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Using pharmacy technicians and telepharmacy to obtain medication histories in the emergency department

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ABSTRACT

Objectives: To determine if telepharmacy can be used to collect medication histories on patients admitted in the emergency department (ED) in a large health system.
Practice description: As part of an effort to address safety concerns, resource limitations, and a decline in medication history completions, a program was developed to use telepharmacy to conduct medication histories on patients admitted in the ED.
Setting: The medication history program covers 5 large facilities. It is staffed by 6 full-time pharmacy technicians 7 days a week and is overseen by a pharmacist.
Innovation: Medication histories are conducted with the use of mobile carts enhanced with videoconferencing equipment allowing technicians to operate from a remote central location. The program allows the technicians to observe multiple EDs at one time, interview patients through videoconferencing, and document completed medication histories in the electronic medical record (EMR). The technicians also transcribe preoperation (pre-op) medication lists for patients being admitted for surgeries.
Evaluation: Medication history completion rates and barriers were assessed. In addition, potential medication errors, medication history accuracy rates for nursing and pharmacy technicians, and a cost analysis of preventable ADEs were explored.
Results: The program, on average, conducts medication histories on 56% to 79% of patients admitted through the ED during hours of operation. In fiscal year 2018, the technicians entered 24,980 medication histories and pre-op lists. A cross-sectional analysis of data collected from December 2016 to March 2017, including 124 patients, revealed 320 potential medication errors among a total of 382 high-risk medications.
Conclusion: Based on the current performance and continued expansion of this novel strategy, use of telepharmacy to obtain medication histories in the ED has led to resource optimization for the remote delivery of a pharmacy service.

Although many factors have been identified as reasons for poor transitions of care (TOC), medication-related problems, including inaccurate medication reconciliation, have been identified as significant sources of morbidity, mortality, unplanned readmissions, and increased total health care costs.[1-10] It is estimated that 1.5 million preventable adverse drug events (ADEs) occur each year throughout the health care continuum.[3]

Medication reconciliation is a key component of TOC and is defined as the "process of comparing the medication a patient should be using or is actively using with new medications that are ordered and resolving any discrepancies."[11] Medication reconciliation and obtaining accurate medication histories are distinct processes. Updating and obtaining accurate medication histories is a task that has been successfully managed by trained pharmacy technicians.[12-18] Obtaining accurate medication histories on admission could be considered as the pivotal gateway to the provision of good medication reconciliation. Furthermore, incomplete or inaccurate information on the patients' medical record may lead to medication errors, inaccurate patient discharge medication lists, and ADEs after discharge. It is estimated that a large portion of hospital-related medication errors and ADEs are attributed to transitions and interfaces of care.[12,19]

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Key Points

Background:

- Incorrect medication histories can lead to inaccurate and incomplete medication reconciliation, leading to medication errors, inaccurate patient discharge medication lists, and adverse drug events after discharge.
- Challenges including staffing and financial limitations can hinder implementation of successful medication history programs.

Findings:

- Telepharmacy can be used to obtain medication histories remotely from the emergency department when encountering limited staffing resources.
- A large percentage of potential errors were identified among high-risk medications.

Although medication reconciliation is an expectation by regulatory agencies, challenges still exist as to the best way to perform and implement these activities, including, but not limited to, financial limitations, staffing shortages, and inadequate communication between providers.[20,21] The standard of practice for medication reconciliation, including medication history collection, has historically relied solely on physicians.[22,23] However, studies from other organizations have demonstrated that the success rate with the nursing and physician model is suboptimal.[18-21] Pharmacists are quickly becoming an integral part of the multidisciplinary team in a wide range of health care settings largely because of their unique training in therapeutics. Although current literature demonstrates the role pharmacists play in medication reconciliation, resource limitations often occur and hinder expansion of these services. Use of pharmacy technicians to perform medication histories has quickly become a unique way to address resource limitations and improve the quality of data for medication reconciliation.[12,17,24,25] Studies have demonstrated significant reductions in medication errors, omissions, duplications, and drug interactions when using pharmacy technicians to obtain medication histories.[12-18,24-26]

Although pharmacy technicians based in the emergency department (ED) is becoming the standard of care for obtaining medication histories, the number of technicians that are needed to cover large EDs or multiple sites may also be resource intensive for large health care organizations. Technologic advances involving telepharmacy would address some of these challenges. Telepharmacy is the delivery of pharmaceutical care via telecommunications to patients in locations where they may not have direct contact with pharmacy staff. It is an example, implemented in the field of pharmacy, of the wider phenomenon of telemedicine. Availability of telepharmacy services to complement on-site personnel could allow for increased rates of medication history completion and expansion to other sites of care.[27]

Objective

A telepharmacy medication history program was instituted in June 2015 in the Ascension Texas network. The aim of this article was to describe the components of this innovative telepharmacy program, including descriptive, qualitative, and exploratory data demonstrating the impact of the program in the health care setting.

Practice setting

Ascension Texas is a large not-for-profit network of 12 hospitals encompassing more than 1500 beds, 4 teaching hospitals, and more than 100 clinical locations across central Texas. The pharmacy model across all facilities consists of both a centralized and decentralized model encompassing staff pharmacists, clinical staff pharmacists, clinical pharmacy specialists, pharmacy technicians, and management staff. The telepharmacy medication history program is located at the Goodhealth Solutions center, an integrated solutions center focused on care coordination and resource optimization. The Goodhealth Solutions Center provides several services, including (1) telemedicine, (2) a digital clinic providing care via secure mobile applications, (3) remote monitoring for chronic conditions, (4) health education and screenings, (5) nurse triage, and (6) centralized scheduling.

Practice description

In 2008, the pharmacy department had 14 full-time site-based pharmacy technicians to conduct medication histories in the EDs at 3 primary locations—Seton Medical Center Austin (SMCA), Seton Northwest (SNW), and University Medical Center Brackenridge (UMCB)—as well as the SMCA surgery department.

In the summer of 2014, because of an organizational realignment, the pharmacy department had to eliminate the site-based medication history program. The number of pharmacy technicians was reduced to 4 full-time employees and the medication history program was consolidated into a centralized call center model (Figure 1). With this new model the front-line nurses were charged with collecting medication histories for all noncomplex patients. The pharmacy technicians' responsibility at the call center was to focus only on patients with complex medication histories. Complex was defined as those patients in whom the patient's physician or retail pharmacy would need to be contacted, the number of medications exceeded 25, or the medication list contained intravenous items.

With implementation of this nurse-driven model, the number of completed medication histories started to decline despite communication and education efforts aimed to increase use of the call center. At one site, the medication history completion declined from 74% to 21% in 6 months. Lack of completed medication histories in the ED increased the possibility of medication errors. To address this challenge, the pharmacy leadership, together with nursing, quality, and telemedicine, brainstormed a unique and novel approach to conduct medication histories in the ED with the use of telepharmacy. With the aid of videoconferencing equipment, pharmacy technicians

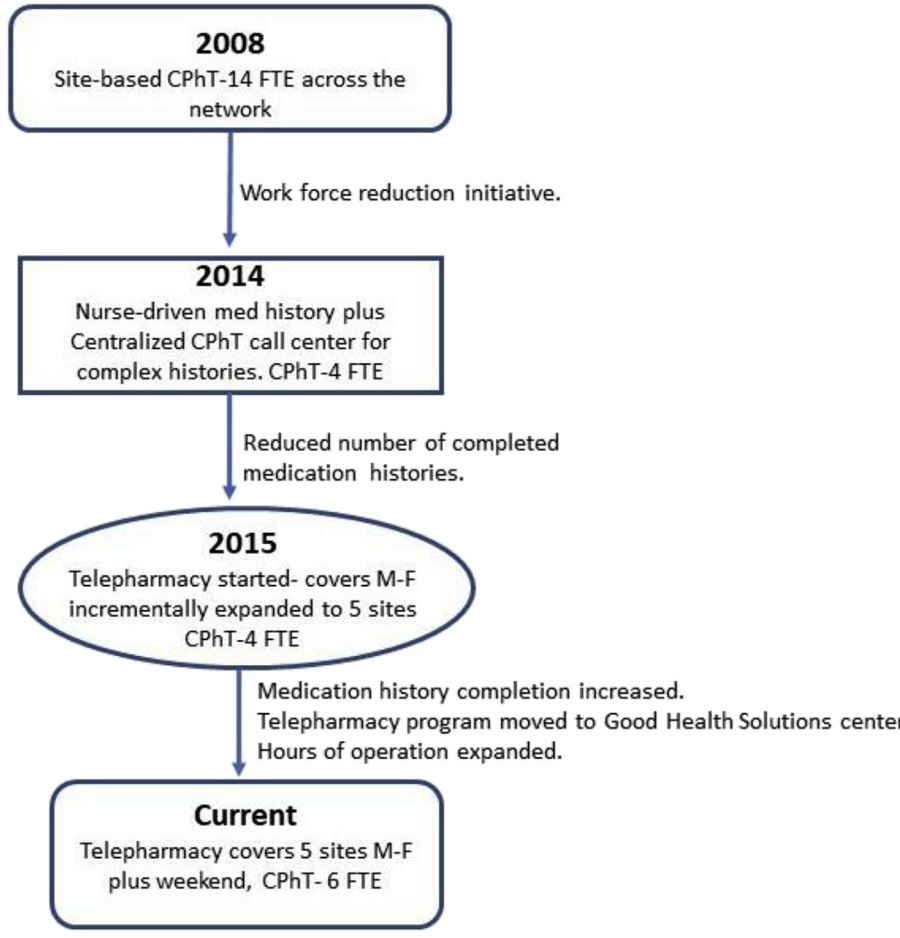

Figure 1. Development and expansion of the telepharmacy medication history program. Abbreviations used: CPhT, certified pharmacy technician; FTE, full-time equivalent; M-F, Monday through Friday.

would be able to remotely observe, interview patients, and obtain completed medication lists for patients being admitted in the ED.

In June 2015, the telepharmacy pilot program was initiated in the SNW ED as a pharmacist-led, pharmacy technician–driven telepharmacy service. The service was offered Monday through Friday from 8 a.m. to 11 p.m. and was staffed by 4 full-time certified pharmacy technicians. The preliminary results from the SNW pilot supported a comprehensive plan for implementation of the program at other sites. The program was expanded to SMCA in August 2015, UMCB in March 2016, Seton Medical Center Hays in November 2016, and Seton Medical Center Williamson in September 2017 (Figure 1). Hours of operation were expanded to allow for weekend coverage.

The medication history program is currently staffed by 6 full-time certified pharmacy technicians. Hours of operation are 7 a.m. to 11:00 p.m. Monday through Friday and 11:00 a.m. to 7:30 p.m. on Saturday and Sunday. The hours of operation were determined based on staffing resources and timing of higher rates of admissions within the ED setting.

Practice innovation

Videoconferencing equipment was installed on computers attached to mobile carts stationed in the ED at the 5 hospital sites. Medication histories are conducted with the use of the video conferencing equipment. This technology allows the technicians to complete medication histories from a remote central location. The technicians can observe multiple EDs at one time, interview patients through videoconferencing, and document completed medication histories in the electronic medical record (EMR). Patients are identified by means of the bed board transfer system within the EMR. Physicians enter an admission order, which signals an icon change via the bed board indicating that the patient is to be admitted. The technicians then call the ED to have the mobile cart moved into the patient's room for medication history completion. The medication lists are then entered into the EMR for the admitting physician. The technology allows patients to show the list and labels of the medications used at home. The technicians have access to an external prescription database via the EMR that allows them to (1) view prescription fills at retail establishments over the previous 18 months, (2) compare those fills to the lists gathered from the patient, and (3) reconcile any discrepancies. The technicians will call outside pharmacies or physician offices to clarify medication discrepancies when needed. The technicians document the sources used to gather the medication history and reasons for incomplete information in the EMR. In addition, the technicians transcribe preoperation (pre-op) medication lists for patients being admitted for

surgeries at SMCA. The pre-op medication lists are faxed electronically and transcribed into the EMR to ensure that the patient's updated medication list is available for the nurse and physician on the day of surgery. The technicians operate from desks with the use of headsets and privacy screens to enhance the security of patient information. The technicians are trained on EMR functionality and technology troubleshooting. The ED staff is also trained on mobile cart and videoconferencing troubleshooting and integration into the workflow. The program is overseen by a pharmacist. The pharmacist provides direct oversight to all 6 full-time technicians, including training, general personnel management, quality assurance, and reporting of outcome measures. Several documents have been developed to ensure that competency is assessed and technicians are appropriately trained to conduct medication histories.

To assess competency, technicians are required to complete online training including a medication history instructional module. The competencies must be completed during new employee orientation and then annually for continuous education and training. New technicians are required to complete training and show proficiency, as approved by a pharmacist, before conducting interviews independently. A competency checklist has been developed to aid medication history technicians in their performance. The checklist includes items such as interviewing techniques to obtain the most accurate medication history (e.g., use of open-ended questions). Proficiency, accuracy, and continuing education are assessed periodically by the supervising pharmacist.

Practice evaluation

Primary, secondary, and exploratory outcomes were collected for evaluating this unique program. The primary outcome was the rate of medication history completion by pharmacy technicians. Rates are reported monthly. The secondary outcomes assessed were (1) barriers for completing medication histories and (2) potential errors prevented among high-risk medications. Barriers were identified by the technician at the time the medication history was being collected. The barriers were documented in an Excel spreadsheet and then categorized and trended over time to determine gaps in care and potential room for improvement.

Potential errors prevented were collected to show the potential errors that could be carried over if a medication history is not completed on admission. High-risk medications were defined as drugs causing hospitalizations, prolonged hospitalizations, life-threatening conditions, fatalities, or disability as a result of medication errors.[28] The authors focused on potential errors among high-risk medications, because reports show that fewer than 1% of all medication errors may cause harm and may not affect clinical outcomes, and that most fatal events and serious medication errors occur among high-risk medications.[28,29] The method used for identifying potential errors was as follows: The technicians reviewed the medication list from the previous admission, external prescription history, and patient reported list, reconciling any discrepancies. The discrepancies or potential errors were then classified into 5 categories: extra, omitted, duplicate, incomplete, incorrect entries, and other reason.

Table 1
Frequency of potential errors with high-risk (HR) medications

Error type	n	%
HR incomplete	104	33%
HR omitted	85	27%
HR extra	59	18%
HR incorrect	58	18%
HR other[a]	12	4%
HR duplicate	2	1%
Total	320	100%

Data collected from December 2016 to March 2017 including 124 patients in the ED.
[a] Other: allergies or intolerances to the medication listed.

To justify additional resources for this program, the following exploratory measures were assessed as well: (1) medication history accuracy rates for nursing and pharmacy technicians and (2) a cost analysis of preventable ADEs. The accuracy and efficiency of nursing versus pharmacy technicians were analyzed to determine the cost-effectiveness of expanding the program versus additional education and training of nursing staff to increase medication history completion. Time to completion of the medication history was conducted by means of direct observation of the nurse or pharmacy technician and a stopwatch. Accuracy was determined by reviewing documented medication histories completed during direct observation for identifiable errors, including review of external prescription history, physician notes, and reinterviewing the patient. Accurate completion of the medication history was defined as correctly entering all of the following parameters into the EMR: drug name, strength, route, dose, frequency, compliance, and last dose taken. The direct observation and time to completion were conducted by a clinical quality improvement advisor, and the accuracy review was performed by an internal medicine clinical pharmacy specialist and an ambulatory care clinical pharmacy specialist. The categories of medication discrepancies included a drug omission, a drug commission, an incorrect or missing drug, an incorrect or missing dose, an incorrect or missing frequency, or compliance information missing.

In addition, a cost analysis centered around preventable ADEs was performed to justify additional resources for

Table 2
The most common high-risk medication categories associated with potential errors

Category	n	%
Cardiovascular	165	43%
Opioids	55	14%
Hypoglycemic	40	10%
Antibiotics	25	7%
NSAIDs	24	6%
Benzodiazepines	18	5%
Steroids	19	5%
Anticoagulants	10	2.6%
Immunomodulating	7	2%
Antiviral	6	2%
Antiepileptics	5	1%
Chemotherapy	4	1%
NTI	4	1%
Total	382	100%

Abbreviations used: NSAIDs, nonsteroidal anti-inflammatory drugs; NTI, narrow therapeutic index drugs (theophylline and lithium).

Table 3
Medication history accuracy by discipline

Position	Number of charts reviewed	Average time to complete medication history[a]	Medication history accuracy[b]
RN	27	12–26 minutes	0–50%
CPhT	19	9 minutes	85%

Abbreviations used: CPhT, certified pharmacy technician; RN, registered nurse.
[a] Time to completion measured by means of direct observation and a stopwatch.
[b] Accuracy determined by a clinical pharmacist reviewing documented medication histories for identifiable errors, including review of external prescription history, physician notes, and reinterviewing the patient.

expansion of this unique service. The analysis included average number of medication errors per patient, potential medication errors avoided, number of harmful medication errors avoided, and estimated cost per harmful error. Both direct observation and literature review were used to determine the average number of medication errors per patient and percentage of medication errors that were potentially harmful to the patient during hospitalization.

Practice implication

After initiation of this program, medication history completion rates improved and continue to increase. A retrospective review indicated in fiscal year (FY) 2016 that 9835 medication histories were conducted by the pharmacy technicians during hours of operation. With continued expansion of the service 18,722 medication histories and pre-op lists were entered in FY2017 and 24,980 medication histories plus pre-op lists were entered in the EMR in FY2018. Currently the percentage of ED admissions with medication histories conducted by the telepharmacy medication history program ranges from 56% to 79%, depending on the site.

The major barriers to completing medication histories via telepharmacy were (1) the timing or efficient mobilization of the carts into the room before patient being moved, (2) ED phone not being answered in a timely manner, and (3) lack of 24/7 medication history technician coverage. Initially, the telepharmacy program led to increased requests for ED personnel to have the mobile carts moved. Not moving the carts in a timely manner, owing to the high task load and complex workflows in the ED, became a challenge. To mitigate these problems, pharmacy engaged the ED medical, nursing, and support staff and provided frequent communication regarding the positive impact of completed medication histories by dedicated medication history technician staff.

A cross-sectional analysis with the use of a convenience sample of medication history data collected from December 2016 to March 2017, including 124 patients, revealed 320 potential errors among a total of 382 high-risk medications. This equates to more than 80% of high- risk medications representing a source for potential error. Most of these potential errors were due to incomplete entries (33%) and omitted entries (27%; Table 1). The most common high-risk medication categories associated with potential errors included cardiovascular drugs, opioids, and hypoglycemic drugs (Table 2).

Results from the exploratory analysis revealed that the pharmacy technicians were both more accurate and more efficient when conducting medication histories (Table 3). In addition, safety and cost analysis data favored the expansion of the program (Table 4). In summary, when considering the potential medication errors avoided, estimated cost per error, pharmacy technician productivity, and the average salary cost, the estimated total annual net savings of the virtual medication history service would be approximately $5 million. Given this, 2 additional full-time medication history technician positions were approved to continue expansion.

Discussion

Obtaining a medication list becomes another burden for physicians and nurses, adding to an already overwhelming list of tasks when assessing a patient.[31,32] There have been studies showing that pharmacy staff perform medication histories more accurately than any other health care professional.[14,32-35] The telepharmacy program at Ascension Texas was developed to address a medication safety issue with limited resources. The motivation for this program was the inconsistent and ineffective use of resources to reliably conduct accurate medication histories, demonstrated by the sharp decline in medication history completion rates after removal of the site-based ED technicians and institution of the nurse-driven program. So far, the program has shown a positive impact on medication history completion rates in a limited-resource environment. This program incorporates a novel strategy using telepharmacy from a centralized remote location to conduct medication histories by trained pharmacy technicians with pharmacist oversight. Currently, the telepharmacy medication history technicians complete more than 24,000 medication histories per year across 5 large facilities as well as pre-op surgery lists. This novel strategy has allowed for wider coverage with fewer resources. By using telepharmacy and monitoring via the bed board tracking

Table 4
Safety and cost analysis of the telepharmacy medication history service

Average number of med errors per patient[a]	1.08
Number of inpatient admissions from ED per year (FY2016 admissions)	39,149
Potential med errors per year that can be avoided	42,160.46
Percent of discrepancies or medication errors that were potentially harmful to patient during hospitalization[a]	3.73%
Number of harmful medication errors avoided per year	1572.59
Annual gross savings to hospital ($3408 per harmful error)[b]	$5,359,370.41

Abbreviations used: ED, emergency department; FY, fiscal year.
[a] 2016 medication history data.
[b] Calculated as number of avoidable harmful med errors per year × $3408 per acceptable daily exposure.[30]

system, the 6 technicians can monitor more than one site at any given time and have demonstrated completion rates of 56% to 79% for ED admissions during hours of operation. Cooper et al. described using 27.5 full-time technicians to cover a 5-hospital system.[25] Although in that system they conducted medication histories for all direct and indirect admissions across the health care system, the use of a telepharmacy approach could potentially decrease the number of full-time technicians needed to conduct that work. The original program instituted at Ascension Texas, before the reorganization, employed 14 full-time technicians and covered only 3 sites with more limited hours of operation. With the use of technology, the telepharmacy medication history program has demonstrated the ability to continually increase medication history completion rates across 5 sites with the use of only 6 full-time technicians. In addition, by maximizing the current technology platform with the use of the standard desktop computer and mobile carts already located in the ED and reconfiguring them with videoconferencing equipment, resources needed for the telepharmacy program were kept at a minimum and allow for generalizability within similar sites across Ascension Texas.

Furthermore, the telepharmacy technicians demonstrated high rates of accuracy (85%), which is consistent with a previous successful site-based program using pharmacy technicians to collect medication histories in the ED.[14] Hart et al. reported that trained pharmacy technicians demonstrated accuracy rates of 88% compared with nursing accuracy rates of around 50%.[14] Accurate medication reconciliation must occur at 2 pivotal time points on the patient's care continuum: hospital admission and discharge. If a patient is admitted to the hospital from the ED with an inaccurate or incomplete medication history, the potential medication discrepancies may be carried through to discharge. A previous study found that remote review by a telepharmacy service led to the identification of approximately 20% of patients in a rural hospital with 1 or more medication errors.[36] In addition, high-risk patients or patients with 5 medications or more may require further review, as described by Kramer et al., who reported that pharmacy's involvement in medication history and reconciliation prevented the greatest number of medication errors, leading to a substantial cost avoidance savings of $589,744.[32] A previous study reported that the per—preventable ADE cost in the inpatient setting of a multicenter community hospital was $4263, and that equated to approximately $5.6 million associated with preventable costs annually.[37] Similar cost savings were estimated within Ascension Texas. When determining the cost-effectiveness of the current program it was estimated that more than 1500 medication errors could be prevented across the Ascension Texas system, equating to more than $5 million in cost avoidance. There is limited knowledge evaluating the place of documented remote pharmacy interventions in a telepharmacy service model across the quality of care continuum.[38] Although this program is unique in its delivery, similar findings of medication discrepancies being identified during the medication history completion phase have been described. Sachita et al. described identifying 1748 errors, indicating the need for a more robust medication history collection process.[24]

In turn, determining the impact of these interventions on successful TOC would be instrumental in expansion of this service. TOC involves the coordination and continuity of health care as patients transfer between different settings.[1] Accurate detection of medication discrepancies during admission would also provide a better medical record and updated source of information for the primary care provider in preparation for patient discharge. At least 50% of discharge discrepancies are associated with admission discrepancies.[32,39-41] Failure to provide effective TOC is a major risk factor that results in readmissions to the hospital.[20,42-45] The transition between inpatient and community settings is prone to medication errors related to a lack of communication between health care providers, missed patient follow-up, inadequate patient education, incomplete medication reconciliation, and the absence of patient involvement in medication management.[5,44,46-48] Inconsistent care coordination contributes to the readmission of 20% of patients within 30 days of discharge and 34% within 90 days, correlating to an associated annual cost of $17.4 billion for unplanned readmissions.[44] Interest in preventing readmissions has grown since the Centers for Medicare and Medicaid Services (CMS) has imposed financial penalties on hospitals with high 30-day readmission rates.[49] Therefore, it is imperative to implement a better TOC program to ensure that hospitals are reducing the amount of medication errors and preventable ADEs. Obtaining the best medication history is an important piece of the medication reconciliation process. When the medication history is missing, incomplete, or incorrect, this may have a negative impact on the patient's admission and post-discharge medication reconciliation process. This in turn can lead to inadequate TOC and medication errors. Using innovative means, such as telepharmacy, to deliver this service would help to expand and cement pharmacies' role in this process. Pharmacy personnel can and should take a more active role in improving medication safety during care transitions. A best practice policy on continuity of care is to "recognize that continuity of patient care is a vital requirement for appropriate use of medications."[12]

Despite the success of the telepharmacy program, challenges still exist within our institution. Improvement of the ED workflow is an ongoing process. The aim is to optimize telepharmacy cart movement and be able to capture most, if not all, patients being admitted in the ED. In addition, strategies are being evaluated to provide this telepharmacy service to all direct admissions, not just in the ED. This will require additional resources and equipment.

Conclusion

The completion of medication histories via telepharmacy by a pharmacy technician is a novel approach that incorporates virtual services with limited resources. By using technology, the pharmacy technicians are able to provide this service to more health care sites, thus increasing the medication histories completed across the Ascension Texas network. This service demonstrates the importance of leveraging technology to expand pharmacy services in a complex and often financially constrained area of care. A future direction, other than service expansion, is to assess the impact of this telepharmacy service on reduced adverse events and readmission rates to aid in the demonstration of the pharmacy profession's value in performing these essential services and providing a better patient TOC between the community setting and the hospital.

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