

Pharmacist-Led Discharge Transitions of Care Interventions for Pediatric Patients: A Narrative Review

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Transitions of care (TOC) before, during, and after hospital discharge are an opportune setting to optimize medication management. The quality standards for pediatric care transitions, however, are lacking, leading to reduced health outcomes in children. This narrative review characterizes the pediatric populations that would benefit from focused, TOC interventions. Different types of medication-focused TOC interventions during hospital discharge are described, including medication reconciliation, education, access, and adherence tools. Various TOC intervention delivery models following hospital discharge are also reviewed. The goal of this narrative review is to help pediatric pharmacists and pharmacy leaders better understand TOC interventions and integrate them into the hospital discharge process for children and their caregivers.

ABBREVIATIONS AAP, American Academy of Pediatrics; BMD, bedside medication delivery; ED, emergency department; EMR, electronic medical record; FTE, full-time equivalent; PIL, patient information leaflet; SMS, short message service; TFU, telephone follow-up; TJC, The Joint Commission; TOC, transitions of care

KEYWORDS discharge; intervention; pediatrics; pharmacy; review; transitions of care

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Introduction

Transitions of care (TOC) for pediatric patients during discharge are a complex process.¹ While each TOC setting serves as an opportunity to optimize the efficacy and safety of medication management, it also is one setting where medication-related problems may occur.^{2,3} According to a study by Wu et al,⁴ approximately 34% of pediatric discharges have been associated with care failures in pediatric patients during TOC. Here, the care failures were defined as any problem that had occurred during discharge, including failure to receive discharge instructions and education. Findings from a systematic review by Glick et al⁵ revealed that errors related to parent execution of pediatric patient discharge instructions from the inpatient setting and emergency department (ED) are common. Medication dosing errors were prevalent, with 33% to 50% of caregivers incorrectly dosing their children's liquid medications.⁵ Furthermore, poor medication adherence was observed. This was especially problematic in low-income families where nearly 33% of caregivers had failed to pick up the prescribed medications for their children.⁵

The importance of TOC has been cited by the World Health Organization, The Joint Commission (TJC), Agency for Healthcare Research and Quality, and the Institute for Safe Medication Practices.^{2,6–8} Despite the widely recognized importance of TOC, quality standards for pediatric TOC from the hospital to home are lacking, leading to reduced quality of health care transition and health outcomes.^{1,9} Data specific to pediatric TOC are

limited; however, it is known that pediatric patients are more susceptible to harm from medication errors than adults.¹⁰ As research involving TOC for pediatric patients is still evolving, interventions shown to reduce readmission rates in adult patients, such as discharge planning and call-backs for follow-up, may be considered when developing pediatric TOC programs.¹¹ As medication experts, pediatric pharmacists are uniquely positioned to affect the rates of medication-related errors at TOC. According to the IPITCH study conducted in adults, a statistically significant reduction in the rate of inpatient readmission or ED visits within 30 days following discharge was observed in patients who received pharmacist intervention including medication reconciliation, discharge counseling, and postdischarge phone calls.¹²

This narrative review aims to 1) characterize patient populations that may benefit from TOC interventions; 2) assist pediatric pharmacists and pharmacy leaders by describing discharge TOC interventions for pediatric patients (Table 1); and 3) highlight the important structural elements and resources (Table 2) that need to be accounted for when implementing (Table 3) and evaluating (Table 4) the effectiveness of TOC interventions at pediatric hospitals.

Identification of Targeted Population of TOC Interventions

While TOC interventions may have the potential to benefit all pediatric patients, pharmacists wishing to show measurable benefits to new services may want

Table 1. TOC Interventions During and After Hospital Discharge

Intervention	Task
During hospital discharge	
Medication reconciliation	<ul style="list-style-type: none"> • Performed by pharmacist and/or pharmacy technicians
Medication education	<ul style="list-style-type: none"> • Use medication lists, which may be created by the pharmacist or generated by using programs such as My Med Action Plan and My Meds • Provide the smallest oral syringe size and demonstrate accurate administration technique • Use pictograms, particularly for low-literacy patients • Apply the teach-back method
Medication access	<ul style="list-style-type: none"> • Provide bedside medication delivery • Facilitate medication transfers to the patient's local pharmacy • Arrange mail orders to be completed by the hospital's outpatient pharmacy • Ensure prior authorization of relevant medications to avoid delays
Medication adherence tools	<ul style="list-style-type: none"> • Provide low-cost, low-tech pill boxes • Provide handmade medication calendars • Send text message medication reminders • Recommend smart phone applications • Recommend electronic pill boxes with refill reminders • Integrate medication adherence equipment into EMRs
After hospital discharge	
Comprehensive, patient-specific interventions	<ul style="list-style-type: none"> • Use telephone follow-up, messages via email and/or SMS, or home visits for discharge follow-up • Address issues related to medication use and management through patient education, medication order clarification, adjustment of medication therapy, laboratory monitoring, and assistance in obtaining medication
Focused, disease-state or outcomes-specific interventions	<ul style="list-style-type: none"> • Develop a collaborative practice agreement that focuses on specific disease state or patient outcomes such as the pharmacist-driven interventions on susceptibility-antibiotic mismatch, no antibiotics prescribed with positive culture, need for renal dose adjustment, and drug-drug interactions

EMRs, electronic medical records; SMS, short message service; TOC, transitions of care

to prioritize and target pediatric populations at higher risk for hospital readmission, especially when resources are constrained. The Centers for Medicare and Medicaid Services outlines 6 conditions (acute myocardial infarction, chronic obstructive pulmonary disease, heart failure, pneumonia, coronary artery bypass graft surgery, elective primary total hip arthroplasty, and/or total knee arthroplasty) to target as part of the Hospital Readmissions Reduction Program; however, most of these conditions are uncommon in pediatric patients.¹³ There is paucity of literature to guide clinicians to efficiently identify targeted patients in the pediatric population who may benefit most from TOC interventions. One study conducted in pediatric patients found the highest readmission rates in the following 10 diagnoses: anemia or neutropenia, appendectomy, asthma, bronchiolitis, gastroenteritis, pneumonia, seizure, sickle cell crisis, upper respiratory tract infection, and ventricular shunt.¹⁴ Here, the prevalence of readmission varied between 3% and 23%.¹⁵ While the complexity of disease management may contribute to readmission rates, institutional variations were found that may sug-

gest factors beyond the pathogenesis of disease may affect readmissions.^{14,15} As such, pharmacists wishing to design effective TOC interventions at discharge, and leaders supporting these transition initiatives, may want to examine institution-specific readmission rates to determine specific patient populations that may benefit from targeted TOC management.

TOC Interventions During Hospital Discharge

Familiarizing oneself with the various types of TOC interventions is a critical first step in program development. Planning for a successful hospital discharge is a complex process that often starts days to weeks before the patient leaves the hospital. As medication experts, pharmacists are uniquely suited to perform many aspects of discharge including medication reconciliation, medication education, and other medication-related interventions to ensure accurate dosing, medication access, and adherence. For pharmacists wishing to design effective hospital discharge programs, it is

Table 2. Structural Components of a Comprehensive Discharge Program

- Begin discharge education planning at admission including daily discussion on rounds
- Provide visual education tracking for providers and patients or caregivers
- Use standardized EMR education documentation
- Ensure electronic systems continuity between inpatient and outpatient pharmacy settings
- Ensure patients or caregivers leave the hospital with medications in hand
- Provide written instructions for patients or caregivers to supplement verbal education
- Commit to continuous improvement with multidisciplinary group with pharmacy support

EMR, electronic medical record

important to consider what those programs involve, required resources for success, and how progress will be monitored and evaluated.

Medication Reconciliation. Medication errors are often linked to medication reconciliation during TOC. Studies in adults have shown that more than 50% of medication errors occur at care transitions, and up to 67% of medication histories contain 1 or more errors.^{16,17} While medication reconciliation is completed by non-pharmacist providers in many institutions, it may be more appropriate for pharmacists to perform this function. A study examining the completeness of medication reconciliation performed by pediatric resident physicians in pediatric asthma admissions showed incomplete documentation in 40% of cases.¹⁸ In contrast, a randomized controlled trial showed that pharmacist-performed medication reconciliation decreased discrepancies in adult internal medicine patients when compared with physician-performed medication reconciliation.¹⁹ Lee et al²⁰ showed a similar decrease in discrepancies at discharge with a pharmacist-managed program. Furthermore, a systematic review on medication reconciliation that demonstrated pharmacist intervention, either at admission or discharge, decreased medication discrepancies throughout care transitions.²¹ In addition to pharmacist involvement in medication reconciliation, pharmacy technicians have been shown to decrease the number of medication errors, improve patient safety, and reduce costs.²² Gardella et al²² showed pharmacy technician–managed medication reconciliation in the ED reduced the number of potential harmful errors from 13.7% to 1.5%, compared with a nurse-driven process. One study estimated the economic value of medication reconciliation conducted by pharmacist and pharmacy technicians to a net benefit of \$206 per patient via

Table 3. Framework to Guide the Implementation of TOC Interventions

- Gather key stakeholders
- Estimate FTE needs
- Identify outcomes for improvement
- Identify technology and documentation needs
- Establish workflow of how patients will receive the TOC intervention
- Design study to show efficacy

FTE, full-time equivalent; TOC, transitions of care

Table 4. Process Measures to Track Discharge Program Success

- Write prescriptions prior to discharge orders
- Fill prescriptions at an outside pharmacy versus retail pharmacy embedded within an inpatient setting
- Partner with outpatient pharmacy
- Document discharge education
- Deliver prescriptions to bedside
- Consult orders for discharge education
- Document follow-up calls

prevention of adverse drug events.²³

Medication reconciliation can be completed as a single intervention or paired with other interventions at the time of discharge. For example, some adult discharge TOC programs have successfully paired pharmacist medication reconciliation with discharge medication education.^{24,25} Anderegg et al²⁶ found that implementation of a pharmacy practice model, which included pharmacy technician medication reconciliation for all patients and pharmacist discharge education for high-risk adult patients, reduced 30-day readmission rates by 5.5% and resulted in \$780,000 in annual cost savings. Data supporting pharmacist involvement in discharge medication reconciliation for pediatric patients are limited; however, positive results of medication reconciliation performed at the time of admission have been reported in children.^{27,28} Based on the positive results seen from pharmacy discharge medication reconciliation in adult patients, pharmacist involvement in discharge medication reconciliation in pediatric patients is a reasonable intervention to consider when aiming to improve pediatric TOC at discharge.

Medication Education. In addition to an accurate discharge medication list, it is vital to provide accompanying education in order to assure success post discharge. While data supporting pharmacist involvement in medication education are more robust for

adult patients, programs in pediatric patients involving pharmacist education have also been reported.^{3,29–33} Literature describing beneficial education techniques and strategies for pediatric patients and caregivers is abundant, and such strategies should be considered by any pharmacists seeking to improve TOC through education.

One such strategic example that may assist with education in TOC is the use of a written medication list. As an important part of discharge medication education, TJC requires an updated medication list at the time of discharge.³⁴ The medication list provided should be clear, accurate, easy to follow, and contain all necessary information to empower adherence. Use of the medication list is a common intervention in pharmacist medication education programs.²⁹ Medication lists can be generated from the electronic medical record (EMR) but may not contain all components relevant to pediatric patients. For example, the ability to specify administration times on the medication schedule, incorporate images of dosage forms, and display complex dosing schedules such as tapers or multiday weekly dosing may not be included in EMR-generated medication lists. Subscription-based programs can be purchased to assist health care providers in creating a more complete medication list suited for education, such as My Med Action Plan (MedActionPlan.com LLC, Peapack, NJ)³⁵ and My Meds (MyMeds Inc, Minneapolis, MN).³⁶ Pharmacists can also create their own medication lists.

Evidence to support the importance of medication education has been well documented in the pediatric literature. Bailey et al³⁷ found that 28% of caregivers misunderstood dosage instructions for oral liquid medications prescribed for children and that low literacy was a risk factor for misunderstanding. According to a Gallup analysis, researchers found that over 50% of Americans in the 16 to 74 age range could not read at or above the sixth-grade reading level.³⁸ There are many specific counseling interventions that have been shown to improve caregiver understanding and decrease medication errors at home. A 2022 study by Algabbani et al³⁹ tested the understanding of medication dosing and administration instructions from patient information leaflets (PILs) or PILs with pictograms given to caregivers of children younger than 13 years. Of 130 caregivers, 43% were identified as having limited health literacy.³⁹ The researchers found a statistically significant difference in medication understanding in the group of caregivers provided with both the PILs and pictograms compared with the group who received PILs only.³⁹

Many studies have demonstrated the benefit of prescribing and labeling pediatric prescriptions using only metric units, as well as provision of oral syringes and demonstration of oral syringe technique.^{40–42} In a study by Yin et al,⁴³ the provision of the smallest-size oral syringe capable of measuring the medication dose was associated with less overdoses than with larger

syringes. Similarly, the use of pictograms and the teach-back method has been associated with decreased medication errors.^{41,44} The teach-back method is an educational technique in which the educator asks the patient to teach-back what they have learned to the provider in their own words to verify understanding of information. A study by Vepraskas et al⁴⁵ demonstrated caregivers' preference for use of live demonstration and use of the teach-back method at the time of a pediatric patient discharge. This evidence led to the American Academy of Pediatrics (AAP) statement on the use of metric units for liquid medications for children in 2015.⁴⁶ In this statement, the AAP strongly states that pharmacies and hospitals should provide appropriately sized oral syringes and use advanced education strategies such as teach-back, demonstration, and pictograms to reduce caregiver errors with these devices.⁴⁶

Although the teach-back method has shown to be effective in TOC, medication education is not a one size fits all intervention. Low literacy and health literacy of caregivers are consistently associated with greater likelihood of medication errors and pharmacists should be mindful of health literacy when designing discharge education programs.^{37,43} A randomized controlled trial comparing pharmacist discharge education with a control group without pharmacist education found a decrease in 30-day readmissions amongst patients with low health literacy.²⁵ There are many ways to measure health literacy and some institutions use these assessments at the time of admission.^{47,48} These measures may be advantageous when identifying patients to target for pharmacist discharge education. Regardless of whether the institution can incorporate the use of a health literacy assessment into discharge medication education, a universal precautionary approach assuming low literacy and emphasizing the teach-back method should be used.^{49,50}

Medication Access. While an accurate medication list and comprehensive medication education are both important, these interventions can be futile if the patient does not obtain their prescribed medications for home use. As a strategy to increase medications in hand at discharge for children, bedside medication delivery (BMD) service has been established in some organizations.^{3,51–53} Studies have shown that poverty and vehicle access negatively affect pediatric patients in low income families, which a BMD intervention may ameliorate.⁵⁴ Furthermore, according to a study conducted by Gupta et al,⁵³ BMD service combined with medication education to pediatric patients and caregivers resulted in improved timeliness of the first antibiotic dose administered at home. This study also suggested that children experience less visits to the ED and reduced rates of readmission when discharge medications were received through the BMD service.⁵³ In pediatric patients with asthma, BMD was shown to increase the percentage of patients with medications

in hand at discharge from 15% to greater than 80%.⁵² In another study by Mallory et al,³ BMD service accompanied with medication education also resulted in an increase of patients with medications in hand from 2% to 85% at discharge, as well as noted improvements in patient satisfaction and understanding of medications. Rogers et al⁵¹ evaluated the effect of a BMD service led by pharmacy students, targeting pediatric patients, and found reduced medication error rates and increased prescribing to the hospital's outpatient pharmacy from 57% to 73% following implementation of the intervention. Other TOC interventions suggested to promote medication access for pediatric patients include facilitating the medication refill processes through medication transfers to the patient's local pharmacy, arranging mail orders to be completed by the hospital's outpatient pharmacy, or ensuring timely prior authorization of relevant medications to avoid delays.^{3,55,56}

Medication Adherence Tools. Despite access to medications at discharge and medication education, patients may still not adhere to a prescribed regimen owing to forgetfulness or intentional non-adherence secondary to adverse effects, lack of perceived benefits, or to exercise control over their condition. Medication non-compliance has been found to be higher in adolescent patients, patients in larger families, and those of lower socioeconomic status.⁵⁷ Inclusion of all family members in the care of chronically ill children and adolescent patients, as well as considerations to incorporate increasing adolescent patient responsibility in their own care, improves adherence rates.^{58,59} One method piloted by Kroon Van Diest et al⁶⁰ combined adolescent autonomy over chronic migraine prophylactic therapy adherence with secondary caregiver oversight.

While patient and caregiver inclusion in the transition plan has been shown to be important, the development of useful tools to navigate this process has also shown significant advancement. The number and complexity of medication adherence tools publicly available have skyrocketed over the past few decades. Tools have evolved from the low-cost, low-tech pill boxes and handmade medication calendars to more expensive, cutting-edge smart phone applications, electronic pill boxes with refill reminders, and medication adherence equipment integrated into EMRs.⁶¹ These adherence tools may provide routine and structure to patients, decreasing opportunities for non-compliance due to forgetfulness. Chronically ill pediatric patients especially noted increases in medication non-adherence on non-school days when they had less structured schedules.⁵⁹ The incorporation of text message medication reminders, smart phone applications, electronic pill boxes or caps, and dose counters on inhalers were noted by pediatric survey participants as potential ways to increase medication compliance.⁵⁹ These findings were mirrored in a study examining preferred

medication adherence technologies in adolescent patients with sickle cell disease and a second study in inner-city patients with asthma, with the latter demonstrating improved medication adherence with the use of these tools.^{62,63}

Resource Considerations for TOC Interventions During Hospital Discharge

The interventions discussed in the previous sections are key components many successful discharge TOC programs use. As outlined above, interventions can be implemented as single elements or part of more comprehensive programs, and the patient population targeted can be narrow or broad depending on institution-specific trends, available resources, and organizational maturity surrounding care transitions. Prior to implementing any new program, pharmacists and other health care providers should consider the patient population being targeted, specific outcome measurements for improvement, and the scope of program necessary to target those goals. Use of a short pilot of proposed services may be helpful to determine needed resources. Consideration of full-time equivalents (FTEs) of staff support required and the electronic tools required for implementation and documentation of interventions are key to the program's success.

Best practice for building a comprehensive and effective TOC program is to establish a top-down approach beginning with senior leadership support. This step is particularly key to success if significant resources are needed to support the program. Similar models are recommended for organizational medication safety programs, which include TOC, in best practice models.^{64–66} The Minnesota Hospital Association⁶⁷ recommends beginning efforts to transform TOC with securing leadership support for a program. They recommend establishing a multidisciplinary team to organize, communicate, and align TOC strategic plans and goals throughout the organization.⁶⁷ Because much can change throughout a hospital admission, which may affect the ultimate discharge plan of care, robust process measures such as reassessment of and updates to the medication discharge plan throughout the admission are critical within an organization.⁶⁸ Dedicated resources and strategic organizational alignment for medication reconciliation and discharge planning yield better safety and error outcomes than programs that lack such resources, therefore alignment with a systemwide approach can be helpful.^{69–73}

In addition to a leadership-level approach to support TOC programs, electronic systems used in targeting patients and documenting interventions are critical in any discharge program's success. Medication reconciliation should be documented consistently in the EMR by all staff involved in the process.⁷⁴ Similarly, a standardized approach to documentation of medication education is critical to closed-loop communication among the

medical team. Best practices include beginning the medication education process with a pharmacy consult order, performing education delivery after the receipt of prescription medications where possible, and concluding with education documentation.^{3,68,75-77}

For programs focused on improving medication access, electronic systems that establish continuity between inpatient and outpatient pharmacy systems remain best practice. However, these programs are typically expensive and resource intensive to implement unless both parties are operated under the same business entity.^{3,68,75} Regardless, a holistic approach to the provision of pharmacy services from inpatient service to outpatient discharge prescription dispensing is ideal. Mallory et al³ demonstrated this via transforming a discharge medication process from 2% to 85% of medications in possession at hospital discharge within a 21-month time frame by focusing on several systematic approaches and several plan-do-study-act cycles that included continuity between EMR systems within the hospital and their outpatient pharmacy.

To integrate TOC interventions within an institution's information technology infrastructure, access to relevant software for use in education and adherence interventions may need to be secured by the institution to achieve best outcomes. Programs such as My Med Action Plan and My Meds, which can be used to generate medication lists and patient adherence tools, can be useful to clinicians; however, these come at a significant cost to the institution.^{35,36} Other interventions such as pill boxes, patient-managed reminders, or smart phone applications may require less institutional financial investment and still yield positive returns. Additional structural elements to consider include staff education, standard work, tools to support communication, and coordination of care, which includes processes for identification of high-risk populations.⁶⁷

TOC Interventions After Hospital Discharge

Even in the presence of a comprehensive discharge TOC program, it is common for patients to encounter questions or complications in the immediate postdischarge period. Development of discharge follow-up interventions may further optimize postdischarge patient outcomes. Within these follow-up programs, a variety of services have been described to benefit pediatric patients. Most of these interventions aim to provide multiple functions, including medication-related assistance, as well as some degree of care coordination, following discharge.^{31,75-80} When implementing a postdischarge follow-up program, pharmacists must consider the method of delivery, resources required, and the outcomes or interventions targeted including how progress will be measured.

Delivery Models for Discharge Follow-up. Many methods of pharmacist-led postdischarge follow-up have

been documented in the literature including telehealth, in-person clinic visits, and in-home visits.^{31,81-84} Telehealth discharge follow-up programs, primarily telephone follow-up (TFU), offer the advantage of fewer required resources than in-home and clinic visits. The use of TFU to communicate with patients and families following ED or hospital discharge is well described in the adult population.⁸¹ TFU encounters can be completed by a variety of members of the health care team, making them an appealing option for optimizing patient outcomes, while freeing up provider time. These programs range significantly in scope, intensity, and purpose.

The target population of postdischarge TFU programs ranges from broad patient groups, such as those in a single service line, to smaller select groups of patients, such as those with a single complex disease state. In 2009, Jack et al⁸⁵ published their experience with a robust reengineered discharge program for adult internal medicine patients, which included a pharmacist's calling patients 2 and 4 days post discharge to reinforce discharge education and complete medication reconciliation. This intervention resulted in decreased health care utilization after discharge in patients randomly assigned to the TOC group.⁸⁵ In the pediatric population, Nguyen et al³¹ reported results of a TOC program that included medication reconciliation, pharmacist discharge counseling, and pharmacist-led TFU for patients discharged from a free-standing children's hospital. This program used a partnership with nurses to target children with medical complexity and resulted in a 5-month cost savings of over 20 thousand dollars.³¹ The approach of targeting patient populations at highest risk for postdischarge complications or readmission has been well described in the adult literature. Successful programs focusing on heart failure, chronic obstructive pulmonary disease, and diabetes, have all been reported.⁸⁶⁻⁹⁰ This approach has been described in pediatric facilities as well.^{78,79} In a small intensive TFU intervention targeting 4 pediatric patients with medical complexity and high rates of readmission, pharmacists reported a decrease in admissions for 3 of 4 patients and increased satisfaction with the health care system for all patients.⁷⁸ In a much larger study, Teufel et al⁷⁹ similarly reported a decrease in 90-day readmissions from 15% to 8% in pediatric patients with asthma. Similar outcomes have been reported with targeted TFU programs focused on hospital-based outcomes for antimicrobial stewardship.⁹¹⁻⁹⁴

TFU programs, including those described thus far, are commonly completed by a member of the hospital care team; however, discharge follow-up can be also facilitated by an outpatient care team. This model was described in targeted adult patient populations, as well as across a system using criteria to identify adults at risk for discharge issues.⁹⁵⁻⁹⁷ A similar program was piloted in a level 3 pediatric primary care medical home serving patients with medical complexity.⁹⁸ Pharmacists included patients who had external specialist notes or hospital

discharge summaries directed towards the primary care team.⁹⁸ The authors found an average of 5.63 medication discrepancies per patient with medical complexity and 3.77 in patients without medical complexity, and found medication therapy delays occurred in 16.1% of the population.⁹⁸ TFU programs have also been used to facilitate postdischarge communication between health care teams and patients. Young et al⁹⁹ compared the efficacy of telephone and videophone follow-up with pediatric caregivers following discharge after surgery for scoliosis. Both groups received follow-up with a nurse on day 3 following discharge, and both modes of communication were deemed successful depending on patient or caregiver characteristics and preferences.⁹⁹ Use of telehealth visits following discharge has also been demonstrated in the neonatal population. An observational cohort study using follow-up telehealth visits, completed by a trained telemedicine provider within 1 week of neonatal intensive care unit discharge, identified issues related to medication administration in 13% of patients.¹⁰⁰

While telehealth has been shown to assist health care providers and patients in TOC, programs targeting in-person postdischarge follow-up with pharmacists have also been reported. Pharmacists may have a role in facilitating appropriate clinic follow-up during this transitional period by assuring appropriate appointments are scheduled with the patient's primary or specialty provider.^{92,96} An alternative approach is the establishment of clinics that specifically serve the postdischarge hospital population. Referred to as transitional care clinics, this type of program lends itself to targeting high-risk patient populations, as determined by medical complexity or disease state. To date, programs such as these have been best described in adults.^{90,97} One program in Taiwan, dedicated to providing follow-up care for patients without a primary care provider, used a hospitalist-run transitional care clinic as a component of a robust postdischarge transitional care program.⁸³ Pharmacist-led home visit transitional programs following hospital discharge have also been described, though with less frequency. Daliri et al⁸⁴ reported on a multifaceted pharmacy-led postdischarge follow-up program in the Netherlands, which included a home visit by the patient's community pharmacist. These authors reported decreased medication-related problems from 65.9% to 52.4% in the pharmacist group compared with usual care.⁸⁴

With discharge follow-up being an important aspect of TOC programs, it is also important to note that methods of discharge follow-up do not typically run successfully in isolation. Importantly, many programs described herein also function as an extension of a discharge education program.^{31,83,84,85,96} These types of programs help to ensure consistent delivery and reinforcement of information. Some of the described programs also function as a single component of a complex follow-up program that hybrids multiple approaches.^{83,84,96} The postdischarge

follow-up program described by Daliri et al,⁸⁴ for example, included a unique collaboration between inpatient and outpatient pharmacists. While no single approach to postdischarge follow-up will be suited for all hospitals, collaborative and hybrid approaches should be considered to optimize workflow and resources.

Interventions for Discharge Follow-up. As heterogeneous as the method of follow-up can be, so too is the focus of interventions during these encounters. Comprehensive pediatric programs described herein primarily focus on assuring continuity of care assisting with access to medications, and/or providing medication reconciliation and education.^{31,78,80,98,100} Others provide more narrowly focused pharmacy services, including medication and symptom education for specific disease states or culture follow-up services.^{79,94,99,101}

Many of the TOC programs described thus far are examples of comprehensive TOC programs. The TFU program implemented by Nguyen et al³¹ included medication reconciliation, discharge counseling, and follow-up phone calls for all patients discharged from a single children's hospital. Following discharge counseling, TFU was completed by a pharmacist at 1, 7, and 14 days after discharge.³¹ The most common interventions made at the TFU encounters were drug order clarification, assistance in obtaining medication, and dose rounding.³¹ In the post-discharge program described by Condren et al,⁹⁸ a clinic pharmacist contacted caregivers of patients recently discharged from a hospital or a specialist visit via TFU to identify and resolve any medication discrepancies. In addition to medication reconciliation, pharmacists were able to provide patient education, adjust drug therapy, coordinate care between providers, recommend laboratory monitoring, and facilitate patient appointments.⁹⁸ Hopkins et al⁸⁰ used an automated discharge communication tool to target pediatric patients discharged from an academic pediatric hospital. Responses requiring action were communicated and routed to a clinician interface for follow-up.⁸⁰ Similarly, the discharge follow-up home visits described provided a comprehensive approach to medication management after discharge.^{78,84}

Other programs have developed interventions that focus on specific disease state or patient outcomes. Teufel et al⁷⁹ reported on a disease-specific targeted quality improvement approach for discharge follow-up in pediatric patients with a primary diagnosis of asthma. In this TFU program, patients were contacted at 3 and 30 to 45 days post discharge, which resulted in a reduction in ED visits and hospital admissions within 90 days of discharge.⁷⁹ Another high-yield area of focused intervention is antimicrobial stewardship. Dumkow et al⁹¹⁻⁹³ have reported success over several years with pharmacist-driven follow-up cultures in the ED and urgent care settings, importantly including a component of TFU focused on symptom assessment and communication of results. The work by this group has demonstrated the utility of a collaborative practice agreement in the urgent care set-

ting, which allowed pharmacists to intervene on susceptibility or antibiotic mismatch, no antibiotics prescribed with positive culture, need for renal dose adjustment, and drug-drug interactions.⁹³ Overall, the results of the studies comparing pre- and post-program outcomes showed an increase in rates of appropriate antibiotic prescribing and a potential to affect rates of readmission.^{92,93} One retrospective chart review describes experience extrapolating this approach to a pediatric-specific population, using a collaborative practice agreement in a pediatric ED.⁹⁴ Patients discharged from the ED with suspected infection and pending microbiologic tests were routed to a clinical pharmacist for review.⁹⁴ Pending evaluation, the pharmacist could initiate, modify, or discontinue drug therapy; the pharmacist then followed up with the patient or caregiver for education.⁹⁴ In the first 6 months of implementation of this program, representing 1040 encounters, there was no effect on rate of return visits to the ED, compared with pre implementation.⁹⁴ However, the authors reported more judicious use of antimicrobials and faster time to patient follow-up.⁹⁴

Resource Considerations for TOC Interventions After Hospital Discharge

Similar to resource considerations for TOC interventions during hospital discharge, pharmacists wishing to implement TOC interventions after discharge need to consider the patient population targeted, scope of interventions, and measurements of success. In addition to deciding which interventions should take place during a postdischarge encounter, pharmacists must consider the structure and resources needed to maintain such a program. If significant investment is needed to support the intervention, such as additional FTEs or electronic resources, a plan to obtain them should be developed prior to implementation of the program. Regardless of the resources available, beginning with organizational senior leadership support is a key structural factor in ensuring the success of a patient-centered outreach program. Setting strategic goals and initiatives with data analytics to track progress are important to advancing any outreach program via quality improvement. In programs in which resources are limited, a structure that supports preferentially targeting patient populations at high risk of readmission is preferred, especially those with objective measures that may link historical local readmission rates or a validated readmission risk assessment tool with potential targeted intervention strategies.^{102,103}

Resources needed to support various patient-centered outreach programs are highly dependent on the type of follow-up interventions performed. For example, automated outreach interventions, such as email, telephone, or short message service (SMS) interactions, require informational technology resources to ensure customer usability and timely intervention strategies. The type and number of FTEs needed to build, test, and maintain such programs should be considered prior to

implementation but will differ considerably from more individualized types of programs, which are dependent on continued investment health care provider FTEs. Additionally, the intervention being used should be reconciled with the appropriateness of automated outreach and available resources, as some interventions have been shown to be equally efficacious if automated rather than investing in human resources to support.¹⁰⁴ Even with some automated outreach systems, additional human resources may need to be considered if responses to automated patient outreach need to be managed by health care providers (e.g., pharmacists, nurses, physicians) or non-medically trained personnel (e.g., clinic administrative staff). Identifying target patient populations to help reduce organizational overhead associated with patient-centered outreach programs has been shown to be an effective tactic; however, without an automated system in place to identify such targeted patients, the work effort to direct human efforts will be slowed, and expenses linked to human resources will rise, by manual targeting activities. Therefore, most manual patient-centered outreach programs have a hybrid model in which there is a manual method of contact, such as a live telephone call or a live in-home or clinic visit, coupled with an automated method of detecting the targeted patient population.^{91–93,98}

Conclusion

The importance of improving TOC processes at hospital discharge for pediatric patients is clear for numerous reasons ranging from increased medication adherence to improved health outcomes and health care cost reduction. This review provides an overview of TOC interventions to integrate at discharge along with the structural elements and resources to consider during the implementation of TOC interventions at pediatric hospitals throughout the course of an admission. This information should help create a framework for pediatric pharmacists and pharmacy leaders wishing to implement changes and discharge TOC (Table 3). TOC interventions will continue to evolve and expand with advancing research and quality improvement, allowing pediatric pharmacists to further optimize hospital discharge and help improve the quality of pediatric care.

Article Information

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