

# The use of an IV to PO clinical intervention form to improve antibiotic administration in a community based hospital

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## Abstract

Antimicrobials are among the most commonly prescribed medications in acute care settings, with 50% of antimicrobial use deemed inappropriate. Antimicrobial stewardship programs (ASP) aim to optimize antibiotic use in order to improve patient clinical outcomes while minimizing unwanted effects of therapy including *Clostridium difficile* infection (CDI) and the emergence of resistant organisms. Antimicrobial Stewardship involves a coordinated set of interventions that ensure patients who require antimicrobial therapy receive the most appropriate agent at the correct dose, by the correct route for the correct duration. This project focused on the appropriate conversion from intravenous (IV) to oral (PO) antibiotics. The purpose of the project was to determine whether antibiotic prescribing patterns improved following the implementation of an IV to PO conversion clinical intervention form.

A collaborative approach was used by an interprofessional team to review medical records and design a clinical intervention form that adheres to evidence-based guidelines to promote appropriate conversion for patients on intravenous antibiotics. Education efforts were made to inform health system staff about the goal of the intervention and to gather feedback for the improvement of the clinical intervention form. A five-week pilot intervention period trial was carried out with a specific focus on the fluoroquinolone class of antibiotics, specifically ciprofloxacin, moxifloxacin, and levofloxacin.

Data from the intervention phase, including overall antibiotic use, ratio of intravenous:oral antibiotic time and compliance with the clinical intervention form were assessed. The ratio of intravenous to oral fluoroquinolone use changed from 39.4% IV: 60.6% PO before the intervention, to 34.7% IV: 65.3% PO during the intervention, indicating an overall increase in the usage of oral fluoroquinolones during the intervention phase. In patients eligible to receive the clinical intervention form, physician compliance with the form was 50%. IV duration decreased by 42% in patients with physician compliance.

Further refinement of this form and the process for implementation will further enhance the conversion of intravenous to oral therapy. Based on these findings and the lessons learned, this process will be considered for further refinements, spread, and sustainability.

## Problem

Antimicrobial stewardship programs (ASP) were rare within Ontario hospitals,[1] however are gaining increasing attention in their potential and application. In some organizations antimicrobial management committees exist, however effectiveness of the committees is not as extensive as ASPs. Moreover, these committees only exist in 67% of academic hospitals and 33% of non-academic hospitals.[1] Although the benefits of ASPs have clearly been demonstrated through studies conducted in numerous hospitals, the development of a successful and sustainable program requires the commitment of extensive resources in front line staff, supporting structures and targeted quality improvement efforts.

Hospitals in Ontario are expected to submit quality improvement reports annually to the provincial government which outline their strategic focus and targeted areas for improvement. The Niagara Health System (NHS) in Ontario, Canada identified reducing the rate of hospital-acquired CDI through improving antibiotic prescribing patterns as one of the core priorities. The rationale for this focused approach was due to the recurring multi-site *C. difficile* outbreaks, of which the most recent had been in 2011. Of the

individuals diagnosed with *C. difficile* during this outbreak, 50% were hospital acquired infections and 10% of the patients infected suffered fatal consequences. Beginning in 2013, Accreditation Canada included ASPs as a Required Organization Practice (ROP) within acute care settings in Canada.[2] Acute care settings must not only implement an ASP based on the IDSA and SHEA guidelines but specific outcome metrics must be developed in order to monitor and maintain effective prescribing patterns.[2] In order to approach this ROP in a proactive way before it was mandated, the team implemented an antimicrobial stewardship quality improvement project where a thorough chart audit was conducted using the electronic medical records to analyze use of intravenous fluoroquinolones. This chart review highlighted the recurrent trend in prolonged intravenous therapy, which then became the strategic focus of the quality improvement project.

## Background

Antimicrobials are among the most commonly prescribed medications in acute care settings with 50% of antimicrobial use deemed inappropriate.[3] ASPs were created with the aim of improving the worldwide misuse of antibiotic therapy with

antimicrobial stewardship being defined as the appropriate use of antimicrobial agents, specifically aimed at reducing the misuse and overuse of antibiotic medication. ASPs are implemented within hospitals with the primary goal of ensuring the appropriate selection, dose, route and duration of antimicrobial (antibiotic) therapy is being prescribed to patients.[4] As well, these programs are designed and implemented within hospitals in order to improve patient safety by decreasing the emergence and spread of antimicrobial resistance (AMR), decreasing drug associated adverse events, improving patient satisfaction, and decreasing health care cost.[4]

## Baseline measurement

Through the use of a retrospective chart audit, prolonged intravenous therapy was identified as a recurrent trend regarding fluoroquinolone therapy at the NHS. Patients were often spending undue time on IV antibiotics when oral therapy was more appropriate. The use of IV to PO conversion as a targeted area of improvement allows for a focus on the quality dimensions of effectiveness and patient safety while also considering the costs associated with treatment options.

In order to determine the scope of the problem and provide a point of reference for any improvements made by the intervention, antibiotic usage data was retrieved for three fluoroquinolones (ciprofloxacin, moxifloxacin, levofloxacin) during a five-week period from January 7th to February 11th, 2013. Data was recorded as defined daily doses (DDD) per 1,000 patient days for both IV and PO antibiotic usage, and collected for the oncology, intensive care, progressive care, palliative, and six general internal medicine wards of the St. Catharines General Hospital site of the NHS. Data collected during this phase as well as the intervention period can be found in the attached Appendix A.

See supplementary file: ds3515.docx - "Appendix A: Baseline and Follow-up Measures"

## Design

The intervention developed for the purpose of improving IV to PO conversion was termed the clinical intervention form (CIF). The CIF is a clinical form designed to facilitate and promote appropriate and timely step-down from IV fluoroquinolone therapy to PO fluoroquinolone therapy within 48 to 72 hours of the initiation of IV therapy. The CIF was created based on the recommendation set out by the IDSA and SHEA to develop a set of guidelines to aid in the conversion from IV to PO therapy.[3] The original information found on the CIF included the attending physician, individual patient information, the Antimicrobial Stewardship recommendations, the evidence-based criteria for appropriate conversion of IV to PO therapy, and an area for the indicated response of the attending physician. The CIF is designed to ensure early reassessment of patients prescribed IV fluoroquinolone antibiotics. Early reassessment is often overlooked by physicians due to time constraints, staff change, inadequate training, and reluctance to change.[5]

## Strategy

PDSA cycle 1: Development of the clinical intervention form (CIF). The CIF initially included the following information: attending physician name, patient information, Antimicrobial Stewardship recommendations based on the evaluation of a clinical pharmacist, scientific based criteria for appropriate conversion of IV to PO therapy, and an area for the indicated response of the physician.

PDSA cycle 2: Assessment and feedback of the CIF: The CIF was assessed by three physicians at the St Catharines General Hospital site including the head of hospitalist medicine, an attending physician, and the co-chief resident. The feedback received was to include less information on the form, and to make it more visually appealing.

PDSA cycle 3: A single hospitalist in the C3E wing of the St Catharines General Hospital site, after being introduced to the project aims, assessed the form on one patient in a clinical environment. The physician advised that the date in which IV antibiotic therapy was initiated be included directly on the CIF.

PDSA cycle 4: Two separate educational presentations were given to various NHS staff. The first was given to the NHS Quality Council, including the CEO, CFO, the chief of staff, as well as a number of regional physician chiefs of various services. The presentation provided an overview of ASP as well as a detailed description of the development and use of the CIF, with the overall goal to highlight current progress of the ASP and present upcoming plans for the implementation of the CIF. It was intended to involve the hospital administration more in the process, and influence development of a sustainable ASP.

A second presentation was given at Grand Medicine Rounds at the St. Catharines General Hospital site. For this presentation, the audience included various physicians and health care professionals. A brief overview on antimicrobial stewardship including the ASP ROP as per Accreditation Canada was provided as background and a more detailed description of the of the upcoming intervention. This was done to ensure proper use of the form by physicians and nursing staff, and increase buy-in during the intervention phase.

Feedback from the presentations was largely positive, stating that they really caused physicians to stop and think about best practice. Suggestions were made to include an option to stop antibiotic therapy altogether, as well as a written notes section and options for less-expensive antibiotics. It was agreed upon that starting small was the best option.

PDSA cycle 5: The final PDSA was the placement of the CIF in the charts of all patients within the St. Catharines General Hospital who met criteria for appropriate IV to PO conversion. Primary outcome measures were the length of total antibiotic, IV antibiotic and PO antibiotic therapy, as well as the IV:PO therapy ratio. The primary process measure was the physician compliance with the form.

## Results

Over the five-week intervention period, a total of 211 patients were prescribed IV fluoroquinolones in the previous described wards. Of these 211, sixty-four were assessed by the Clinical Pharmacist, and a total of nine were determined eligible for IV to PO switch. These nine had the CIF placed in their charts. One patient was removed as more than 72 hours had passed, thus making them ineligible for timely switch. Of the remaining eight patients with CIFs, four received physician compliance with the form.

Despite the small sample size, the effect of physician compliance can be seen in the ratio of IV:PO antibiotic time seen among these eight patients. The average length of time spent on IV was 42% longer in those without physician compliance, while the IV:PO ratio was 1.55:1 and three of the four patients were on IV for four days or longer. Conversely, the IV:PO ratio was a more ideal 1:1 in the compliant group, while only one of the four was on IV for four or more days.

Finally, the hospital-wide fluoroquinolone usage also demonstrated a positive shift during the intervention phase. During the pre-intervention phase, the IV:PO usage was 39.4%IV : 60.6%PO, while during the intervention phase it shifted to 34.7%IV : 65.3%PO. Figures and tables outlining these results can be seen in Appendix B.

See supplementary file: ds3522.docx - "Appendix B: Intervention Results Tables & Figures"

## Lessons and limitations

A number of lessons were learned throughout the completion of this quality improvement project. First and foremost is the need for an effective change champion from the physician group. This should be an individual willing to embrace new ideas while also able to recruit other stakeholders to the process. Without an appropriate change champion for this project, the team was subject to a number of delays and scheduling difficulties. This caused the educational seminars to be pushed back months, and thus the intervention and pre-intervention periods to be greatly compressed.

This project helped the organization to move forward and garner support and funding for a full scale ASP. However at the time of implementation for the current project, carrying out an effective intervention was impacted by the considerable amount of work required on the part of the "on-the-ground" staff. For this project, a single clinical pharmacist was not able to monitor every single hospitalised patient on fluoroquinolones due to their primary role as an ICU pharmacist, thus resulting in a reduced sample size and limited study power.

There were some limitations to this project, most notably the small sample size brought about by the aforementioned barriers. Poor communication and a lack of physician engagement or physician champion caused delays throughout the process, while the small project team was limited in their ability to reach an optimal number

of patients. These two issues resulted in a shorter than intended intervention period, and thus a greatly limited sample size. With a small sample size, it was difficult to determine the overall effect size of the intervention, and therefore the true benefit of this project. However, the use of the quality improvement framework and initial work in this area has helped to move the organization in a positive direction for improving infection control practices through a quality improvement lens.

## Conclusion

This Antimicrobial Stewardship quality improvement pilot project demonstrated promising gains through a five-week intervention phase. The CIF reduced IV antibiotic duration by 42% in patients that had physician compliance, and the overall hospital-wide IV usage decreased following the two separate educational seminars. Through the use of a series of small steps, and by planning for short-term wins, the study team was able to effectively build a foundation for future Antimicrobial Stewardship developments within the new St. Catharines Hospital Site and the NHS as a whole. A number of the drawbacks of this project were associated with limited resources, both financial and personnel, thus limiting the sample size and overall strength of the study. In the future, providing a greater amount of resources to the Antimicrobial Stewardship team would be a necessary step, and it is likely that further gains will be made towards preventing adverse events and improving patient outcomes.

## References

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## Declaration of interests

Nothing to declare.

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