

ENGAGING HOSPITALISTS IN ANTIMICROBIAL STEWARDSHIP:**LESSONS FROM A MULTIHOSPITAL COLLABORATIVE**Megan R. Mack, MD¹Jeffrey M. Rohde, MD¹Diane Jacobsen, MPH²James R. Barron, MD³Christin Ko, MD, MBA⁴Michael Goonewardene, MD, PhD⁵David J. Rosenberg, MD, MPH, FACP, SFHM⁶Arjun Srinivasan, MD⁷Scott A. Flanders, MD, MHM¹

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Inappropriate antimicrobial use in hospitalized patients contributes to antimicrobial-resistant infections and complications. We sought to evaluate the impact, barriers, and facilitators of antimicrobial stewardship best practices in a diverse group of hospital medicine programs. This multi-hospital initiative included 1 community non-teaching hospital, 2 community teaching hospitals, and 2 academic medical centers participating in a collaborative with the Centers for Disease Control and Prevention (CDC) and the Institute for Healthcare Improvement (IHI). We conducted multimodal physician education on best practices for antimicrobial use including: 1) enhanced antimicrobial documentation; 2) improved quality and accessibility of local clinical guidelines; and 3) a 72-hour antimicrobial “timeout”. Implementation barriers included variability in physician practice styles, lack of awareness of stewardship importance, and overly-broad interventions. Facilitators included engaging hospitalists, collecting real time data and providing performance feedback, and appropriately limiting the scope of interventions. In 2 hospitals, complete antimicrobial documentation in sampled medical records improved significantly (4% to 51%, and 8% to 65%, $p < 0.001$ for each comparison). A total of 726 antimicrobial timeouts occurred at 4 hospitals, and 30% resulted in optimization or discontinuation of antimicrobials. With careful attention to key barriers and facilitators, hospitalists can successfully implement effective antimicrobial stewardship practices.

Introduction

Inappropriate antimicrobial use in hospitalized patients is a well-recognized driver for the development of drug-resistant organisms and antimicrobial-related complications such as *Clostridium difficile* infection (CDI). [1] [2] Infection with *C. difficile* affects nearly 500,000 people annually resulting in higher healthcare expenditures, longer lengths of hospital stay, and nearly 15,000 deaths. [3] Data from the CDC suggest that a 30% reduction in the use of broad-spectrum antimicrobials, or a 5% reduction in the proportion of hospitalized patients receiving antimicrobials, could equate to a 26% reduction in CDI. [4] It is estimated that up to 50% of antimicrobial use in the hospital setting may be inappropriate. [5]

Since the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA) published guidelines for developing formal, hospital-based antimicrobial stewardship programs in 2007, stewardship practices have been adapted by frontline providers to fit day-to-day inpatient care. [5] A recent review by Hamilton, et al, described several studies in which stewardship practices were imbedded into daily workflow by way of checklists, education reminders, and periodic review of antimicrobial usage, as well as a multi-center pilot of point-of-care stewardship interventions successfully implemented by various providers including nursing, pharmacists, and hospitalists. [6]

In response to the CDC's 2010 *Get Smart for Healthcare* campaign which focused on stemming antimicrobial resistance and improving antimicrobial use, the Institute for Healthcare Improvement (IHI), in partnership with the CDC, brought together experts in the field to identify practical and feasible target practices for hospital-based stewardship and created a "Driver Diagram" to guide implementation efforts. **(Figure 1)** Rohde, et al, described the initial pilot testing of these practices, the decision to more actively engage frontline providers, and the 3 key

strategies identified as high yield improvement targets: enhancing the visibility of antimicrobial use at the point of care, creating easily accessible antimicrobial guidelines for common infections, and the implementation of a 72-hour timeout after initiation of antimicrobials. [7]

In this paper, we describe how, in partnership with the IHI and the CDC, the hospital medicine programs at 5 diverse hospitals iteratively tested these 3 strategies with a goal of identifying the barriers and facilitators to effective hospitalist-led antimicrobial stewardship.

Methods

Representatives from 5 hospital medicine programs, IHI, and the CDC attended a kick-off meeting at the CDC in November 2012 to discuss the 3 proposed strategies, examples of prior testing, and ideas for implementation. Each hospitalist provided a high-level summary of the current state of stewardship efforts at their respective institutions, identified possible future states related to the improvement strategies, and anticipated problems in achieving them. The 3 key strategies are described below:

Improved documentation/visibility at points of care

Making antimicrobial indication, day of therapy, and anticipated duration transparent in the medical record was the targeted improvement strategy to avoid unnecessary antimicrobial days that can result from provider uncertainty, particularly during patient handoffs. Daily hospitalist documentation was identified as a vehicle through which these aspects of antimicrobial use could be effectively communicated and propagated from provider to provider.

Stewardship educational sessions and/or awareness campaigns were hospitalist-led, and were accompanied by follow-up reminders in the forms of emails, texts, flyers, or conferences.

Infectious disease physicians were not directly involved in education but were available for consultation if needed.

Improved guideline clarity and accessibility

Enhancing the availability of guidelines for frequently encountered infections, and clarifying key guideline recommendations such as treatment duration was identified as the improvement strategy to help make treatment regimens more appropriate and consistent across providers.

Interventions included designing simplified pocket cards for commonly-encountered infections, (**Appendix A**) collaborating with infectious disease physicians on guideline development and dissemination through emails, smartphone, and wall flyers; and creation of a continuous medical education module focused on stewardship practices..

72-hour antimicrobial timeout

The 72-hour antimicrobial timeout required that hospitalists routinely reassess antimicrobial use 72 hours following antimicrobial initiation, a time when most pertinent culture data had returned. Hospitalists partnered with clinical pharmacists at all sites, and addressed the following questions during each timeout: 1) Does the patient have a condition that requires continued use of antimicrobials?; 2) Can the current antimicrobial regimen be tailored based on culture data?; and 3) What is the anticipated treatment duration? A variety of modifications occurred during timeouts, including broadening or narrowing the antimicrobial regimen based on culture data, switching to an oral antimicrobial, adjusting dose or frequency based on patient specific factors, as well as discontinuation of antimicrobials. Following the initial timeout, further adjustments were made as the clinical situation dictated; intermittent partnered timeouts

continued during a patient's hospitalization on an individualized basis. Hospitalists were encouraged to independently review new diagnostic information daily and make changes as needed outside the dedicated time-out sessions. All decisions to adjust antimicrobial regimens were provider-driven; no hospitals employed automated antimicrobial discontinuation without provider input.

Implementation and evaluation

Each site was tasked with conducting small tests of change aimed at implementing at least 1, and ideally all 3 strategies. Small, reasonably achievable interventions were preferred to large hospital-wide initiatives so that key barriers and facilitators to the change could be quickly identified and addressed.

Methods of data collection varied across institutions and included anonymous physician survey, face-to-face physician interviews, and medical record review. Evaluations of hospital-specific interventions utilized convenience samples to obtain real time, actionable data. Post-intervention data were distributed through biweekly calls and compiled at the conclusion of the project. Barriers and facilitators of hospitalist-centered antimicrobial stewardship collected over the course of the project were reviewed and used to identify common themes.

Results

Participating hospitals included 1 community non-teaching hospital, 2 community teaching hospitals, and 2 academic medical centers. All hospitals used computerized order entry and had prior quality improvement experience; 4 out of 5 hospitals used electronic medical records. Post-intervention data on antimicrobial documentation and timeouts were compiled,

shared, and successes identified. For example, 2 hospitals saw an increase in complete antimicrobial documentation from 4% and 8% to 51% and 65%, respectively, of medical records reviewed over a 3-month period. Additionally, cumulative timeout data across all hospitals showed that out of 726 antimicrobial timeouts evaluated, optimization or discontinuation occurred 218 times or 30% of the time.

Each site's key implementation barriers and facilitators were collected. Examples were compiled and common themes emerged (**Table 1**).

Discussion

We successfully brought together hospitalists from diverse institutions to undertake small tests of change aimed at 3 key antimicrobial use improvement strategies. Following our interventions, significant improvement in antimicrobial documentation occurred at 2 institutions focusing on this improvement strategy, and 72-hour timeouts performed across all hospitals tailored antimicrobial use in 30% of the sessions. Through frequent collaborative discussions and information sharing we were able to identify common barriers and facilitators to hospitalist-centered stewardship efforts.

Each participating hospital medicine program noticed a gradual shift in thinking among their colleagues, from initial skepticism about embedding stewardship within their daily workflow, to general acceptance that it was a worthwhile and meaningful endeavor. We posited that this transition in belief and behavior evolved for several reasons. First, each group was educated about their own, personal prescribing practices from the outset rather than presenting abstract data. This allowed for ownership of the problem and buy-in to improve it. Secondly,

participants were able to experience the benefits at an individual level while the interventions were ongoing (e.g., having other providers reciprocate structured documentation during patient handoffs, making antimicrobial plans clearer), reinforcing the achievability of stewardship practices within each group. Additionally, we focused on making small, manageable interventions that did not seem disruptive to hospitalists' daily workflow. For example, 1 group instituted antimicrobial timeouts during pre-existing multi-disciplinary rounds with clinical pharmacists. Lastly, project champions had both leadership and frontline roles within their groups and set the example for stewardship practices, which conveyed that this was a priority at the leadership level. These findings are in line with those of Charani et al, who evaluated behavior change strategies that influence antimicrobial prescribing in acute care. The authors found that behavioral determinants and social norms strongly influence prescribing practices in acute care, and that antimicrobial stewardship improvement projects should account for these influences. [8]

We also identified several barriers to antimicrobial stewardship implementation (**Table 1**) and proposed measures to address these barriers in future improvement efforts. For example, hospital medicine programs without a pre-existing clinical pharmacy partnership asked hospitalist leadership for more direct clinical pharmacy involvement, recognizing the importance of a physician-pharmacy alliance to stewardship efforts. To more effectively embed antimicrobial stewardship into daily routine, several hospitalists suggested standardized order sets for commonly encountered infections, as well as routine feedback on prescribing practices. Furthermore, while our simplified antimicrobial guideline pocket card enhanced access to this information, several colleagues suggested a smart phone application that would make access even easier and less cumbersome. Lastly, given the concern about the sustainability of

antimicrobial stewardship initiatives, we recommended periodic reminders, random medical record review, and re-education if necessary on our 3 strategies and their purpose.

Our study is not without limitations. Each participating hospitalist group enacted hospital-specific interventions based on individual hospitalist program needs and goals, and while there was collective discussion, no group was tasked to undertake another group's initiative, thereby limiting generalizability. We did, however, identify common facilitators that could be adapted to a wide variety of hospitalist programs. We also note that our 3 main strategies were included in a recent review of quality indicators for measuring the success of antimicrobial stewardship programs; thus while details of individual practice may vary, in principle these concepts can help identify areas for improvement within each unique stewardship program. [9] Importantly, we were unable to evaluate the impact of the 3 key improvement strategies on important clinical outcomes such as overall antimicrobial use, complications including CDI, and cost. However, others have found that improvement strategies similar to our 3 key processes are associated with meaningful improvements in clinical outcomes as well as reductions in healthcare costs. [10] [11] Lastly, long term impact and sustainability were not evaluated. By choosing interventions that were viewed by frontline providers as valuable and attainable, however, we feel that each group will likely continue current practices beyond the initial evaluation timeframe.

While these 5 hospitalist groups were able to successfully implement several aspects of the 3 key improvement strategies, we recognize that this is only the first step. Further effort is needed to quantify the impact of these improvement efforts on objective patient outcomes such as readmissions, length of stay, and antimicrobial-related complications, which will better inform our local and national leaders on the inherent clinical and financial gains associated with

hospitalist-led stewardship work. And finally, creative ways to better integrate stewardship activities into existing provider workflows (e.g., decision support and automation) will further accelerate improvement efforts.

In summary, hospitalists at 5 diverse institutions successfully implemented key antimicrobial improvement strategies, and identified important implementation facilitators and barriers. Future efforts at hospitalist-led stewardship should focus on strategies to scale-up interventions and evaluate their impact on clinical outcomes and cost.

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Figure Legend

Table 1 describes the common themes of barriers and facilitators to antimicrobial stewardship within each hospitalist program with accompanying examples. Barriers and facilitators were collected during biweekly conference calls as well as upon conclusion of our initiative.

Figure 1 depicts the “Antibiotic Driver Diagram” that was developed as part of CDC and IHI partnered efforts to stem antimicrobial overuse through the CDC’s Get Smart for Healthcare campaign. Eight pilot hospitals were recruited to participate in field testing and refining the diagram in a variety of settings from September 2011 through June 2012.

Appendix A illustrates an example pocket card antimicrobial guideline with commonly-encountered infections that was developed and distributed at one hospital during our initiative. Importantly, antimicrobial step down therapy and expected duration were included to encourage appropriate de-escalation or discontinuation during the partnered timeouts and thereafter.

Table 1: Barriers and Facilitators to Antimicrobial Stewardship Implementation in Hospitalist Programs

Barriers: What impediments did we experience during our stewardship project?	Schedule and practice variability	<ul style="list-style-type: none"> • Physician variability in structure of antimicrobial documentation • “Prescribing etiquette”: it’s difficult to change course of treatment plan started by a colleague • Competing schedule demands of hospitalist and pharmacist
	Skepticism of antimicrobial stewardship importance	<ul style="list-style-type: none"> • Perception of incorporating stewardship practices into daily work as time-consuming • “Improvement project fatigue” from competing quality improvement initiatives • Unclear leadership buy-in
	Focusing too broadly	<ul style="list-style-type: none"> • Choosing large initial interventions, which take significant time/effort to complete and quantify • Setting unrealistic expectations, e.g., expecting “perfect” adherence to documentation, guidelines, or timeout
Facilitators: What countermeasures did we target to overcome barriers?	Engage the hospitalists	<ul style="list-style-type: none"> • Establish a core part of the hospitalist group as stewardship “champions” • Speak one-on-one to colleagues about specific goals and ways to achieve them • Establish buy-in from leadership • Encourage participation from a multi-disciplinary team (e.g., bedside nursing, clinical pharmacists)
	Collect real time data and feedback	<ul style="list-style-type: none"> • Utilize a data collection tool if possible/engage hospital coders to identify appropriate diagnoses • Define your question and identify baseline data prior to intervention • Give rapid cycle feedback to colleagues that can impact antimicrobial prescribing in real time • Recognize and reward high performers
	Limit scope	<ul style="list-style-type: none"> • Start with small, quickly implementable interventions • Identify interventions that are easy to integrate into hospitalist workflow

Antibiotic Stewardship Driver Diagram



Antibiotic Stewardship Driver Diagram



Timely and appropriate antibiotic utilization in the acute care setting

Decreased incidence of antibiotic-related adverse drug events (ADEs)

Decreased prevalence of antibiotic resistant healthcare-associated pathogens

Decreased incidence of healthcare-associated *C. difficile* infection

Decreased pharmacy cost for antibiotics

Primary Drivers

Timely and appropriate initiation of antibiotics

Appropriate administration and de-escalation

Data monitoring, transparency, and stewardship infrastructure

Availability of expertise at the point of care

Secondary Drivers

- Promptly identify patients who require antibiotics
- Obtain cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations not supported by evidence or guidelines
- Determine and verify antibiotic allergies and tailor therapy accordingly
- Consider local antibiotic susceptibility patterns in selecting therapy
- Start treatment promptly
- Specify expected duration of therapy based on evidence and national and hospital guidelines

- Make antibiotics patient is receiving and start dates visible at point of care
- Give antibiotics at the right dose and interval
- Stop or de-escalate therapy promptly based on the culture and sensitivity results
- Reconcile and adjust antibiotics at all transitions and changes in patient's condition
- Monitor for toxicity reliably and adjust agent and dose promptly

- Monitor, feedback, and make visible data regarding antibiotic utilization, antibiotic resistance, ADEs, *C. difficile*, cost, and adherence to the organization's recommended culturing and prescribing practices

- Develop and make available expertise in antibiotic use
- Ensure expertise is available at the point of care

Leadership and Culture