID, twice a day.

**Table 1. Comparison of 12-month Average DDD/1000 RD FQ Usage Pre- and Post-intervention**

| Fluoroquinolone | Pre-intervention DDD/1000 RD | Post-intervention DDD/1000 RD | % Change | *P*-value (95% CI) |
|---|---|---|---|---|
| Ciprofloxacin | 7.08 ± 2.49 | 4.34 ± 1.98 | - 38.70% | 0.02 (0.58 – 4.91) |
| Levofloxacin | 6.16 ± 2.46 | 6.72 ± 2.41 | + 9.09% | 0.65 (-3.21 – 2.09) |
| Moxifloxacin | 0.34 ± 0.31 | 0.32 ± 0.38 | - 5.88% | 0.93 (-0.32 – 0.34) |

Abbreviations: mean DDD/1000 RD, defined daily doses per 1000 resident days; FQ, fluoroquinolone.

informed that this number could be called 24 hours a day 7 days a week for any infectious disease related questions.

When the LTCF representatives met with the H-AST, it was identified that antibiotics are often prescribed in a LTCF due to pressure on prescribers by family members. This is also well established in other relevant literature.[3] To address this concern, a 60-minute educational presentation titled "To Treat or Not to Treat" was developed for family members and presented at one of the monthly family council meetings. This was followed by a question and answer session by the infectious disease physician. Similar to the provider presentation, topics included UTI, SSTI, RTI, and CDI. This presentation included basic true-and-false questions to help engage the audience and gauge their baseline knowledge. For example, the audience was asked: "If my family member has bacteria in their urine, should he/she receive an antibiotic?" In addition, family pamphlets were prepared for each of the disease states. Each pamphlet clearly explained when the use of antibiotics was deemed necessary and the adverse effects associated with inappropriate antibiotic use (**Figure 2**). Written material was reviewed by the patient education department at the hospital to ensure a reading level of sixth grade or lower. Pamphlets were distributed on each care unit in the LTCF.

### *Data Collection*

Pre- and post-intervention data was collected monthly from July 2012 to June 2013 and July 2013 to June 2014, respectively. Monthly inventory usage reports were generated by the dispensing pharmacy for all antibiotics prescribed at the LTCF, including doses sent to fill automated dispensing cabinets. For each antibiotic, the total grams dispensed were converted to a DDD, as defined by the World Health Organization.[9] All DDDs were standardized per 1000 RD. Pre- and post-intervention mean DDD per 1000 RD data for ciprofloxacin, levofloxacin, and moxifloxacin were calculated. Pre- and post-mean data for total antibiotic consumption was calculated and divided by antibiotic class. The infection prevention nurse at the LTCF provided monthly totals of RD, as well as rates of UTI, SSTI, RTI, and CDI cases per 1000 RD as defined by standard CDC definitions.[10]

### *Analysis*

Comparison of the 12-month mean DDD per 1000 RD pre- and post-intervention for ciprofloxacin, levofloxacin, moxifloxacin, fluoroquinolones, penicillins, cephalosporins, macrolides, tetracyclines, nitrofurantoin, sulfonamides, and total antibiotic utilization were analyzed using a paired *t* test. The rates of UTI, SSTI, RTI, and CDI from the pre- and post-intervention periods were also analyzed using a paired *t* test. Results were determined to be significant with a 2-tailed $P < 0.05$. Analysis was performed using IBM® SPSS® Statistics Version 22. A post-hoc analysis was performed in June 2015, 12 months after the intervention period was over, to determine if the interventions had lasting effects on prescribing habits of ciprofloxacin and FQ DDD per 1000 RD at the LTCF.

## Results

A significant 38.70% decrease was seen in ciprofloxacin utilization in the post-intervention period from 7.08 to 4.34 DDD per 1000 RD $P = 0.02$ (**Table 1**). Levofloxacin and moxifloxacin use did not show a statistically significant change, going from 6.16 to 6.72 and 0.34 to 0.32 DDD per 1000 RD respectively ($P = 0.65$ and 0.93). Total FQ consumption (ciprofloxacin, levofloxacin, and moxifloxacin) also did not change significantly, decreasing from 13.58 to 11.38 DDD per 1000 RD $P = 0.31$ during the intervention period.

Total antibiotic consumption decreased 11.68% from 82.33 to 72.71 DDD per 1000 RD ($P = 0.06$) during the intervention period. In addition to a 16.20% decrease usage in the FQ class, there was also a decrease of 24.49%, 25.34%, 25.63%, and 14.29% in the cephalosporins, nitrofurantoin, macrolides, and tetracycline classes respectively (**Table 2**). Sulfonamide use increased 39.45% from 2.18 DDD per 1000 RD to 3.04 in the post-intervention period. Post-intervention penicillin usage increased 10.23% comparatively $P = 0.20$. When reviewed at an individual antibiotic level, the

**Table 2. Comparison of 12-month Average DDD/1000 RD for Separate Antibiotic Classes and Total Antibiotic Usage Pre- and Post-intervention**

| Antibiotic Class | Pre-intervention DDD/1000 RD | Post-intervention DDD/1000 RD | % Change | *P*-value (95% CI) |
|---|---|---|---|---|
| Penicillins | 19.26 ± 5.79 | 21.23 ± 4.92 | + 10.23% | 0.20 (-5.15 – 1.21) |
| Cephalosporins | 12.78 ± 4.56 | 9.65 ± 2.26 | - 24.49% | 0.06 (-0.15 - 6.41) |
| Macrolides | 6.36 ± 2.60 | 4.73 ± 2.86 | -25.63% | 0.24 (-1.25 – 4.50) |
| Tetracyclines | 22.33 ± 9.70 | 19.14 ± 4.88 | - 14.29% | 0.29 (-3.10 – 9.48) |
| Fluoroquinolones | 13.58 ± 3.50 | 11.38 ± 4.07 | - 16.20% | 0.31 (-2.38 – 6.78) |
| Sulfonamides | 2.18 ± 1.06 | 3.04 ± 1.40 | + 9.45% | 0.13 (-2.02 – 0.30) |
| Nitrofurantoin | 1.97 ± 1.17 | .47 ± 0.64 | -25.34% | 0.22 (-0.34 – 1.33) |
| Total Antibiotic Use | 82.33 ± 12.23 | 72.71 ± 6.80 | - 11.68% | 0.06 (-0.44 – 19.67) |

Abbreviations: mean DDD/1000 RD, defined daily doses per 1000 resident days.

LTCF utilized more amoxicillin (23.70 vs 31.12 DDD per 1000 RD) and ampicillin (18.9 vs 40.1 DDD per 1000 RD) with a decrease in cefuroxime (59.8 vs 50 DDD per 1000 RD) and ceftriaxone (22.5 vs 9.42 DDD per 1000 RD) in the post-intervention period.

Overall FQ consumption in June of 2015 was 10.03 DDD per 1000 RD in comparison to 11.38 DDD per 1000 RD during the intervention period (July 2013-June 2014) and 13.58 in the pre-intervention period.

A comparison of infection rates per 1000 RD pre- and post-intervention showed a 5.51% decrease in UTI diagnosis/treatment from 1.71 to 1.61 ($P = 0.28$) and a 5.73% decrease in RTI from 1.35 to 1.27 ($P = 0.67$) (**Table 3**). There was an 11.10% increase in the rate of SSTI during the post-intervention period from 0.92 to 1.04 ($P = 0.27$). The rate of CDI in the LTCF decreased by 19.47% from 0.094 to 0.076 ($P = 0.58$) in the post-intervention period.

## Discussion

Our results confirm that the collaboration of a H-AST with a LTCF can result in a significant 38.7% decrease in ciprofloxacin usage with a decrease trend in overall antibiotic usage. Antibiotic stewardship interventions that are commonly employed in an acute-care setting such as the creation of antibiograms, treatment guidelines, and educational materials are not readily available in LTCF. The use of a H-AST team to fill this gap in the LTCF setting and provide microbiology data, provider education, and a 24-hour hotline, as done in this study, is a novel concept.

The four initiatives employed by the H-AST had the biggest impact on ciprofloxacin prescribing. The LTCF antibiogram results showed that only 56% of facility *E coli* were susceptible to ciprofloxacin, providing clear evidence that ciprofloxacin is an inappropriate agent for empiric therapy of a symptomatic UTI in this population. In addition, both the provider and family educational campaign focused on decreasing inappropriate prescribing for asymptomatic bacteriuria in the LTCF population. With these initiatives, the H-AST was able to decrease the treatment rate of UTI by 5.51% in the post-intervention period, which may have also contributed to the decrease in ciprofloxacin use. The H-AST was not able to significantly decrease levofloxacin or moxifloxacin prescribing.

In addition, the interventions to decrease ciprofloxacin prescriptions resulted in a decrease in overall antibiotic consumption and a shift in antibiotic classes prescribed at the LTCF. Overall antibiotic consumption in the LTCF decreased by 11.68%. Although this decrease did not quite reach statistical significance ($P = 0.06$), the trend is promising. One of the main goals of the H-AST was to educate prescribers and patient families on the risks of treating asymptomatic bacteriuria and viral infections. Studies on the inappropriate treatment of these disease states in the elderly population have shown an increase risk of MDRO and antimicrobial adverse effects, without a change in morbidity and mortality.[11,12] The number of reported cases of UTI and RTI decreased during the intervention period but did not reach statistical significance. Treatment guidelines and educational sessions reinforced shorter treatment courses for UTI, RTI, and SSTI, which may have also contributed to the decrease in overall antibiotic use at the LTCF.

The H-AST also had an impact on promoting antimicrobial classes with a lower incidence of causing CDI. Over the 12-month period, there was a decrease in cephalosporin, tetracycline, and macrolide prescribing with an increase in the use of agents in the penicillin and sulfonamide classes.

**Table 3. Comparison of Infection Rates per 1000 RD Pre- and Post-intervention**

| Infection | Pre-Intervention | Post-Intervention | % Change | value (95% CI) |
|---|---|---|---|---|
| UTI | 1.71 ± 0.21 | 1.61± 0.24 | - 5.51% | 0.28 (-0.088-0.28) |
| RTI | 1.35 ± 0.47 | 1.27 ± 0.44 | - 5.73% | 0.67 (-0.31 – 0.46) |
| SSTI | 0.92 ± 0.19 | 1.04 ± 0.33 | +11.10% | 0.27 (-0.33 – 0.10) |
| CDI | 0.094 ± 0.09 | 0.076 ± 0.59 | -19.47% | 0.58 (-0.053 – 0.090) |

Abbreviations: RD, resident days; UTI, urinary tract infection; RTI, respiratory tract infection; SSTI, skin and soft tissue infection; CDI, Clostridium difficile infection.

During the post-intervention period, broad-spectrum cephalosporins, such as ceftriaxone and cefuroxime, decreased by 13.08 and 9.8 DDD per 1000 RD, while penicillins, such as amoxicillin and ampicillin, increased by 7.42 and 21.2 DDD per 1000 RD. The increase in aminopenicillins in the post-intervention period may have been the result of promoting these agents for the treatment of nonpurulent cellulitis during the educational campaign as recommended in current SSTI guidelines from the Infectious Disease Society of America.[13] This therapy may have replaced the use of cephalosporins or the inappropriate use of fluoroquinolones for SSTI. The use of sulfamethoxazole-trimethoprim also increased in the post-intervention group by 39.45%. The provider education sessions highlighted the use of sulfamethoxazole-trimethoprim as a first-line option for the empiric treatment of UTIs (**Figure 2**) as well as *Staphylococcal* skin infections. Despite the significant decrease in ciprofloxacin use, decrease in overall antibiotic consumption, and shift away from high-risk CDI inducing antibiotics, there was not a statistically significant decrease in the rate of CDI. This is likely due to the fact that CDI rates at the institution were already reasonably low.

LTCF providers and nursing staff commonly state that a large obstacle to appropriate antimicrobial prescribing is family pressure. Providing family member education was a unique element to this stewardship initiative. Providing an education session with a question-and-answer period and providing easy-to-read pamphlets (**Figure 3**) throughout the facility, explaining the harm of inappropriate prescribing, may have contributed to a decrease in family member pressure on medical and nursing staff, overall antibiotic use, and treatment rates for UTI and RTI.

Other LTCF initiatives that have been reported to decrease inappropriate antimicrobial prescribing have included education, prescriber feedback, nursing audit, guideline development, and infectious disease physician consultation.[14-18] One initiative studied the effect of printed educational material in conjunction with periodic physician scorecards on adherence to the treatment guidelines for UTI, RTI, SSTI, and septicemia of unknown origin over a 9-month period.[16] Education and prescribing feedback significantly decreased non-adherent prescribing by 64% (odds ratio 0.35 95%; CI 0.18-0.73) at the 6-month follow-up, but this significance was not maintained at the 9-month interval. Another initiative provided a UTI treatment algorithm to LTCF physicians and nurses along with written material consisting of pocket cards, posters, real-time reminders, and outreach visits.[17] For that initiative, there was a statistically significant decrease in the proportion of total antibiotics prescribed for UTI in the intervention group compared to the paired controls 28% to 39% (weighted mean difference, -9.6%; range, -16.9 to -2.4%), although there was no significant change in urinary cultures obtained, hospitalization, or mortality between groups. Similar to the previous study, the impact of education was not maintained at the 12-month post-intervention. In our study, the H-AST collected data 12 months after the intervention period (June 2105) to assess the durability of the effect on FQ consumption. One year following the intervention, FQ use had declined further, from 11.38 DDD per 1000 RD at the end of the intervention to 10.03.

Previous studies have shown that decreasing the use of fluroquinolone antibiotics results in lower CDI rates.[19,20] A community hospital decreased their rate of CDI from 1.6 to 1.2 cases per 1000 RD by restricting FQ usage from 17.6 to 6.0 DDD per 1000 RD in addition to implementing environmental cleaning procedures. The baseline rate of CDI at the LTCF where our study was conducted was low, preventing us from showing a statistically significant decline in CDI rates, however, the measured rate did decline from 0.094 to 0.076 post-intervention. In addition, it is unknown what the effect of decreasing CDI rates in a LTCF has on the transferring hospital.

Controlling the use of fluoroquinolones in a LTCF may also have an impact on the incidence of the NAP-1/027/B1 strain of CDI.[21] Fluoroquinolones are known to single out the NAP-1/027/B1 strain that can be associated with greater toxin production and more severe disease, especially in the

## How can you help?

It is a natural and common feeling to want to ask that your family member be treated with antibiotics every time a urine culture comes back positive, or they have a symptom that is consistent with a urinary tract infection.

Our hope is that by educating you on the appropriate and inappropriate times to treat a urinary tract infection, you can help us to decrease the use of antibiotics when they are not necessary

## What do we need from you?

**TRUST!**

The doctors, physcian assistants and nurses all know when they should use antibiotics. They won't let your loved one go untreated if they should be.

## Why is it important to not use antibiotics when they aren't necessary?

There are several negative results of using antibiotics more than necessary:

**1. Adverse Drug Reactions**

**2. Resistance**

a. Every time an organism is exposed to an antibiotic, it gets smarter. Eventually, they get so smart that our medications no longer kill them

b. This is especially an issue in Long Term Care facilities across the country so we need to do our best to prevent it from happening at Loretto

**3. *Clostridium Difficile* Infection**

a. This infection is caused by exposure to antibiotics

b. The most common symptom is uncontrollable diarrhea

c. Antibiotic use is the most common risk factor for getting this infection

# Urinary Tract Infections

## To Treat or Not to Treat?

St. Joseph's Antibiotic Stewardship Team

**Figure 3.** Pamphlet for Family Members

elderly population.[22] A prevalence study showed that hospital patients admitted from a LTCF were four times more likely to be infected with this strain than patients admitted from home.[22] It is unknown if the decrease in FQ usage had an effect on the occurrence of the NAP-1 strain at the LTCF, since this data was unavailable from the microbiology laboratory.

Despite the ability to collect monthly antibiotic usage data, the lack of electronic medical records at the LTCF made it difficult to track the exact indication for FQ use. The antibiotic usage data were captured by pharmacy dispensing data. This may not have accurately captured doses received since the dispensing pharmacy did not credit doses that were not administered. In addition, the use of DDD in the elderly population may over-predict usage as these patients are commonly on lower, total daily doses based on reduced renal function. Infection data were evaluated using definitions of UTI, SSTI, and RTI as reported by the infection control nurse at the institution and may have included patients with non-infectious or viral causes. These definitions, however, were consistent throughout the study period. An additional limitation was that the number of phone calls made from the LTCF to the on-call physician and pharmacist were not documented during the study period. Finally, the LTCF performed environmental changes during the pre-intervention period that could have affected the CDI rates during the post-intervention period.

This study was not able to identify the potential impact of antibiotic stewardship in a LTCF on the hospital, although it is anticipated to be beneficial. Future research needs to focus on the impact of transitions in care on CDI and MDRO in LTCF patients. During collaborative meetings with the LTCF providers, it was identified that patients transferred to the hospital's emergency department with confusion or delirium were inappropriately prescribed antimicrobials, including ciprofloxacin, and then sent back to the LTCF to complete the therapy. To help combat this issue, the H-AST

provided an interactive, case-based in-service to the emergency department (ED) providers on patients transferred from the LTCF to the ED with asymptomatic UTIs after the intervention period was completed. This reiterates the importance of recognizing the impact of transition of care on inappropriate antimicrobial prescribing. Future research also needs to focus on education programs for LTCF nursing staff and consultant pharmacists on the appropriate prescribing of antimicrobials in this population.

## Conclusion

A minimal resource education campaign at a LTCF performed by a H-AST was able to have a large impact on decreasing ciprofloxacin prescribing for UTI and asymptomatic bacteriuria with a statistically significant decrease in ciprofloxacin consumption by 37.7% over a 12-month period. This may have contributed to a decreased incidence of CDI by 19.47%. In 2011, the AHRQ Healthcare Cost and Utilization Project estimated that 21.5% of hospital discharges of older adults were either preceded by a LTCF transfer or resulted in admission to a LTCF.[6] This high patient flow amongst institutions represents a large risk for the transmission of MDRO including CDI. With this influx, H-ASTs would be advised to focus on more than just antimicrobial use within the hospital walls. ◆

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