Analysis of an Infectious Diseases Pharmacist on Call Pager Program to Inform Educational Efforts

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Abstract

Background: An on call infectious diseases (ID) pharmacist may be used as a resource for physicians, pharmacists, and other health care providers to help answer questions regarding anti-infective agents. **Objective:** To assess type, requestor, resources dedicated, and temporal trends of questions received through an ID pharmacist on call pager program. A secondary objective was to gather insight as to how this information was utilized to inform educational initiatives. **Methods:** This was a retrospective study of questions received by the ID pharmacist on call via pager at a large academic medical center. Question data were documented in a central database and analyzed to assess temporal trends and question type, and qualitatively analyzed to determine areas for targeted educational efforts. **Results:** The ID pharmacist on call recorded 545 questions during the 1-year study period; questions were composed of various antimicrobial agent-related queries, including antibiotic spectrum and selection ($n = 251$, 46.1%), dosing of antimicrobials ($n = 195$, 35.8%), and drug monitoring ($n = 26$, 4.8%). Targeted educational initiatives secondary to questions received included pharmacist education regarding the use of polymyxin antibiotics and antibiotic dosing protocol updates. **Conclusions:** An ID pharmacist on call pager program was utilized to inquire about antibiotic spectrum and selection for the majority of questions. Records of questions received may be utilized to direct educational efforts and create or revise targeted resources for pharmacists and other clinicians.

Keywords

clinical pharmacy, infectious diseases, antibiotics, antifungals, antivirals, dosing

Introduction

The landscape of infectious diseases (ID) pharmacotherapy is continuously evolving due to the constant stream of new clinical evidence. Thus, disseminating the newest and most accurate information regarding the appropriate use of anti-infective agents may be challenging across various health care settings.^{1,2} Treatment guidelines may not always contain the most up-to-date data for a given disease state or address all clinical situations.³ Highlighting these challenges, the Centers for Disease Control and Prevention note that up to 50% of antibiotic use in the hospital setting may be unnecessary or inappropriate.⁴ Furthermore, antimicrobial susceptibility patterns vary according to site of culture, unit location, and infectious source.⁵⁻⁷ Therapeutic individualization is often necessary in the setting of critical illness or end-organ dysfunction.^{8,9} Thus, pharmacists with specialized training in ID, who have hands-on experience and knowledge of the critical patient-bug-drug interaction, are

uniquely positioned to provide insight into anti-infective optimization or discontinuation.¹⁰

Antimicrobial Stewardship Programs (ASPs) promote the rational use of anti-infective agents. Antimicrobial stewardship implementation has recently moved to the forefront of attention for health care institutions with the publishing of the Core Elements of successful ASPs from the Centers for Disease Control and Prevention.¹¹ To date, ASP and pharmacist involvement in the care of patients with infectious diseases has been shown to improve antimicrobial selection,

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decrease time to initiation of optimal therapy, and reduce readmission rates.¹²⁻¹⁴

The ASP at Northwestern Memorial Hospital (NMH) includes physician-pharmacist collaboration to enhance anti-infective use by providing guidance for the most appropriate drug selection, drug dose, and treatment duration. In addition to in-person guidance, hospital staff members have access to electronic anti-infective resources. These resources include antibiograms, recommendations for dosing of agents in renal impairment, guidelines for empiric antimicrobial agent selection, and antibiotic minimum inhibitory concentration interpretation, among others. However, many questions regarding the use of anti-infective agents still arise from clinicians.

Given the ubiquitous nature of ID questions within the institutional healthcare setting, an ID pharmacist on call pager program was established as part of our ASP. A previous study at our institution noted a reduction in cost associated with use of an ID pharmacist on call pager program,¹⁵ indicating that there may be numerous benefits to pharmacists and health care providers when a pager service of this nature is offered. This program supports broader pharmacist-clinician interaction and collaboration to optimize patient care and anti-infective use, and is supported by recently published guidelines on antimicrobial stewardship.¹⁰ However, more information is needed on the most appropriate way to analyze information gathered from the on call pager program and provide potential novel ASP interventions and methods. The objective of this study was to assess type, requestor, resources dedicated, and temporal trends of questions received through an ID pharmacist on call pager program. A secondary objective was to gather insight as to how this information was utilized to inform educational initiatives and the creation or revision of anti-infective resources.

Methods

This was a retrospective study of the ID pharmacist on call pager program at NMH in Chicago, Illinois, between February 1, 2015, and January 31, 2016. The program was assessed by qualitatively and quantitatively analyzing characteristics of questions received during the 1-year study period. The ID pharmacist on call was an ID trained pharmacist, a post graduate year 2 ID pharmacy resident, or an ID pharmacy fellow. The individual on call was available as a 24-hour a day, 7-day a week, 365-day per year resource to answer questions from any staff member at the facility (eg, physician, pharmacist, nurse). The on call pager program was advertised to staff members through various means, including a listing in the online paging directory of specialists and as a reference in anti-infective usage policies. The ASP at NMH primarily utilizes a prospective audit and feedback method for optimization of

rational anti-infective use, and the on call pager number is regularly included to facilitate pharmacist-to-pharmacist communications. It is important to note that the on call pager is not utilized for anti-infective agent use prior authorization and pages were not anticipated to be related to approval for anti-infective use.

The ID pharmacist covering the pager documented all questions received within a centralized database for internal quality improvement and process of care measurement. If a single question was sent to the pager via multiple discrete pages, it was recorded in the database as a single paged question. Data elements that were collected included the following: the month and day of the week in which a question was received, the time spent to respond to the question rounded to the nearest 5 minutes (including all time needed to collect patient information, research the question, and provide a response to the questioner), a general classification of the questioner (eg, clinical pharmacist [including pharmacy residents], ID physician fellow, medical resident, medical student, attending physician, nurse, or physician's assistant), and a brief description of the question/issue raised by the questioner. Of note, the role of clinical versus staff pharmacist is not designated at NMH as all pharmacists fulfill what would be considered traditional staffing roles. Therefore, questions from any pharmacist were noted under the classification "clinical pharmacist." No patient- or questioner-specific identifying information was recorded in the database, other than general classification of the questioner's role. Fielded questions were retrospectively categorized by subject matter as follows: drug dosing, drug selection and spectrum of activity, drug monitoring (eg, drug-drug interactions, therapeutic drug monitoring, adverse effects), duration of treatment, or miscellaneous questions not otherwise specified. This study was reviewed and considered exempt from institutional review board approval by Northwestern University.

Following completion of the study period, descriptive statistical analysis was completed using Microsoft Excel (Microsoft, Seattle, WA). Day and month data were analyzed at the bivariate level compared with all other days or months combined to assess for association with type of question asked. Chi-square and logistic regression tests were calculated using EpiInfo version 7.0 (Centers for Disease Control and Prevention, Atlanta, GA) with $P < .05$ considered to be significant. Question data were qualitatively assessed to determine if existing educational materials addressed common queries. In the case that thematic questions were not addressed via existing educational resources, the ASP team enhanced existing or created new, targeted educational resources.

Results

There were a total of 545 documented questions received during the 1-year study period. Of the 365 evaluated days,

Figure 1. Number of documented questions received during the study period (a) by month and (b) by weekday.

242 days had a minimum of one documented question. A total of 5165 minutes (86 hours) were documented as time spent to respond to questions, corresponding to a median of 10 minutes (interquartile range [IQR] 0-20 minutes) per calendar day for the entire year or 15 minutes (IQR 10-30 minutes) per day with at least one documented question received. Most frequently, the ID pharmacist on call needed 5 to 10 minutes to respond to the question asked ($n = 450$, 82.6%), and a response to a question rarely needed more than 30 minutes ($n = 4$, 0.73%), with the longest question response requiring 120 minutes. Most questions were asked by clinical pharmacists ($n = 354$, 65%), followed by medical residents ($n = 73$, 13.4%), ID fellows ($n = 61$, 11.2%), and attending physicians ($n = 48$, 8.8%). Questions asked by medical students, nurses, and physician's assistants each accounted for <1% of total questions received ($n = 4$, $n = 2$, and $n = 3$, respectively; Supplemental Table 1, available at <http://journals.sagepub.com/home/pmt>).

The median number of monthly questions received was 46 (IQR 39-55, range 22-58; Figure 1a). Questions were more frequently received Monday through Friday (471 of 545, 86.4%), with a marked reduction in questions during weekend days (74 of 545, 13.6%; Figure 1b). Weekdays were more likely to have at least one question received compared to weekend days (197 of 260 weekdays [75.8%] vs 45 of 105 weekend days [42.9%]; $P < .001$). Sixty of 123 (48.7%) days without any documented questions were weekend days.

There were 251 (46.1%) questions related to drug spectrum of activity and selection, 195 (35.8%) related to drug dosing, 26 (4.8%) related to drug monitoring (including therapeutic drug monitoring, adverse effects, and drug-drug interactions), 8 (1.5%) related to treatment duration, and 65 (11.9%) did not fall into a designated category. Questions were asked about all classes of anti-infective medications, including antibacterial, antiviral, antifungal, and antiretroviral agents. There were no significant associations found between question type and day of the week in which the question was received. On the bivariate level, the month of January was associated with an increased number of questions that did not fall into a designated category ($n = 10$ of 34, $P = .0017$). Furthermore, the month of December was associated with a decreased number of questions related to dosing ($n = 10$ of 56, $P = .0044$) and an increased number of questions related to drug spectrum of activity and selection ($n = 35$ of 56, $P = .0104$). No other significant associations were found.

Qualitative analysis of questions received revealed a number of thematic areas for educational material revision or creation (data not shown). The ASP team developed educational resources and initiatives including pharmacist education regarding the use of polymyxin antibiotics, orientation to and updating of available protocols for antibiotic dosing, updating internal resource tables (eg, minimum inhibitory concentration breakpoints, empiric therapy

guidelines, dosing of antibiotics in continuous renal replacement therapy), and the addition of a direct weblink to the antibiotic resources intranet page embedded within the electronic medical record system.

Discussion

In this study of questions received by the ID pharmacist on call at a large academic medical center, 86 hours were spent responding to inquiries over the course of the 1-year study period. The majority of questions were asked from Monday through Friday and required 5 to 10 minutes to evaluate and provide a response. Questions were received from a variety of clinicians, and topics of inquiries included anti-infective agent dosage, antimicrobial spectrum of activity and appropriateness of use, and anti-infective agent monitoring, among others. Fluctuations in number of questions asked by month were noted, which may have been influenced by many factors, including hospital census and the number of ID clinical service consultations. The question-based data were utilized to create new educational resources, modify previously existing resources, and make resources more accessible via weblink.

An on call specialty discipline pager, such as the ID pharmacist on call pager program described herein, may act as one way to promote pharmacist-driven best practices, as set out by the Practice Advancement Initiative.¹⁶ We believe our program is highly relevant to our prescribers and pharmacists as evidenced by the diverse nature of questions and the continued use of the pager by both pharmacists and individuals in multiple nonpharmacy disciplines across the study period. To our knowledge, there is limited published data exploring the role of an on call pharmacist to assist in answering pharmacotherapy related questions, both within and outside the area of ID. As mentioned, a previous study at our institution assessed the utility of an ID pharmacist on call to effect costs.¹⁵ The present study augments that study by evaluating the frequency and nature of questions received, including assessment of the use of ID pharmacist time needed to respond to questions. Future studies, both descriptive and outcomes-based, may help define the role of an on call pharmacist and justify utilization of resources.

Inclusion of an ID pharmacist on call pager program into a hospital ASP may offer both opportunities and challenges. While our single institution retains ID pharmacist resources such that the on call program may continue as a 24-hour a day, 7-day a week, 365-day per year resource, this may not be feasible for all ASPs due to ID pharmacist resource availability. However, as demonstrated in Figure 1b, questions were most frequently asked during weekdays. As such, these data may be utilized to schedule limited resources to maximize impact of an ID pharmacist on call service. Analysis of an ID

pharmacist on call pager program that has been implemented with limited coverage days and/or times may still offer the opportunity for evaluation of clinician needs for ID education and allow for educational resource development.

Limitations to our methodology must be considered. First, our database did not include patient- or questioner-specific data and was reliant on documentation from the ID pharmacist on call. Due to limited collection of specific data, recommendation implementation outcomes could not be assessed, and characteristics of hospital staff (aside from general classification) could not be evaluated. Due to recall bias, the duration of time spent responding to each inquiry may have been overestimated or underestimated, or the specific nature of the question may have been incompletely documented in the database. However, we believe that the impact of any misestimation was likely random. Second, other interprofessional interactions such as questions asked to the ID pharmacist on rounds were not classified in the database and were therefore not evaluated in this study. As these questions may have been asked via the pager had there not been a pharmacist rounding with the team, this may have led to underestimation of the utilization of the ID pharmacist on call by other practitioners at our institution, particularly ID physician fellows. Finally, due to multiplicity of testing, interpretation of data on the bivariate level is limited; future studies may be designed to better assess time-question-type associations to minimize potential influencing factors and to determine the clinical and educational need implications of such findings.

Conclusion

Records of questions received by an ID pharmacist on call pager program may be utilized to direct educational efforts and create or revise targeted resources for health care providers. Future areas of research should be considered, including assessment of the rate of recommendation acceptance from the ID pharmacist on call into the patient care plan and if anti-infective prescribing improved over time in areas that were addressed via questions from the on call program. We plan to continue to offer ID pharmacist on call services via the pager as 24-hour a day, 7-day a week, 365-day per year resource.

Declaration of Conflicting Interests

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