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Original article

Evaluation of pharmacy intern-led transition of care service at an academic hospital in Saudi Arabia: A prospective pilot study

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ABSTRACT

Objectives: The transition of patients from one setting to another increases the risk of medication errors (MEs). This study aims to assess the implementation of pharmacy intern-led transition of care (TOC) service and to demonstrate its impact on the quality of patient care.
Method: A prospective interventional pilot study was carried out from August 2020 to April 2021 at an academic hospital in Saudi Arabia. The TOC team consisted of three pharmacy interns and one pharmacist-in-charge. Daily activities included medication reconciliation, discharge counseling, and follow-up call after 3 days of discharge. The identified discrepancies were categorized according to the National Coordinating Council for Medication Error Reporting Program.
Key findings: A total of 182 patients were included in the analysis. During medication reconciliation, 102 discrepancies were detected, with an average of 0.7 discrepancy per patient. The most common discrepancy at admission and discharge was omission (41.7% and 70%, respectively). Category B was the most frequent and accounted for 46% at admission and 93% at discharge. Around 39% of TOC beneficiaries received a follow-up call, and all reported a high level of satisfaction with the service.
Conclusion: Involving the pharmacy team in TOC activities was effective in identifying discrepancies and resolving MEs.

1. Introduction

Transition of care (TOC) is defined as "the movement of patients between health care practitioners, settings, and home as their condition and care need change." (Smith et al., 2014). It incorporates logistical arrangements, patient and family education, and coordination between the healthcare providers involved in the transition (Transitions of Care: Technical Series on Safer Primary Care, 2016). Transition from one healthcare setting to another increases the risk of medical errors, particularly adverse drug events (ADEs) (Coleman, 2003), which account for 66% of post-discharge adverse events (Forster et al., 2003). Of these, approximately two-thirds are considered preventable or ameliorable (Forster et al., 2003, Forster et al., 2005, Donovan et al., 2013, Al-Hashar et al., 2018, Schnipper et al., 2006, von Laue et al., 2003). A systematic review of fifty-four studies has found that the median rate of medication errors (MEs) was 53% and the unintentional medication discrepancies rate after discharge was 50%. At least one ADE following discharge is reported in 19% of adult and elderly patients (Alqenae et al., 2020). It is estimated that 80% of serious medical errors are due to miscommunication among healthcare providers during TOC ("Joint Commission Center for Transforming Healthcare releases targeted solutions tool for hand-off communications - PubMed," n.d.). Thirty-day readmission rates have risen and comprised 19.6% of Medicare beneficiaries (Joynt and Jha, 2012). In an effort to reduce re-hospitalizations, new financial penalties have been imposed for institutions with high readmission rates (Kripalani et al., 2014). Furthermore, regulatory agencies such as the Joint Commission are advocating healthcare organizations to "accu-

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rately and completely reconcile medications across the continuum of care" in order to reduce adverse events during care transitions ("National Patient Safety Goals | The Joint Commission," n.d.).

Several interventions have successfully reduced the readmission rates (e.g., medication reconciliation, patient education, follow-up calls, timely outpatient appointments, and patient's needs assessment) (Hansen et al., 2011). There are various evidence-based models for TOC that are designed to improve patient care and mitigate negative outcomes such as readmission rates, ADEs, and rising costs. Such models include Better Outcomes for Older adults through Safe Transitions (BOOST) (Williams et al., 2013), Care Transitions Intervention (CTI) (Coleman et al., 2006), and project Re-Engineered Discharge (RED) (Jack et al., 2009). These models proposed different interventions that include discharge counseling, improvement in multidisciplinary communication, patient education, and post-discharge contacts by phone. Moreover, numerous strategies have been applied to improve TOC by involving several healthcare professionals such as nurses and pharmacists (Jack et al., 2009, Harrison et al., 2014, Cheen et al., 2017).

A recent meta-analysis of sixteen studies showed that the total incidence of MEs in Saudi hospitals was estimated at 44.4%, where the majority of MEs were detected in the prescribing stage (40.2%) followed by the administration stage (34.5%) (Almalki et al., 2021). A qualitative study was conducted to identify experts' perspective on medication safety practice in Saudi Arabia. This study identified the lack of implementation of medication reconciliation practice as one of the factors contributing to medication safety problems (Aljadhey et al., 2014). In Saudi Arabia, the inaccurate medication reconciliation process across all levels of care is fairly common due to the lack of clear implementation methods, human resources, and limited Saudi literature on the issue (Mazhar et al., 2017). While there have been several attempts to assess the role of pharmacists in the medication reconciliation process during TOC (Mazhar et al., 2017, Elamin et al., 2021, Aljumah, 2013), the involvement of pharmacy interns has been given less attention (Bawazeer et al., 2021). Only a few studies have evaluated the effect of pharmacy interns on TOC activities which have shown that interns can be effective in conducting this service, in addition to enhancing their confidence and clinical skills (Walker et al., 2010, McLaughlin et al., 2015, Champion et al., 2019, Andrus and Stevenson, 2015, Hertig et al., 2017). Therefore, this study aimed to describe and assess the pharmacy intern-led TOC service in Saudi Arabia.

2. Methods

2.1. Study design and setting

This prospective interventional pilot study was carried out between August 2020 and April 2021 at King Abdullah Bin Abdulaziz University Hospital (KAAUH). It is a 300-bed academic teaching hospital located in Riyadh, Saudi Arabia. The average daily admission from the emergency department (ED) is 47, with an average unit transfer of 4.

2.2. Study procedure

In the beginning, the director of pharmaceutical services at KAAUH interviewed some pharmacy interns with a view to begin building the TOC program. After that, a TOC team consisted of three pharmacy interns and one pharmacist-in-charge was initiated. They created standardized forms for documentation, a guide for interns, and electronic data collection sheets using Research Electronic Data Capture (REDCap). REDCap was used to collect and manage the study data. It is a secure, web-based software platform intended to support data capture for research studies and is hosted at KAAUH. Moreover, the TOC team introduced the service to healthcare professionals at the hospital. Afterward, a new five-week elective rotation in TOC was established for the 2020–2021 academic year. Throughout the first week of the rotation, the interns underwent training in TOC which included shadowing their preceptor, reviewing modules and guides, reading assigned articles, and learning appropriate documentation. In the following four weeks, the team started the TOC program composing three encounters during admission, discharge, and post-discharge Fig. 1.

2.3. Study population

This study involved patients admitted from ED and were (1) on five or more home medications, (2) taking certain medications (such as antidiabetics, insulins, antithrombotics, respiratory inhalers, antidepressants, antiepileptics, antipsychotics, antiarrhythmics, chemotherapeutics, digoxin, and antimicrobials), or (3) having a disease with a high readmission rate (diabetes, asthma, chronic obstructive pulmonary disease, heart failure, or mental illness). Patients were excluded if they were: (1) admitted for less than 24 h, (2) admitted electively, (3) left against medical advice, or (4) both admitted and discharged outside TOC program hours (Sunday through Thursday from 8 AM to 4 PM).

2.4. TOC workflow

The admission office sent the daily list of newly admitted patients from ED to the pharmacist-in-charge via email. Then, the pharmacy team screened the patients using the study inclusion criteria to determine the eligible patients. After that, they interviewed the patients and obtained the best possible medication history (BPMH) to validate the medication reconciliation. In addition, the pharmacy interns evaluated medication knowledge during the patient interview to understand their health literacy and avoid unnecessary interventions. Validation of medication reconciliation, bedside discharge counseling, along with a printed dosing schedule were offered by the team. The identified medication discrepancies were communicated with the medical team through phone calls. Follow-up calls three days after discharge were made to assess the patients' understanding regarding their medications and level of satisfaction with the TOC service. All activities were performed under the supervision of the pharmacist-in-charge and were documented in both REDCap and electronic health record (EHR). REDCap was used to extract the data for the statistics and data were documented in the patients' EHR for the healthcare providers to view.

2.5. Outcome measures

This program sought to i) determine the type and frequency of medication discrepancies and interventions; ii) categorize MEs; iii) assess the acceptance of the TOC team's recommendations; iv) evaluate patients' understanding of the medication regimen; and v) estimate patients' level of satisfaction with the TOC service.

The TOC team provided several interventions involving medication reconciliation at admission and discharge, verbal and written instructions at discharge, and post-discharge phone calls.

In this study, medication discrepancy was defined as any difference between the home medications list obtained by the TOC team and EHR, but without clear documentation of the intended change. The identified discrepancies included omission, commission, duplication, medication not taken by the patient, or changed dose/frequency/route.

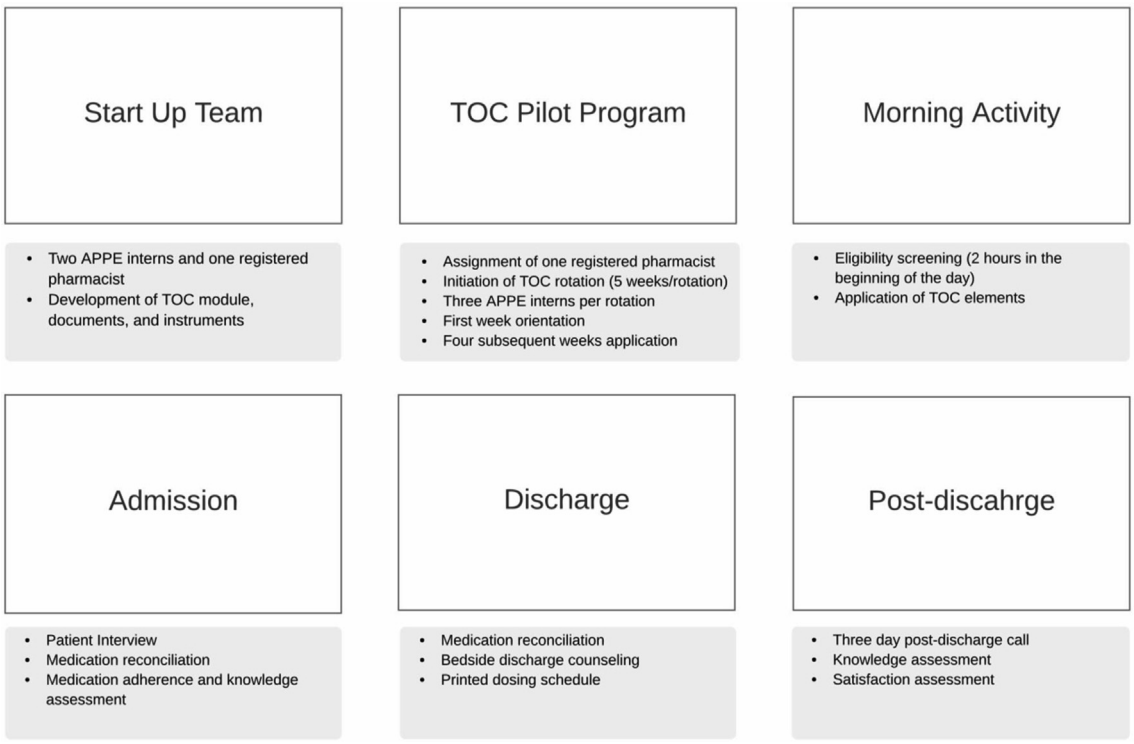

Fig. 1. Pilot Program of TOC Service led by Pharmacy Interns.

The type of errors was categorized according to the National Coordinating Council for Medication Error Reporting Program (NCC MERP). It contains four major subscales, namely a potential for error (Category A), an actual error that did not reach the patient (Category B), an actual error that reached the patient but did not result in harm (Categories C and D), and an actual error that reached the patient and resulted in harm (Categories E, F, G, H, and I) (Hartwig et al., 1991).

Patients' understanding of their medications was assessed using a tool that was created by the TOC team which contains three yes/no questions about medication indication, frequency, and time of administration. For each item, if the patient knows half of the medications, the answer was considered 'yes', which means that the patient had a good understanding. While if the patient knows less than half of the medications, the answer was considered 'no', which means that the patient had a poor understanding.

The satisfaction survey, which was generated by the TOC team, comprised four questions. Responses to each question were rated on a 5-point scale ranging from 1 (very poor) to 5 (very good). The final score ranged from 4 to 20 and was subdivided into three categories: low (4–9), moderate (10–14), and high satisfaction (15–20) Table 1.

2.6. Statistical analysis

Descriptive statistics were used, and included means, standard deviation deviations, and percentages as appropriate.

2.7. Ethical Approval

The Institutional Review Board of Princess Nourah Bint Abdulrahman University has exempted this study from formal ethical approval (reference number: HPA-01-R059) in June 2021.

3. Results

Over nine months, 21 pharmacy interns participated in the program during the seven rotations (3 interns per rotation). A total of 182 patients were included in the analysis. Patients' demographics and clinical characteristics are shown in Table 2. The mean age was 54 with a standard deviation of 22, and about 62% were female. Nearly half of the patients reported taking five or more medications. Oral and injectable antidiabetics were the most used medications (79%), followed by antithrombotics and respiratory inhalers (29.8% and 17.7%, respectively). Patients with heart failure accounted for 8.9%, while mental illness accounted for 7.2%.

Around 86% of the patients received medication reconciliation from the TOC team at admission, while about 50% had their medication reconciled at discharge. Upon discharge, counseling and dosing schedule were offered to 80 and 57 patients, respectively. Seventy patients were contacted via phone 3 days after discharge.

During medication reconciliation, 102 discrepancies were detected, with an average of 0.7 discrepancy per patient. The most common discrepancy at admission and discharge was the omission

Table 1
TOC Satisfaction Survey.

Questions
1. When I left the hospital, I clearly understood how to take my medications
2. The service enhanced my adherence to the medications
3. My overall experience with the service team
4. I recommend the service to be continued

Table 2
Patient Demographics and Clinical Characteristics.

Characteristics	n = 182
Average age ± SD*	54 ± 22
Gender, n (%)	
Female	112 (61.5)
≥ 5 chronic medications, n (%)	89 (48.9)
Medications, n (%)	
Antidiabetics (other than insulin)	87 (48.1)
Insulins	56 (30.9)
Antithrombotic	54 (29.8)
Respiratory Inhalers	32 (17.7)
Antidepressants	16 (8.8)
Anti-epileptics	16 (8.8)
Antipsychotics	9 (5.0)
Antiarrhythmics	5 (2.8)
Chemotherapeutics	3 (1.7)
Digoxin	2 (1.1)
Antimicrobials	1 (0.6)
None of the above	3 (1.7)
Comorbidities, n (%)	
Diabetes	121 (67.2)
Asthma	33 (18.3)
Heart failure	16 (8.9)
Mental illness	13 (7.2)
Cancer	0 (0.0)
Others	39 (21.7)

*Standard Deviation (SD).

of medications (41.7% and 70%, respectively). At admission, medication not taken and changed dose/frequency/route represented about 22% and 17%, respectively as shown in Table 3. Around 68% of the discrepancies identified by the pharmacy team were communicated to the physicians, of which 80% were implemented.

Among MERP index categories, category B was the most frequent which accounted for 46% at admission and 93% at discharge Fig. 2. Knowledge assessment regarding medication indication at admission and post-discharge was 86.2% and 98.4%, respectively. All patients showed high satisfaction levels with the TOC service.

4. Discussion

The pharmacy intern-led TOC services represent an opportunity for healthcare institutions to reduce ADEs, in addition to providing a holistic, educational experience for pharmacy interns. The pharmacy interns under the supervision of a registered pharmacist encountered patients at admission, discharge, and post-discharge. During medication reconciliation, 102 discrepancies were detected, with an average of 0.7 discrepancy per patient which is lower than reported in other studies (Sebaaly et al., 2015, Buckley et al., 2013).

Table 3
Outcomes of the TOC service led by pharmacy interns.

Variable	Admission	Discharge	Post discharge
Medication reconciliation, n (%)	156 (85.7)	90 (49.5)	–
Discrepancies, n (%)	72	30	–
Omission	30 (41.7)	21 (70.0)	–
Commission	2 (2.8)	2 (6.7)	–
Incorrect dose/frequency/route	12 (16.7)	4 (13.3)	–
Duplication	2 (2.8)	0 (0.0)	–
Medication Not taken	16 (22.2)	1 (3.3)	–
Other	10 (13.9)	1 (3.3)	–
Knowledge Assessment, n (%)	152	–	63
Medication indication	131 (86.2)	–	62 (98.4)
Medication frequency	137 (90.1)	–	62 (98.4)
Time of medication administration	134 (88.2)	–	63 (100)
Dosing schedule, n (%)	–	57 (31.3)	–
Discharge counseling, n (%)	–	80 (44.0)	–
Post-discharge call, n (%)	–	–	70 (38.5)
Satisfaction assessment, n (%)	–	–	70 (100.0)

Our results support other studies in which omission was the most common medication discrepancy at admission and discharge (Almalki et al., 2021, Buckley et al., 2013, Walker et al., 2009, Digiantonio et al., 2018, Mongaret et al., 2018). Many reasons could have contributed to omissions, such as patients not bringing the medication list or bottles, not remembering some medications, or limited physician time. Most MEs reported in our study were category B of the NCC MERP index, followed by category C, which was also found in a previously published study (Digiantonio et al., 2018). Although most of the discrepancies did not cause direct harm to the patient, identifying them could be a pivot for subsequent quality improvement. Only three discrepancies resulted in temporary harm that required hospitalization. Another finding was that some patients were not taking their medications as prescribed. For example, a patient was taking oral antidiabetics as needed instead of scheduled doses which caused temporary harm. A lack of knowledge about such information may lead to unnecessary interventions such as adding more medications or increasing the dosage, thereby raising the risk of adverse effects and increasing the cost. In such cases, the interns had the opportunity to educate patients on the importance of adhering to the prescribed regimen and also informed the physician about the compliance issue. Only two-thirds of the discrepancies were communicated to the physicians, which might be explained by the difficulty of reaching the physicians. However, a high percentage (80%) of the recommendations was accepted and implemented, which is higher compared to other studies reporting acceptance rates between 48% and 72% (Lubowski et al., 2007, Galvin et al., 2012, Karaoui et al., 2019, Cornu et al., 2012).

The interns were able to conduct medication reconciliation for 50% of the patients before discharge while providing medication counseling for about 44% of them. Only one-third of the patients received a written customized dosing schedule as it was time-consuming. Therefore, we suggest providing the customized dosing schedule for the priority categories or automating the forms to help facilitate the process. Post-discharge service was beneficial; however, not all patients answered their phones. Thus, we had to work with a different method to answer and clarify any discharge medication-related issues (i.e., discharge business chat).

Patients' knowledge regarding their medications' indication, frequency, and administration time seems to have improved after the service. All TOC beneficiaries reported a high level of satisfaction toward the service, as the service has enhanced their understanding and adherence to their medications. Moreover, they suggested that the service be continued.

In order to implement this service, it is essential to interview the interns who would be assigned to start designing the TOC program in order to ensure the project quality. The interns should have prior experience in the inpatient and outpatient pharmacy as well as good research skills to look for evidence-based TOC models and to evaluate their applicability. Technical skills are needed to build data collection instruments. Furthermore, introducing the service to healthcare providers and new interns requires good communication skills.

To our knowledge, this is the first study evaluating TOC activities that was led by pharmacy interns in Saudi Arabia. The service was offered to patients at high risk of readmission who needed the service. MERP index was used to classify MEs. We believe the service expanded the role of the pharmacy team to more integrated participation in the coordination and continuity of care. One of the study limitations was the inability to provide the service after working hours which were from 8:00 AM to 4:00 PM during weekdays. This resulted in the exclusion of some patients and could

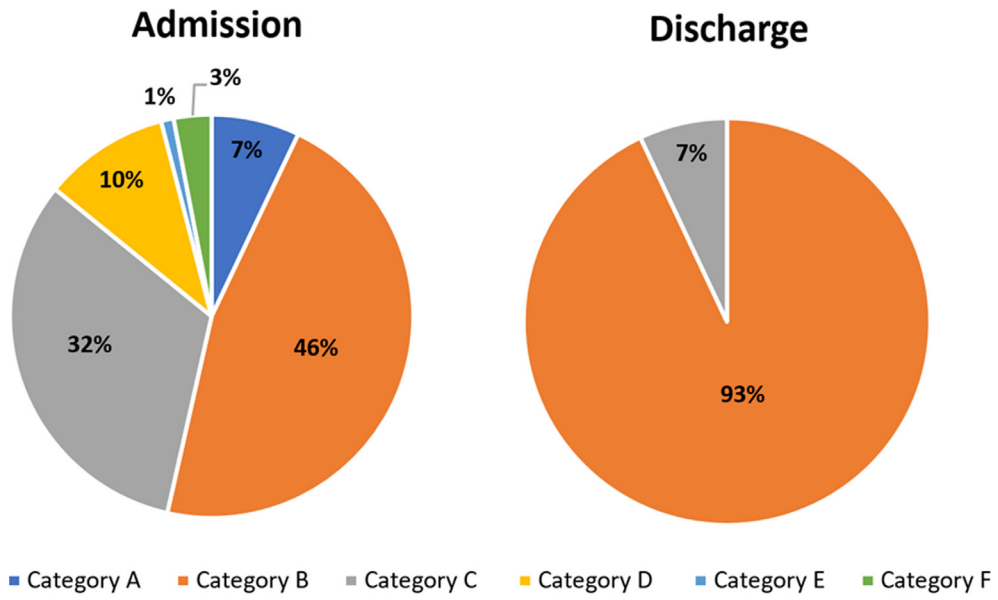

Fig. 2. MERP Categories of Medication Errors.

have introduced selection bias. Another limitation was that we did not follow up with some patients because they could not be reached by phone. Additionally, the TOC program was conducted at a single academic teaching hospital, thereby limiting the ability to generalize the results to other institutions in Saudi Arabia and beyond.

5. Conclusion

In Saudi Arabia, the lack of implementation of medication reconciliation has been identified as one of the main challenges to medication safety. Involving the pharmacy team in TOC activities was effective in identifying discrepancies and preventing MEs. This is the first study evaluating TOC activities that was led by pharmacy interns in Saudi Arabia. The study highlighted the potential role of pharmacy interns to effectively participate in TOC services. A multi-center study is required to further assess the impact of pharmacy interns' participation in TOC services on reducing MEs and ADEs in this setting.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Disclosure.

All authors have approved the final article and declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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