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Reducing Medication Errors in Pneumonia Patients During Transitions of Care

Reducing Medication Errors in Pneumonia Patients During Transitions of Care

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Purpose: At Stanford Health Care, as part of a hospital-wide initiative to reduce pneumonia readmission rates, an interdisciplinary collaborative effort was created between physicians and transitions of care (ToC) pharmacists to optimize discharge planning and medication management for pneumonia patients. The purpose of this study was to describe the impact of the ToC pharmacist in identifying and reducing medication errors on discharge for pneumonia patients.

Methodology: Retrospective chart review was conducted on patients discharged with a pneumonia diagnosis between December 2015 to Feb 2016. Patients were stratified based on whether they received ToC pharmacist medication review vs. standard of care. Errors were identified by comparing the patient discharge medication list to the physician discharge summary, home, and inpatient medication lists. Errors rates were compared and stratified by error type. Pharmacist interventions were quantified.

Results: Of the 125 patients discharged with pneumonia, 69 patients received ToC pharmacist medication review, while 56 patients received standard of care. In the ToC intervention group, 6 errors were identified for 5 patients, which equates to an error rate of 7.2%. In the standard of care group, 85 medication errors were identified for 36 patients (64.3% error rate). The difference was statistically significant (P < 0.0001) and corresponds to an 88.8% relative decrease. The most common error recorded was incorrect medication/dose/frequency. During this time, the ToC pharmacist had 71 documented interventions.

Conclusions: ToC pharmacist interventions demonstrated a clinically and statistically significant decrease in medication discrepancies, as well as an increased rate of accuracy of the discharge medication list. Continued metrics and interventions are being collected to assess the impact of the ToC pharmacists on patient outcomes.

Keywords: Transitions of care, discharge medication reconciliation, discharge medication education, pneumonia, med errors, formulary

Introduction

Patients admitted to the hospital with a diagnosis of pneumonia are at high risk for readmission. In 2012, the Affordable Care Act established the Hospital Readmission Reduction Program, which requires the Centers for Medicare and Medicaid Services (CMS) to reduce payments to hospitals with excess readmissions. Applicable conditions, including heart failure, myocardial infarction, and pneumonia, are penalized for

unplanned readmissions within 30 days of hospital discharge.[1] As a result, many hospitals are expanding transitions of care (ToC) services to optimize discharge planning and medication management.

Unintended medication discrepancies during ToC have contributed to adverse drug events and may play a role in hospital readmissions.[2] A medication reconciliation pilot at John Hopkins Hospital found that 40% of patients had at least one unintended discrepancy on hospital admission or discharge. Twenty-nine percent of those discrepancies had the potential to result in moderate or severe adverse drug events.[3] To address medication safety, The Joint Commission has implemented National Patient Safety Goal 03.06.01 to guide hospitals in maintaining and communicating accurate patient medication information.[4] The Joint Commission defines medication reconciliation as comparing medications the patient is or should be taking to newly prescribed medications, and resolving discrepancies. Specific elements of performance are provided to perform complete and comprehensive medication reconciliation.

At our institution, a service line of ToC pharmacists was introduced in 2012 to reduce readmissions and medication errors in our high risk cardiac and general medicine patient populations. The role of this pharmacist includes reviewing prior to admission medication histories, performing medication reconciliation, identifying and addressing barriers to discharge, reviewing discharge medications, and providing discharge medication education to the patient and/or family/caregivers. Pharmacist interventions are prioritized for high-risk patient populations, including patients with high-risk medications, polypharmacy, and high-risk disease states, including pneumonia.

As part of a hospital-wide initiative to reduce pneumonia readmission rates at our institution, an interdisciplinary collaborative effort was created between physicians and ToC pharmacists to optimize medication regimens for pneumonia patients on hospital discharge. While there is data available on the impact of ToC pharmacists in reducing medication errors and readmission rates in the general population, there is very limited data focusing on outcomes in pneumonia patients. Given the high risk for readmission in this patient population, the reimbursement penalty for excess readmissions, and the changes to patient medications on hospital admission and discharge, it is prudent and important to evaluate the incidence of medication errors and the outcomes associated with implementing ToC interventions.[5] The purpose of this study was to describe the impact of ToC pharmacists in identifying and reducing medication errors on discharge for pneumonia patients.

Methodology

Intervention

Pharmacists participated in a daily sign off with the general medicine teams to identify all admitted pneumonia patients and begin preparing their medication list in anticipation of discharge. Patients admitted with a diagnosis of pneumonia may have many changes to their home medication regimens, not limited to: prescription of new antibiotics, renal dose adjustments to existing medications, and changes to anticoagulation, blood pressure or diabetic regimens, which may be held or adjusted during their hospital stay. Upon discharge, medication lists were evaluated for accuracy and completeness. In addition to evaluating the accuracy of medication lists, ToC pharmacists and physicians collaborated to ensure patients had appropriate follow-up visits, and to address any access or formulary issues which may prevent the patient

from picking up their medication post discharge. This included completing prior authorizations, checking for stock of medication, and arranging medication delivery to bedside before discharge when appropriate. Patients were educated by the ToC pharmacist on their medications and follow up instructions before discharge.

Study Design

To evaluate the impact of this intervention, a retrospective chart review was conducted on all patients discharged with a diagnosis of pneumonia between December 2015 to February 2016. Our institution uses the Epic (Verona, Wisconsin) electronic medical record system, which allows for tracking of pharmacist interventions,

as well as documentation of patient medication education provided. Patients were stratified based on whether they had documented ToC pharmacist medication review before discharge vs. standard of care (medication teaching by nursing before discharge with no additional medication review). Baseline characteristics were compared between the two groups (Table 1).

Medication errors were identified by comparing the patient discharge medication list to the physician discharge summary, before admission and inpatient medication lists. For patients discharging to home with or without home health, the after visit summary (AVS) medication list, which is provided to the patient on discharge, was assessed for medication errors. For patients discharged to a skilled nursing facility (SNF) or another healthcare facility, an interagency form was assessed for medication errors. This form, which includes a complete and updated list of discharge medications, is generated by Epic and provided to the receiving facility at the time of patient transfer. Patient-specific treatment plans, labs, vitals and diagnostic exams were also taken into consideration in assessing the appropriateness of therapy.

Outcomes and Statistical Analysis

The primary objective of this study was to describe the incidence of medication errors in pneumonia patients and to evaluate the impact of the ToC pharmacist in reducing medication errors. The secondary objective was to describe the pharmacist interventions made for patients who received ToC pharmacist interventions. Errors rates were compared between the standard of care group and the pharmacist intervention group, and statistical analysis was performed using the chi-square test. Errors were stratified by error type and separated into the following categories: prescription of incorrect medications (wrong drug,

Table 1. Baseline Characteristics

Baseline Characteristics	Pharmacist Intervention (N = 69)	No Pharmacist Intervention (N = 56)	P Value
Age	72 (SD: 18)	69 (SD: 21)	0.479
Male	42%	39.28%	0.728
Duration of stay	4 days	4 days	0.726
Discharge disposition			
Home	56	34	0.01208
Skilled nursing facility	13	18	0.0687
Hospice	0	2	0.093
Long term care facility	0	1	0.238
Acute rehab	0	1	0.238
Antibiotics on discharge	82.6%	53.57%	0.00044
Type of Pneumonia			
Community acquired pneumonia	20	5	0.0054
Healthcare-associated pneumonia	4	4	0.787
Aspirational pneumonia	11	7	0.6455
Viral pneumonia	4	1	0.285
Pneumonia: Unspecified	25	26	0.267
Possible pneumonia	3	8	0.0549
Necrotizing pneumonia	1	0	0.375
Fungal pneumonia	1	0	0.375
Ventilator-associated pneumonia	0	2	0.093
Other	0	3	0.0601

strength, dosage, or frequency), missing or incomplete instructions, duplicate medications or therapeutic class, and missing or omitted medications. Additionally, for patients who did receive pharmacist medication review at the time of hospital discharge, the interventions made by ToC pharmacists were quantified and documented. The severity of errors was classified as mild, moderate or severe based on the American Society for Healthcare Risk Management (ASHRM) criteria.[6] Errors were assessed individually by two ToC pharmacists who were in agreement for all identified errors.

This study received Institutional Review Board Approval #37647. The statistical analysis for categorical data was performed using chi-square statistical test, while numerical data was analyzed using t-test with an alpha of 0.05.

Results

A total of 125 patients were discharged with pneumonia during the study period. Sixty-nine patients' medication lists were reviewed by ToC pharmacists, while 56 patients received standard of care. In the ToC intervention group, five patients had discrepancies on their medication list during chart review, which equates to an error rate of 7.2%. In the standard of care group, 36 patients had medication errors, which equates to an error rate of 64.3%. The difference was statistically significant (P < 0.00001) and corresponds to an 88.8% relative decrease in medication errors (Table 2).

In the total patient population, 95 errors were identified. Amongst patients who received standard of care, or nursing medication education at bedside, 89 medication errors were identified for 56 patients. On average, there were 1.6 errors per patient, and 47% of errors in this group resulted from prescription of incorrect medications. This was identified as having an incorrect medication prescribed, having an incorrect dose or frequency defined, or having a significant

drug interaction that would affect the appropriateness of therapy. Twenty-one percent of errors were missing instruction errors which included missing dose, frequency, or route, and 16% of errors were omission errors in which a medication was unintentionally not prescribed. The remaining 16% of errors were duplicate medication or duplicate therapeutic class errors (Table 2). Errors were classified as mild (45%) in severity, moderate (46%), and severe (9%). While 67% of errors were identified in patients discharged to home, 33% of errors were identified in patients discharged to a SNF.

In the ToC intervention group, six medication errors were identified for 69 patients. On average, there were 0.09 errors per patient. Four errors (67%)

Table 2. Classification of Errors

Classification of Errors	Pharmacist Intervention Group (N = 69)	Standard of Care Group (N = 56)
Number of patients with error	5 (7.2%)	36 (64.3%)
Total number of errors	6	89
Error Type		
Incorrect medication	4	42
Missing Instructions	0	19
Omission	2	14
Duplicate medication	0	14
Error Severity		
Mild	4	40
Moderate	2	41
Severe	0	8
Error by Discharge Disposition		
Patients discharging home with errors	1	24
Patients discharging to SNF with errors	4	12
Antibiotic Prescribing		
Number of patients prescribed antibiotics	57	30
Number of patients with antibiotic-related error	1	5

were incorrect medication errors, and two errors (33%) were omission errors (Table 2). Errors were classified as mild (67%) and moderate (33%) in severity. Twenty percent of errors were identified in patients discharged to home while 80% of errors were identified in patients discharged to a SNF.

During this time period, the ToC pharmacist also documented 71 interventions, which were made before the patient's discharge. Thirty-one interventions were documented which involved resolving access or formulary issues, including resolving insurance issues. Twenty-three interventions addressed incorrect medication, dose or frequency issues. Twelve interventions addressed omitted medications, and five interventions addressed duplicate medications or therapeutic classes.

Discussion

We are the first to our knowledge to show that patients admitted with a pneumonia diagnosis would benefit from ToC interventions, including discharge medication reconciliation. With the focus on patient safety, many organizations, including The Joint Commission, place significant emphasis on medication reconciliation around ToC. This study provides statistically significant data in advancing and showing the importance of pharmacist involvement in comprehensive patient care, especially in the reduction in medication errors. Many studies may show a need for medication reconciliation, but there is limited literature on the pharmacist affecting outcomes of pneumonia patients. The results show clear evidence that during the complex situation of a patient's discharge or transfer of care, medication errors do occur (33% in this study). ToC pharmacists show a significant benefit in ensuring the correct medication are ordered/prescribed for patient safety.

Overall, the baseline characteristics were balanced between the two groups, including age, gender, and length of stay. The ToC group had a larger percentage of patients discharged on an antibiotic, as compared to the standard of care group (82.6% vs. 53.6%, p < 0.001). This may be attributed to the high-risk criteria used by our ToC program to triage patients, which includes prioritizing patients discharging on an antibiotic. Patients who already completed their course of antibiotics during their admission were lower priority for being seen by the ToC pharmacist. However, the majority of errors identified were unrelated to antibiotic prescribing minimizing potential for apparent bias (Table 2). Additionally, the ToC group also had a larger population discharged to home, as opposed to SNF or other assisted care facilities (81.2% vs. 60.7%, p = 0.01). This is also by design as the ToC program prioritizes patients discharging home over those discharging to a facility, due to a greater perceived benefit based on the assumption that patients discharging to an acute care facility will have medications managed by healthcare personnel. However, since the patients discharging to SNF did have a high rate of error, this would not create any favorable benefit in reporting error rates. This distinction is also unique as most of the previous literature for ToC programs focused on patients discharging to the home setting. This study sheds light on the complexity of other dispositions as well.

While patients seen by the ToC pharmacist at discharge had significantly fewer errors compared to the standard of care group, the majority of errors identified in the ToC group were in patients discharging to a SNF. The significance of a higher error rate in patients discharged to a SNF speaks to the overall discharge process in this patient population. At the time of discharge, the patient's nurse generates and prints an "interagency form" which should be provided to the

nursing facility and is accepted as the primary source of updated medications. However, if this list is printed too early, and additional changes are made to the patient's medication list by the team, the nursing facility may be provided with an outdated medication list. This is further complicated by placement issues that may arise and lead to unexpected delays to patient discharge. In many cases, the patient may stay hours to days longer than originally anticipated. Upon discharge, a new medication list should be, but is not always, generated. For the SNF patients seen by the ToC pharmacist, all errors identified in chart review were due to medication changes made to the list after pharmacist review. There is room for improvement in interdisciplinary communication as well as the overall discharge process when patients are transitioning to a SNF.

The majority of medication errors were identified in patients who were not seen by the ToC pharmacist at the time of discharge. A common cause of discharge errors was related to incorrect medication reconciliation on admission. This highlights the importance of comprehensive and complete medication reconciliation on admission, as it relates to reducing discharge medication errors. For example, if an incorrect dose or frequency was entered on admission, it is generally then incorrectly resumed on discharge as well. A frequent source of duplicate medication errors was due to therapeutic interchange on admission due to formulary restrictions. For example, a patient may have their ACE inhibitor changed to an alternative within the same class once admitted, and then both medications would be incorrectly resumed on discharge. Another source of error was an appropriate de-escalation of antibiotics on discharge. The ToC pharmacist evaluates cultures, renal function, and days' supply in ensuring appropriateness of therapy. For patients

de-escalated from IV to oral antibiotics on discharge, errors were identified in patients who did not receive a sufficient supply or who did not have renally-adjusted regimens. Another source of errors was related to unintentional omission of medications. Many of the patients had their blood pressure regimens held on admission due to hypotension secondary to sepsis. On discharge, the medications were not resumed despite resolution of the hypotension. Lastly, insulin regimens were also frequently altered in the hospital and incorrectly resumed on discharge not taking into account other changes like a new steroid regimen. Many of these errors were specific to health status changes associated with a pneumonia admission and highlight the importance of comprehensively assessing patient medication during ToC following a pneumonia admission.

In classifying errors based on severity, there were no severe errors in the ToC intervention group. The standard of care group had primarily mild and moderate errors although there were severe errors identified as well. Mild errors had minimal potential for harm, such as the omission of an over-the-counter medication. Moderate errors had the potential for adverse effects but would not severely affect quality of life, such as incorrect dosing of a blood pressure medication or an inhaled corticosteroid. Severe errors had potential for severe harm, such as incorrectly dosing anticoagulants, which was seen in several patients.

In the ToC intervention group, we evaluated interventions the pharmacist provided at the time of patient discharge. 44% of our interventions were resolving access or formulary issues. Clinical pharmacists at our institution participate in daily team care rounds with physicians, nurses and case managers, to anticipate and address barriers to discharge. We assisted with identifying medications that would have a high copayment or

require prior authorization, as well as ensuring or securing stock of medication, and coordinating delivery to bedside when appropriate. A significant portion of our interventions revolved around ensuring our patients were able to access their medications on discharge, so as not to delay discharge or increase the risk of readmission.

While the primary outcome of this study evaluated the impact of ToC pharmacists in reducing medication errors, there was tremendous value in collaborating with physicians to anticipate and plan for discharge. Typically, the ToC pharmacist is notified when discharge orders are placed for a patient and has limited time to review the medication list, educate the patient, and resolve any medication-related issues. Daily sign off allowed the pharmacist to anticipate discharges in advance, which provided time to coordinate teaching with the patient and caregivers or family members, review the medication list for medications which might be problematic for insurance claims, as well as collaborate with the physicians to set up any follow up appointments for acute or chronic disease states identified during their hospital admission.

The ToC pharmacist interventions reduced medication discrepancies and increased the rate of accuracy for patients admitted with a diagnosis of pneumonia. Future studies would benefit from further evaluating the impact of interdisciplinary efforts in optimizing ToC. While our results did not focus on cost savings or readmission rates, we hope that future research is able to address how ToC pharmacist interventions can be translated into favorable outcomes in readmission reduction and health care cost savings related to medication error, discharge delays, and excessive readmissions.

At our institution, we expanded our ToC pharmacist services to include a dedicated pharmacist for our high-risk
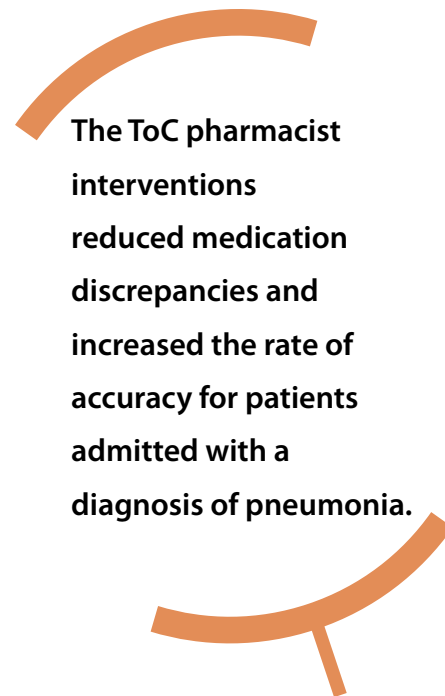
The ToC pharmacist interventions reduced medication discrepancies and increased the rate of accuracy for patients admitted with a diagnosis of pneumonia.

medicine patients, including pneumonia patients. We continue to collaborate with our medicine teams to plan for discharge and participate in daily interdisciplinary rounds to anticipate and address patient-specific needs during ToC.

Limitations

Limitations of our study were that it was conducted as a retrospective chart review in a single academic medical center. While randomized controlled trials are the gold standard, it would not have been ethical to intentionally withhold care to a subset of our patient population who would benefit from pharmacist medication review, based on our ToC program criteria. However, the two groups were overall similar in baseline characteristics. At the time of this study, our service was comprised of two pharmacists, and our workflow was limited by staffing and rolling discharges. Therefore, despite our best attempt to see all patients who meet our program criteria, patients could still discharge without pharmacist medication review or education. Additionally, our study was conducted over a shorter period with a relatively small patient population. However, statistically significant results were demonstrated. Future steps should expand upon this research to evaluate the impact of ToC pharmacist interventions and medication error reduction on readmission rates and hospital-related costs.

Conclusion

To our knowledge, this is the first study to show the importance of pharmacist involvement in reducing medication errors in pneumonia patients on hospital discharge. The ToC pharmacist interventions demonstrated a clinically and statistically significant decrease in medication discrepancies, as well as an increased rate of accuracy of the discharge medication list. The ToC pharmacists most documented interventions included identifying and resolving access or formulary issues and incorrect frequency, dose, or duration of therapy. Continued metrics and interventions are being collected to assess the impact of the ToC pharmacist on patient outcomes. ○

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Disclosures

The authors have declared no potential conflicts of interset

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