Effect of a pharmacist-managed culture review process on antimicrobial therapy in an emergency department

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Purpose. The impact of an emergency department (ED) procedure requiring pharmacist review of all culture results as a way to improve use of antimicrobial therapies was evaluated.

Methods. Rates of antimicrobial regimen modifications before and after implementation of a pharmacist-managed ED culture review procedure at Carolinas Medical Center—Northeast were determined through retrospective evaluation of medical records. To assess the potential impact of pharmacist-initiated antimicrobial regimen modifications on overall patient care, the frequency of ED readmissions within 96 hours of ED discharge and the reasons for those readmissions were evaluated.

Results. In the 12 months before implementation of the pharmacist-managed ED culture review process, the medical center's ED physicians reviewed 2278 culture reports and ordered antimicrobial regimen modifications in about 12% of cases; in about 19% of cases, patients were readmitted to the ED within 96 hours of discharge for treatment failure, patient noncompliance, allergy to medication, adverse drug reactions, and other reasons. In the 12 months after program implementation, pharmacists initiated antimicrobial regimen modifications in about 15% of cases; readmission to the ED occurred in about 7% of cases, with comparatively lower rates of readmission for treatment failure, noncompliance, and allergy to medication.

Conclusion. ED pharmacists at Carolinas Medical Center—Northeast designed and implemented a pharmacist-managed culture review process. During a one-year period, ED pharmacists reviewed 2361 culture reports and modified the antimicrobial regimens of 355 patients.

Index terms: Antiinfective agents; Compliance; Drugs, adverse reactions; Hospitals; Patient care; Patients; Pharmaceutical services; Pharmacists, hospital; Pharmacy, institutional, hospital; Rational therapy; Tests, laboratory; Toxicity

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The American Society of Health-System Pharmacists has called on all hospital pharmacy departments to provide a host of clinical pharmacy services in the emergency department (ED), including participation in the development of "systems that promote safe and effective medication use" and overall patient care.[1] That call to action was predicated on statistics indicating a need for more pharmacist involvement in efforts to improve the quality of care for the estimated 114 million patients admitted to EDs each year in the United States. Research has shown that medication-related problems are a significant cause of medical errors resulting in injury or death, and that adverse drug events occur frequently in the ED setting.[1-3] With significant room for improvement in patient safety and quality of care, it is imperative that ED pharmacists continue to pursue patient-focused clinical intervention opportunities. As the role of ED pharmacists nationwide continues to grow, clinical services provided should focus on the goal of large-scale improvements in patient care. Many clinical services with this focus have been reported, and previous research has demonstrated that ED-based pharmacy services lead to increased patient safety.[4]

An ED-based pharmacy service was implemented at Carolinas Medical Center—NorthEast in July 2007 for the purpose of medication reconciliation and prospective evaluation

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of medication orders. Pharmacists are on duty in the ED each day from 7 a.m. to 1 a.m. As initial services were implemented, our team of ED pharmacists quickly realized a significant need for antimicrobial intervention and education. Through patient chart reviews and consultation with physicians, our ED pharmacists identified a number of issues involving antimicrobial therapy, and we consistently educated the ED physicians accordingly. Despite several educational activities, however, issues such as inappropriate antibiotic selection and dosing were not adequately addressed. Our recognition of the need for more direct pharmacist involvement in the antimicrobial therapy process led us to initiate efforts to design and implement a program to achieve that end.

Program goals and development

To establish the greatest potential for intervention, the plan for ED pharmacist involvement in antimicrobial therapy was focused on the review of culture samples drawn in the ED, as well as empiric antibiotic selection. Our team of four ED pharmacists collaboratively designed a process in which they would be directly involved in the care of all patients receiving antimicrobial therapy. It was determined that to have the greatest impact on patient care, our ED pharmacists would need to be heavily involved in the process of reviewing reports for all cultures ordered in the ED. Before any formal plans were developed, our ideas were presented to pharmacy management, ED management, and the ED's chief of medicine. Each member of management was open to the idea and requested that we develop a detailed proposal to implement such a service.

The development of our plan to become more involved in the culture review process at our institution was completed over the course of four weeks and finalized in early April 2008; we presented the plan to senior management. After extensive discussion and two follow-up meetings, the plan was approved in late April, with a target implementation date of July 1. During May and June, we worked to educate the ED staff about the upcoming changes to the culture reporting and review processes.

As planned, on July 1 culture reporting and review procedures were officially amended to stipulate ED pharmacist review of all cultures originating in the ED; those include cultures of blood, urine, throat, sputum, stool, cerebrospinal fluid (CSF), synovial fluid, and wounds. Reports of positive tests for sexually transmitted disease are also reviewed by ED pharmacists at the medical center.

In addition to our involvement in culture reporting and review, the ED pharmacists are frequently consulted about empiric antimicrobial selection for patients with suspected infectious processes before hospital admission or discharge. After assessing the patient and consulting with the physician, the pharmacist on duty selects the most appropriate antibiotic agent and dosage. The ED pharmacists also ensure that blood culture samples are drawn before antibiotic administration and that the timing, selection, and dosing of antimicrobial agents concur with the clinical indicators for community-acquired pneumonia and surgical prophylaxis set forth by the Centers for Medicare & Medicaid Services and the Joint Commission.[5]

Since the inception of the program, culture and susceptibility reports are delivered to the ED pharmacist every morning at 8 a.m. When blood, stool, or CSF cultures test positive, the ED pharmacist on duty is immediately called, regardless of the organism involved. The pharmacist reviews the patient's empirically prescribed antimicrobial therapy in light of the culture report and sensitivity data. If a patient is deemed to be receiving inappropriate or suboptimal antimicrobial therapy, the ED pharmacist consults with a physician and adjusts the regimen; if necessary, a new prescription is called in to the patient's outpatient pharmacy. The patient is then contacted and counseled by the ED pharmacist about the culture results and prescribed antibiotics. By speaking directly with the patient, our ED pharmacists are better able to counsel patients to optimize antibiotic regimen compliance and field any questions. If a patient deemed to be receiving inappropriate antimicrobial therapy is admitted to the hospital from the ED, the attending physician is consulted about the need for adjustments.

Benefits and advantages of the program

The involvement of ED pharmacists in antimicrobial therapy management has allowed us to become more involved in direct patient care and helped raise the standard of care for patients requiring antimicrobial therapy. Moreover, as many of the tasks we handle were formerly performed by ED physicians, their aggregate workload has been reduced. On average, the thorough review of a culture report takes 15 minutes; if the ED pharmacist team performs 200 culture reviews per month, that effectively reduces the ED physicians' aggregate monthly workload by 50 hours. That workload reduction allows the ED physicians to dedicate more of their time and focus to other patient care concerns. We believe this shift in workload and use of ED resources has helped produce substantial improvements in the overall quality of patient care in the ED.

In an effort to quantify the impact of the program on patient care, we compared data on 12 months of physician-managed culture review and 12 months of pharmacist-managed culture review, measuring the number of antimicrobial regimens modified and the rate of readmission to the ED for likely antimi-

crobial therapy-related problems. An unplanned readmission was defined as readmission after a culture review of a patient with a chief complaint directly related to the initial ED presentation and occurring within 96 hours of ED discharge. Scheduled ED or hospital readmissions and readmissions that were considered unrelated to the initial ED visit were excluded from this analysis. A modified antimicrobial regimen was defined as a regimen involving any change in medication, dose, frequency, or duration of therapy.

The records of a total of 4639 patients were included in the retrospective evaluation. In all cases evaluated, a culture sample was obtained in the ED and the final culture report reviewed by a physician (n = 2278) or a pharmacist (n = 2361); for this study, these were defined as "physician-managed" and "pharmacist-managed" cases, respectively.

Of 2278 physician-reviewed cases in the 12 months before implementation of the culture review program, a modified antimicrobial regimen was required in 275 cases (12%). In the 12 months after program implementation on July 1, 2008, our team of ED pharmacists reviewed culture reports on 2361 patients; of those, 355 patients (15%) required a modified antimicrobial regimen.

To assess the impact of pharmacist-initiated modifications of antimicrobial regimens on overall patient care, we studied unplanned readmissions to the ED and the reasons for readmissions. A review of the medical records indicated that of the patients who had physician-managed culture review, 432 patients (19%) had an unplanned readmission to the ED. Patients who had pharmacist-managed culture review had unplanned readmission to the ED of 7% ($p < 0.001$). Reasons for unplanned readmissions included treatment failure, patient noncompliance due to cost (i.e., reported inability to pay for medication), noncompliance for other reasons, allergy to medication, and adverse drug reaction; if the reason for an unplanned readmission was unclear, it was categorized as "other" (Table 1).

Patients in the pharmacist-managed group were less likely to experience an unplanned readmission to the ED due to treatment failure, noncompliance due to cost, noncompliance for reasons other than cost, and allergy to medication ($p <$ 0.001). The observed differences in the number of unplanned readmissions due to adverse drug reactions and other reasons were not significant ($p = 0.08$).

Table 1.
Reasons for Unplanned Readmission to the Emergency Department

Reason	No. Pts Physician Managed	No. Pts Pharmacist Managed	p[a]
Treatment failure	85	21	<0.001
Noncompliance due to cost	63	18	<0.001
Noncompliance for any reason other than cost	172	67	<0.001
Allergy to medication	39	4	<0.001
Adverse drug reaction	60	50	0.08
Other	13	5	0.08
Total (% of reviewed cases)	432 (19%)	165 (7%)	<0.001

[a]Two-tailed p values were calculated using figured z test scores based on total number of culture reports in each group and the frequency of each reason for readmission within their respective group (physician managed or pharmacist managed).

Discussion

The pharmacist-managed culture review process implemented at Carolinas Medical Center—NorthEast is, we believe, innovative in a number of ways. Health-system pharmacists encounter issues that require intervention on a daily basis, and they have a key role in designing and implementing processes and protocols for reducing adverse drug events and medical errors. For pharmacists, one of the most challenging aspects of implementing protocols and procedures is ensuring that they are consistently applied in all applicable cases. Staffing issues, lack of communication, and scheduling challenges can serve as potential barriers to pharmacist involvement. To help overcome those barriers, our team of ED pharmacists worked in close collaboration with pharmacy management, ED management, and the ED physicians to implement a process that guarantees pharmacist involvement in the care of every patient from whom a culture sample is obtained in the ED.

Health-system pharmacists have an important role in helping to ensure appropriate antimicrobial use. In addition to pharmacist participation in clinical rounds, pharmacist consultation of physicians and prospective order evaluation have been implemented in health systems nationwide, serving to enhance the involvement of pharmacists. However, EDs typically lack organized clinical rounds and generally do not involve a pharmacist in the prospective evaluation of medication orders. Consequently, much of the antimicrobial use in the nation's EDs occurs without the direct involvement of a pharmacist.

The results of our research suggest that a pharmacist-managed culture review process can yield substantial improvements in antimicrobial use and overall patient care. Our institution is currently in the process of requiring the prospective review of

all antimicrobial orders placed in the ED prior to administration to patients; once implemented, this process will enable the ED pharmacists to be involved in the care of all patients receiving an antimicrobial agent in the ED, not just those from whom a culture sample is obtained.

As a result of our program and its success, ED physicians and nurses at our institution are more attuned to the value of pharmacists' expertise in the areas of infectious disease and antimicrobial therapy. As institutions nationwide continue to develop and implement programs that directly involve health-system pharmacists in the patient care process, our profession will continue to advance and pharmacists will be better positioned to assume additional and expanded clinical responsibilities.

Conclusion

ED pharmacists at Carolinas Medical Center—NorthEast designed and implemented a pharmacist-managed culture review process. During a one-year period, ED pharmacists reviewed 2361 culture reports and modified the antimicrobial regimens of 355 patients.

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