JPPT | Single-Center Retrospective Study

Effect of Pharmacy Involvement in Transitions of Care for Children With Medical Complexity

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OBJECTIVE The purpose of this study is to evaluate the effects of pharmacy integration into care transitions for children with medical complexity. These children are at a higher risk for medication errors and adverse effects because of their complex medication regimens. In addition, care transitions increase the risk for medication errors, especially during hospital-to-home transitions.

METHODS This was a retrospective chart review of patients enrolled in a complex care clinic who were discharged between September 1, 2021, and December 31, 2021, and who had received a discharge medication evaluation. Intervention categories were predetermined (medication reconciliation and clinical interventions) and documented. The primary outcome was to quantify and characterize the types of interventions made by the pharmacist. Descriptive statistics were used for data analysis. Continuous data were analyzed using Wilcoxon rank sum test, and correlation was measured using Spearman correlation values.

RESULTS A total of 92 clinic encounters for 60 patients were included, with a median patient age of 7 years (IQR, 5–12.3), median length of stay of 3.2 days (IQR, 1.2–5.7), and a median number of 18 discharge medications (IQR, 14.8–25). A total of 283 interventions were made, consisting of 192 (68%) clinical interventions and 91 (32%) medication reconciliation interventions. In addition, 82 (89%) of the clinic encounters had at least one pharmacist intervention.

CONCLUSIONS Pharmacist evaluation of a patient's discharge medication regimen clarifies and better optimizes the patient's medication regimen.

ABBREVIATIONS CMC, children with medical complexity; ED, emergency department; MRCI, medication regimen complexity index

KEYWORDS hospital-to-home transition; medication reconciliation; medication regimen complexity; pharmacists; polypharmacy; transitions of care

J Pediatr Pharmacol Ther 2023;28(4):348–353

DOI: 10.5863/1551-6776-28.4.348

Introduction

Medication errors and adverse drug events have a significant effect on patients' overall health and outcomes. Kaushal et al[1] demonstrated that children were 3 times more likely to experience a medication error or adverse drug event (ADE) during a hospitalization when compared with adults. Pediatric patients use weight-based dosing, require custom medication formulations (such as compounded liquid medications), and may rely on their caregivers for administration. These factors result in additional medication intricacies that increase the risk of medication errors.[2] A growing pediatric subpopulation are children with medical complexity (CMC). This pediatric population is defined as "a subgroup of children who are the most medically fragile and have the most intensive health care needs."[3] CMC have the same risk factors listed above as other pediatric patients. However, they are more likely to use numerous chronic medications and have unique medication formulations, increasing the risk of an ADE or medication error. In addition, CMC are more likely to have an emergency department (ED) visit because of an ADE.[4–6]

In the geriatric population, studies have shown that patients had increased hospitalizations and higher rates of medication nonadherence with increased medication regimen complexity. Complexity of a medication regimen increases with the number of medications, dosage forms, strengths, and frequency of administration among other factors.[7] Complex medication regimens are also seen in the pediatric population, especially in CMC.[4–6] The medication regimen complexity index (MRCI) is a scoring system developed to quantify the complexity of a medication regimen. This 65-item scoring system is divided into 3 subcategories: dosage form, dosage frequency, and additional directions.

This tool has been validated in the adult population and used to identify patients who may benefit from medication therapy management services.[8,9] A study was conducted to determine whether the MRCI could predict the likelihood of an ADE or unplanned 30-day hospital readmission in adults who had at least one comorbid condition, such as congestive heart failure, and were discharged to a home health agency. This study determined that those with an MRCI score ≥22 at discharge had 5.45 times greater odds of experiencing an unplanned 30-day readmission and suggested that those patients receive additional transitional care interventions (e.g., when the patient transitions from home to hospital and then from hospital to home).[10] This tool has been extrapolated to the pediatric population but has not yet been validated. One study used the tool to determine a medication complexity score for pediatric patients with neurological impairment and assessed whether the score was associated with more frequent acute care visits.[11] This study determined that patients with a higher MRCI score had a higher incidence of acute health care use in a 30-day period compared with those with a lower MRCI score.

Studies show that transitions between care settings such as home to hospital and hospital to home increase the risk of medication discrepancies and ADEs in both adults and pediatric populations for multiple reasons. One reason is the gap in communication about medication regimen changes that exists both between providers and between providers and patients.[4] The Joint Commission recognizes the effect that care transitions have on patients vulnerable to ADEs and thus implemented a safety standard to address this as a result.[12] According to the National Patient Safety Goals for 2022 sponsored by the Joint Commission, health systems must "record and pass along correct information about a patient's medicines."[12] This safety standard has led to an increased focus on transitions of care and medication reconciliation.

While adult health systems have prioritized medication reconciliation upon admission and at discharge, the focus in the pediatric population has historically prioritized medication reconciliation only upon admission. This raises concern as previous studies have shown that the transition from hospital to home puts patients at risk for a safety event, especially for CMC.[13]

At this institution, there is a multidisciplinary primary care clinic dedicated to CMC. This clinic recognized the need to improve the transition of care process for CMC and employed a nurse practitioner to follow each CMC patient during hospitalization and to act as a liaison for the clinic. In addition, a dedicated ambulatory care pharmacist assists with both outpatient to inpatient and inpatient to outpatient transitions. When a patient is admitted, this pharmacist collaborates with the inpatient pharmacist to review the home medication regimen and the reason for admission. Once the patient is discharged, the ambulatory care pharmacist provides telephone follow-up with the family to review any medication changes, clarify any discrepancies, and ensure patients have access to medications.

While there has been an increased focus on transitions of care from outpatient to inpatient in the pediatric setting, there have been limited studies analyzing the effect pharmacists have upon the transition from inpatient to outpatient care in the pediatric population. This study focuses on that gap and evaluates the effect of pharmacist-driven hospital follow-up in CMC with the potential to provide a framework for other pediatric patient populations.

Materials and Methods

This was a single center, retrospective chart review study. Patients were eligible for inclusion if they were <22 years of age, enrolled in the primary care clinic for CMC, hospitalized between September 1, 2021, and December 21, 2021, and they had a medication evaluation documented within 7 days of hospital discharge. Patients were excluded if they were unable to be reached by the pharmacist or if they were readmitted before evaluation. The study's primary objective was to characterize the number and types of interventions made by the pharmacist per inpatient encounter. The secondary objectives were to examine the association between the MRCI score and both readmission rates and types of pharmacist interventions.

The electronic health record was queried for the inclusion criteria to create a data report. This report was used to collect demographics, number of medications pre- and postdischarge, as well as the number and type of interventions through a manual chart search of the existing medical record. The interventions were documented in a pharmacy note for all patients included in the study.

The intervention classifications were predetermined and classified as clinical interventions or medication reconciliation interventions. The specific clinical intervention classifications included dose change, frequency change, change in therapy, lab monitoring, exam monitoring, interaction (food or drug) noted, prior authorization, and education. These interventions ensured that the patients' medications were clinically efficacious, safe, and tailored to their clinical statuses. The specific medication reconciliation interventions included dose change, frequency change, missing medication added, completed medication removed, reentry of a medication to add additional details, and adverse drug reaction or allergy added. The focus of medication reconciliation interventions was to ensure the medication list in the EHR was accurate and matched the discharge summaries and discharge instructions. The chart was then searched for either an inpatient admission or ED visit that was within 30 days postdischarge.

Finally, the patient's discharge medication list that contained the dosage form, frequency, and additional directions was used to calculate an MRCI score. The MRCI score was calculated using the Microsoft Access Version 1.0 data capture tool developed by the University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences. This tool is publicly available online (https://pharmacy.cuanschutz.edu/research/MRCTool).[14]

Data were descriptively analyzed using median and IQR (25%–75%). Continuous data were analyzed using the Wilcoxon rank sum test, and correlation was measured using Pearson correlation values. A p value of 0.05 was considered statistically significant.

Results

Baseline Demographics. A total of 128 clinic encounters were identified for inclusion. Thirty-six patients (28.1%) were excluded because they had not yet been seen in the primary care clinic for CMC or they did not have a discharge evaluation completed within the 7-day time frame. A total of 92 clinic encounters for 60 patients were included in this study. Most of the patients were male (63%) with a median age of 7 years. The median length of stay was 3.2 days, and patients had an average of 18 medications on their discharge medication list. The median MRCI score was 59.25 (range, 9–139.5) (Table 1).

Pharmacy Interventions. A total of 283 interventions were made during 92 clinic encounters with 192 (68%) interventions classified as clinical interventions and 91 (32%) interventions classified as medication reconciliation interventions. The average number of interventions per patient encounter was 3 (range, 0–12). Of the 92 patient encounters, 82 (89%) encounters had at least one pharmacist intervention (Figure 1). Education was the most common clinical intervention with 68 occurrences (35%) (Figure 2). The most common medication reconciliation intervention was discontinuing a medication from the medication list, accounting for 40 interventions (44%) (Figure 3).

Association of MRCI Score and Readmission. Of the 92 clinic encounters, 32 of those encounters (34%) had either an ED visit or an inpatient admission or both within 30 days of discharge. However, there was not a statistically significant difference between the median MRCI scores of those who were readmitted and those who were not (60.8 vs. 58.2, p = 0.4506), indicating that higher MRCI scores were not associated with readmission rates in this study (Table 2).

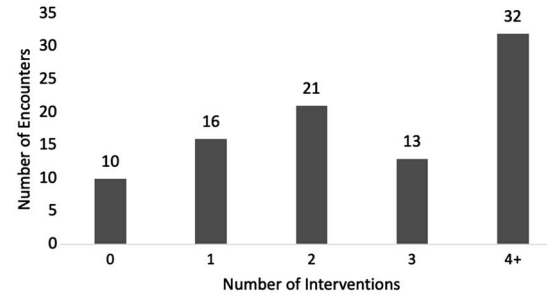
Association of MRCI Score and Types of Interventions. The correlation between MRCI score and number of clinical interventions was 0.105 (p = 0.318), while the correlation between MRCI score and number of medication reconciliation interventions was 0.133 (p = 0.207). The correlation between length of stay and number of interventions was 0.222 (p = 0.033), suggesting an association for increased length of stay with increased number of clinical interventions.

Table 1. Patient Demographics (N = 60 patients)

Parameter	Value
Male sex, n (%)	34 (57)
Age, median (IQR), yr	7 (5–12.5)
Length of stay, median (IQR), days	3.2 (1.2–5.7)
Method of communication (92 clinic encounters), n (%)	
Phone, clinic encounter	73 (80)
In-person, clinic encounter	11 (12)
Portal message, clinic encounter	4 (4)
Telehealth, clinic encounter	4 (4)
No. of medications at discharge, median (IQR)	18 (14.8–25)
MRCI score at discharge, median (IQR)	59.3 (41.5–71.4)

MRCI, medication regimen complexity index

Figure 1. Number of interventions per clinic encounter (N = 92 clinic encounters).

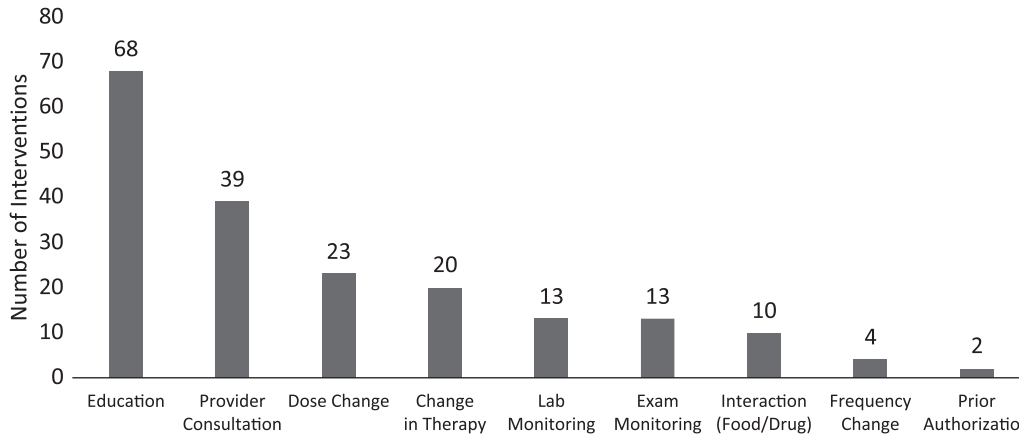


Discussion

Medication regimens are often altered during the transition from the home setting to the hospital and then again from the hospital to home, which increases the risk of medication errors and ADEs. Many institutions have implemented protocols and practices to ensure safe transitions, with pharmacists leading the efforts. Pharmacists have the clinical knowledge and skills that position them well to assist with medication reconciliation and transitions of care. One study demonstrated that pharmacist-obtained medication histories were more accurate and complete than physician-obtained medication histories.[13] In the American Society of Health-System Pharmacists 2021 Pharmacy Forecast, they predicted that pharmacists would have an increased role in the transitions of care process and would be more involved in managing patients with complex medication-related needs to assist in achieving optimal health outcomes.[15]

In the pediatric setting, the primary focus has been on the home-to-hospital transition. CMC are a vulnerable

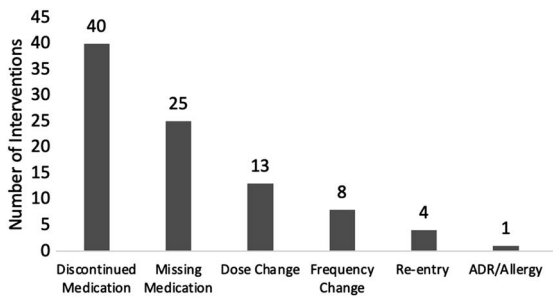
Figure 2. Type of clinical interventions (N = 192 interventions).



patient population that may experience medication errors or ADEs because of their frequent health care use and complex medication regimens, especially at times of transition from home to hospital and then from hospital to home. This study demonstrates the value a pharmacist has when involved in the discharge medication reconciliation process during hospital-to-home transitions. The primary objective of this study was to quantify and characterize the types of interventions made by a pharmacist during a discharge medication evaluation. Within 120 days, 82 (89%) clinic encounters had at least 1 pharmacist intervention made, and 32 (35%) had at least 4 interventions made. Although these interventions were made by the primary care pharmacist, this role could be extrapolated to inpatient pharmacists to ensure safe and optimal care prior to patient discharge.

The secondary objectives of this study were to examine the associations between MRCI score and readmission rates and pharmacy interventions. This study did not demonstrate a significant difference in MRCI scores and readmission rates within this cohort. This finding differs from the literature, which shows that higher MRCI scores are associated with higher readmission rates.[9] This could be for several reasons. Of the 92 clinic encounters, only 32 (38.4%) encounters resulted in patient readmission. Pharmacist involvement in performing a discharge medication reconciliation may have affected these readmission rates despite no difference in MRCI scores. In addition, CMC are a unique patient population and use health care resources more frequently compared with the general pediatric patient population, which may contribute to the increased readmission rate.[16] Although the MRCI tool is validated in adults and has been used in the pediatric population, there are aspects of pediatric medication regimens that are not accounted for in the MRCI score and may limit the validity in pediatric patients. Some aspects of medication regimens in CMC that cannot be accounted for in the current MRCI include administering medications through feeding tubes, use of compounded medications, as well as the need for ketogenic-friendly (low carbohydrate) medications for patients on a ketogenic diet for their neurologic conditions. These are just a few factors that may increase the medication regimen complexity in pediatric patients. Therefore, a pediatric-specific MRCI tool should be developed to better assess this patient population.

Figure 3. Type of medication reconciliation interventions (N = 91 interventions).



ADR, adverse drug reaction

While there was not a significant correlation between MRCI score and type of pharmacist intervention, a post hoc analysis demonstrated a direct correlation between increased length of stay and number of clinical interventions. This correlation suggests that those with an increased length of stay could be a target population for pharmacy services to perform a discharge medication evaluation to ensure safe and optimized care. Although this was a weak correlation, future studies should determine if a stronger correlation exists.

This study adds to the limited literature of pharmacist involvement in the pediatric discharge medication evaluation process. A major strength of this study is the unique patient population. There are, however,

Table 2. MRCI Scores and Correlation With Health Care Use Within 30 Days

Inpatient Admission or ED Visit in 30 Days	No. of Patients, n (%)	MRCI, Median (IQR)	p value
No	60 (65.2)	58.2 (41.0–70.5)	0.4605
Yes	32 (34.8)	60.8 (49.4–75.2)	

ED, emergency department; MRCI, medication regimen complexity index

several limitations to this study. The retrospective, single center design and small sample size may limit the generalizability of findings to other institutions. In addition, the MRCI scoring tool used in this study was created for and validated in the adult population only, and therefore, may not account for the intricacies of a pediatric medication regimen. Also, the study lacked a comparator group; thus, determining the pharmacist effect may be limited for other patient populations. Finally, the study time frame may confound results since the COVID-19 pandemic may have influenced hospitalization and acute care visit rates.

Conclusions

This study showed that a pharmacist's involvement in patients' discharge medication reconciliation resulted in multiple interventions to improve the accuracy of and optimize the patients' medication regimens. Pharmacists are trained to identify and address drug-therapy problems, which positions them well to serve in this role. However, there was no association between increased MRCI scores and number of pharmacy interventions or increased MRCI scores and readmissions rates. A pediatric-specific MRCI scoring tool should be developed to better understand pediatric medication regimen complexity and allow pharmacists to better target patients who may benefit from their services.

Article Information

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Disclosures. Alannah Yoder was affiliated with Children's Mercy Hospital as noted above; employment is now at Novo Nordisk Inc. The publication is written in her capacity, not on behalf of Novo Nordisk Inc. (Business address: 900 Scudders Mill Road, Plainsboro, NJ 08536).

The other authors declare no conflicts or financial interest in any product or service mentioned in the manuscript, including grants, equipment, medications, employment, gifts, and honoraria. The authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Ethical Approval and Informed Consent. Children's Mercy Hospital Institutional Review Board (IRB) approved this study as exempt status. Written informed consent was not required by the IRB.

Acknowledgments. The authors would like to thank Susan Elmore, MSN, APRN, PCNS-BC, and Emily Goodwin, MD, for their assistance with this project. This work was presented previously at the 31st Annual Pediatric Pharmacist Association Meeting on May 2–6, 2021, in Norfolk, VA.

Submitted. July 9, 2022

Accepted. September 13, 2022

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