Effective medication management is critical to successful patient outcomes. Pharmacists and pharmacy technicians working within North Carolina Health Systems provide a variety of services that aid in those successful outcomes. By leveraging the North Carolina Clinical Pharmacist Practitioner designation along with integrated health records, health system pharmacists are uniquely positioned to provide expert clinical support to patients. Services such as medication history collection, discharge medication dispensing and counseling, post discharge clinic engagement, and drug therapy management are all components of an even larger number of strategic health system pharmacy assets that aid in the care of patients whether they are admitted to hospitals, seen in clinics, or cared for in the community.

With the advent of population health management and the shift towards value-based payment models, successful transitions of care from one care setting to another are becoming more important than ever. According to the Agency for Healthcare Research and Quality, nearly 1 in 5 hospital patients covered by Medicare are readmitted within 30 days, accounting for $15 billion a year in added health care costs [1].

Proper medication management is crucial to care transition, but can be costly if mismanaged. It is estimated that over 60% of medication errors occur during times of care transition [2]. As medication experts, pharmacists have a responsibility to provide counseling and sufficient medication reconciliation throughout the spectrum of care. However, pharmacists are currently underused in this regard [2, 3]. A review of pharmacists' services in US hospitals revealed only 5% performed admission histories, and only 49% provided medication counseling. The opportunity for pharmacist-driven improvements in quality and cost-effective outcomes is evident in a recent single-center prospective cohort study of readmission rates. Over a year's time, a pharmacist was involved in the education of over 1,000 patients and performed 452 documented interventions [2]. Readmission rates were significantly lower in those patients that received discharge education compared to those that did not. Starting an omitted medication, preventing multiple discharge problems, avoiding duplication of therapy, and correcting insurance issues related to medication coverage were the most common pharmacist interventions in the study [2].

Pharmacists have been a valued part of the health care team; as the landscape of health care shifts, they are uniquely positioned to advance effective medication management and use.

**Pharmacy Practice**

*Traditional Role*

The pharmacists’ traditional roles of acquiring, storing, preparing, and dispensing medications and counseling patients on prescriptions remain the core of the profession. Many aspects of the prescription process are now carried out by supportive personnel, referred to as pharmacy technicians. Technicians manage the supply chain and prescription preparation, utilizing automated dispensing systems whenever possible. Today, technicians have a significantly expanded role. They interview patients to obtain medication histories, facilitate patient access to medication through patient assistance programs, and coordinate prior and continuing authorization for medications. Technicians are typically based in a pharmacy but may also be deployed directly to inpatient areas, as well as clinics. Pharmacists supervise the support staff and assure medications are dispensed in a safe and effective manner.

**Where Health System Pharmacists Practice**

Pharmacists practice in all segments of the health care system (see Figure 1). In addition to traditional centralized main health system pharmacies and satellite pharmacies, dedicated staff are located in a number of inpatient clinical areas (e.g., critical care, oncology, pediatric, and perioperative units) to support today’s increasingly complex and specialized medication therapy. Due to the complexity of medications administered and control requirements (e.g., temperature, sterility, dosing accuracy), pharmacies that serve inpatient operating rooms and ambulatory surgery centers are now common. Pharmacists are deployed...
to patient care units and rounding teams, and work closely with providers in therapeutic decision-making, monitoring, and managing drug therapy. Pharmacists deployed in this manner may order medication as well as review and verify the medication orders of providers and mid-levels (ie, nurse practitioners and physician assistants).

In the ambulatory environment, pharmacies and staff are deployed to a variety of areas such as clinics, oncology and non-oncology infusion centers, and ambulatory surgery centers. In the clinic setting, pharmacists consult with providers, educate patients, and manage assigned patients through clinic visits or telephonic/electronic means. In addition, many health care systems own and operate their own retail and specialty pharmacies.

Pharmacists are also employed by insurance companies and prescription benefit managers with primary responsibility for a plan’s formulary, prior authorization program, utilization evaluation, and provider correspondence. As continuing care networks have evolved into population health management organizations (PHMOs), the pharmacist’s role in assuring safe and effective drug therapy has expanded. In addition to maintaining the PHMO’s medication management programs for all patients, pharmacist resources are dedicated to closely managing medication therapy for complex and higher-risk patient populations.

Impact on Interdisciplinary Teams and Patient Care Services

As health systems’ knowledge and understanding of optimal care models evolves, evidence mounts for the inclusion of pharmacy staff in transitions of care [4, 5]. Organizations that have added pharmacists and pharmacy technicians to key transitional care roles have greatly benefitted from being able to offer a variety of strategic pharmacy assets that support a strong continuity of care plan.

Pharmacists and/or pharmacy technicians are now being positioned at key points of entry (eg, emergency departments, pre-arrival clinics) to perform medication histories and reconcile those histories with what is intended to be administered during the acute care stay to avoid disruptions in therapy, incorrect dosing, or duplicate therapy. This effort supports nurses, physicians, and other providers by freeing their time to focus on other direct patient care activities. Studies have shown a higher accuracy of medication reconciliation when performed by pharmacists and/or pharmacy technicians [6, 7].

Pharmacy staff have long been a part of care teams in hospitals. Pharmacists embedded within these care teams are able to recommend safe and effective therapies for the circumstances that initially led to the admission while ensuring that new medications do not adversely interact with medications patients may already be taking. Pharmacist participation ranges widely from being available for consult to being present for patient care rounds. Services can include drug therapy selection, dosing, monitoring, and proactive review of discharge medications along with drug therapy counseling to ensure that patients safely transition to the post-acute environment. Pharmacists in these roles not only facilitate positive patient outcomes and avoid adverse events, but may also reduce costs associated with drug therapies [8].

A number of studies have shown that patients do not regularly get their prescriptions filled [9-11]. Reasons may include affordability, distance of travel from the hospital, discharge time in relation to retail pharmacy hours, and lack of medication availability, especially if the medication is considered a specialty medication. Considering these issues along with the Affordable Care Act’s focus on reducing readmissions, it’s important that health systems have a strategy for ensuring that patients have their medications in-hand at the time of discharge.

Health systems in North Carolina are utilizing their own retail pharmacies to improve continuity of care by providing outpatient medications to their own patients. Health system-owned retail pharmacies ensure a tight ecosystem of patient care. By knowing what medications were provided to patients during an acute care visit, what medications were intended for post-acute care, and/or what medications patients were on prior to an acute care event, providers are better able to ensure that medication therapies are fully maximized.

Along with ensuring continuity of care, a growing trend for health systems is to offer concierge-style, at-bedside delivery of prescription medications to patients immediately prior to discharge. The planning and execution of this type of service requires a strong multi-disciplinary approach. When implemented effectively, a coordinated pharmacy process results in patients acquiring critically needed prescription medications in a safe and convenient manner.

Likewise, health systems can offer advanced clinical pharmacy services that include calls by pharmacists or pharmacy technicians to patients to ensure that the patient has not experienced any adverse events with regimen adjustments (eg, new therapies or dosage adjustments). By knowing when medications were dispensed to patients, health systems may also proactively call patients prior to their next refill to ensure that essential medications have been taken appropriately across the last refill period. These check ins help to ensure medication compliance and are especially helpful with older adults. Within the context of electronic health records and multidisciplinary teams, these pharmacy service offerings may make the difference for positive patient outcomes.

A growing barrier to accessing outpatient medication therapy is the predominance of pre-certifications for infusions and prior authorizations for oral and self-injectable therapies. Insurance companies have implemented these mechanisms in response to the rapidly rising cost of many pharmaceuticals and to ensure that medications are in fact being prescribed in a manner consistent with the insurer’s pharmacy benefit plan. Health systems have responded
to this trend by engaging their own pharmacists and pharmacy technicians to work with providers on behalf of their patients to ensure that critically important medications have appropriate approvals in place before administration or dispensation. In many cases, these services prevent delays in treatment, avoid costly out of pocket expenses for patients, ensure that patients are not lost to follow up, and result in better patient satisfaction.

**North Carolina Clinical Pharmacist Practitioner**

The Clinical Pharmacist Practitioner (CPP) designation allows pharmacists in North Carolina to provide pharmaceutical care that improves direct patient care outcomes and increases patient awareness of pharmaceutical care services.

In North Carolina, a CPP can independently provide drug therapy management and implement pre-determined drug therapy through a collaborative practice agreement under the supervision of a licensed physician. These collaborative practice agreements reduce fragmented care and allow CPPs to be recognized as providers and leaders within the interdisciplinary team. Studies have shown that successful implementation of collaborative practice agreements can save on overall health spending, improve patient health, and increase preventative care. For instance, a CPP may conduct face-to-face visits with patients to manage a variety of chronic disease states such as anticoagulation, diabetes, hypertension, and complex medication management. CPPs may also manage certain chronic disease states and other initiatives such as transitions of care services by telephone, thus freeing up time for a patient's primary care provider to focus on other disease states and outcomes.

Many health systems in North Carolina have begun to utilize the CPP designation to leverage pharmacists as licensed independent practitioners. With the CPP designation, pharmacists can act as a critical component of the interdisciplinary team. Thus far, CPPs have primarily been used in the ambulatory environment as physician extenders. The CPP can focus on patients' medication needs whether they are considering new therapy, performing medication therapy management assessments, or ensuring therapy compliance with high cost treatment regimens. Oftentimes, this frees up the primary care provider or specialist to see more new patients while the CPP is able to focus on established patients and reduce the potential for readmissions. In one study, pharmacist involvement with patients in a family medicine clinic following patient discharge was shown to reduce ED visits and readmissions by 25% [12].

**Electronic Health Records**

Certainly, utilizing the electronic health record within a health system is a powerful tool when interdisciplinary teams are coordinating the various needs of a single patient throughout various care environments. Pharmacists in health systems actively contribute to clinical notes within patients’ electronic charts while the patient is both within the hospital and in the ambulatory environment. These notes may include recommendations for therapy in relation...
to a patient’s disease state(s) (eg, recommendations to add, delete, or modify therapies), an update on the status of prior authorizations/pre certifications, or results of therapeutic outcomes. This information can then be utilized by other licensed providers on the multi-disciplinary team for the ongoing care of their patients.

**Population Health**

Further, pharmacists working within the area of population health on behalf of a health system are able to leverage medication therapy information at an aggregated level. This combined data allows population health pharmacists to identify patients who are at moderate or high risk for acute care admissions. This data also alerts pharmacists to other concerns such as patients being prone to non-compliance for self-administration of medications. For example, aggregate data may include information on prescription refills as a surrogate for compliance, medications that are prone to cause drowsiness and result in falls, or medications that are not prescribed in accordance with current evidence based medicine. Population health pharmacists work with other care team members such as a primary care providers to decrease medication related problems, reduce the use of high risk medications, and be a liaison with Accountable Care Organizations/health plans to reduce out-of-pocket expenses and/or reduce per-member per-month spending.

As transitions of care have been identified as a potential source of poor patient outcomes, health systems have supported the evolution of the role of pharmacists and pharmacy technicians within multi-disciplinary services. These services have led to positive patient outcomes. 

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**References**

1. Steiner C. New AHRQ Database Tracks Hospital Readmission Rates. Agency for Healthcare Research and Quality website. http://www.ahrq.gov/news/blog/ahrqviews/112015.html. Reviewed November 2015. Accessed April 10, 2017.
2. Balling L, Erstad BL, Weibel K. Impact of a transition-of-care pharmacist during hospital discharge. J Am Pharm Assoc. 2015;55(4):443-448.
3. Rochester-Eyeguokan CD, Pincus KJ, Patel RS, Reitz SJ. The current landscape of transitions of care practice models: a scoping review. Pharmacotherapy. 2016;36(1):117-133.
4. Gillespie U, Alassaad A, Henrohn D, et al. A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: a randomized controlled trial. Arch Intern Med. 2009;169(9):894-900.
5. Schnipper JL, Kirwin JL, Cotugno MC, et al. Role of pharmacist counseling in preventing adverse drug events after hospitalization. Arch Intern Med. 2006;166(5):565-571.
6. Reeder T, Mutnick A. Pharmacist-versus physician-obtained medication histories. Am J Health Syst Pharm. 2008;65(9):857-860.
7. Nester TM, Hale LS. Effectiveness of a pharmacist-acquired medication history in promoting patient safety. Am J Health Syst Pharm. 2002;59(22):2221-2225.
8. Chisholm-Burns MA, Graff Zivin JS, Lee JK, et al. Economic effects of pharmacists on health outcomes in the United States: a systematic review. Am J Health Syst Pharm. 2010;67(19):1624-1634.
9. Kennedy J, Tuleu I, Mackay K. Unfilled prescriptions of medicare beneficiaries: prevalence, reasons, and types of medicines prescribed. J Manag Care Pharm. 2008;14(6):553-560.
10. Tamblyn R, Egual T, Huang A, Winslade N, Doran P. The incidence and determinants of primary nonadherence with prescribed medication in primary care: a cohort study. Ann Intern Med. 2014;160(7):441-450.
11. Solomon MD, Goldman DP, Joyce GF, Escaicel JJ. Cost sharing and the initiation of drug therapy for the chronically ill. Arch Intern Med. 2009;169(8):740-748.
12. Cavanaugh JJ, Hawes EM, Pinell NR, et al. Advancing Pharmacy Practice through an Innovative Ambulatory Care Transitions Program. American Society of Health-System Pharmacists website. http://www.ashpadvantage.com/bestpractices/2014_papers/Univ-of-North-Car.htm. Accessed February 22, 2017.