

Oncology Pharmacists Bring Value and Contribute to Cancer Care

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KEY FINDINGS

Pharmacists have been involved in cancer care for more than 70 years.¹ Oncology pharmacists now permeate every aspect of oncology care. Some of their roles are highly visible to patients and the health care community; however, others are less well recognized. Oncology pharmacists are as diverse as the cancers they manage and have key roles in the following areas of the cancer care continuum:

1. Infusion center or decentralized hospital pharmacist
2. Inpatient clinical pharmacist
3. Practice manager
4. Ambulatory care pharmacist
5. Specialty pharmacist
6. Managed care
7. Academia

The vision of the Hematology/Oncology Pharmacy Association (HOPA) is that all individuals affected by cancer have a hematology/oncology pharmacist as an integral member of their care team.² Oncology pharmacists are making this happen in a variety of ways, but as explained by Larry Buie, PharmD, BCOP, FASHP, President of HOPA, “Many patients still don’t know that an oncology pharmacist is actually on their team.”

This is, in part, because many of the functions an oncology pharmacist performs are less visible to patients and health care stakeholders. Nevertheless, oncology pharmacists can add tremendous value to cancer care in multiple ways. The nuances within their practices and skill sets create diversity in the educational needs for oncology pharmacists practicing in a variety of different roles. “It’s difficult for me to imagine any part of cancer treatment today that could exist without the work of our pharmacy professionals,” said Justin Klamerus, MD, MMM, President of Karmanos Cancer Hospital, Network & Specialty Pharmacy. “With the growing number of therapeutic options available to patients with cancer, the role of the oncology pharmacist is only increasing over time.”

Introduction

A common misconception is all oncology pharmacists do the same thing. In fact, there are multiple unique and critically important roles for pharmacists providing cancer care. As pharmacists have been involved in the care of patients with cancer for multiple decades, their roles have continued to evolve to meet needs related to the growing complexity of therapies and the health care landscape in collaboration with multidisciplinary oncology teams and their patients.^{1,2} A systematic literature evaluation by Segal and colleagues highlighted 66 peer-reviewed studies that validate positive outcomes in 4 key areas of care provided by an oncology pharmacist.³ This white paper will detail 7 distinct roles and numerous, often unrecognized ways oncology pharmacists add value to cancer care.

Pharmacists can play a key role in oncology decision making alongside physicians, patient advocates, and advanced practice professionals (APPs). The total number of oncology pharmacists across the country is difficult to capture, as not all oncology pharmacists pursue board certification in oncology.⁴ As of 2021, the Hematology/Oncology Pharmacy Association (HOPA) included approximately 3000 members.⁵

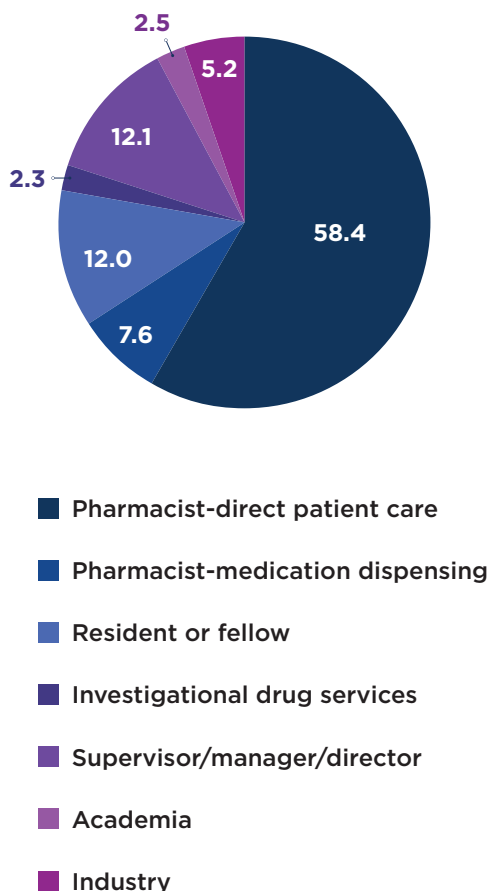
Oncology pharmacists practice in a variety of roles (FIGURE 1⁶) and diverse work locations (FIGURE 2⁷). William Soliman, PhD, BCMAS, Founder and CEO, Accreditation Council for Medical Affairs (ACMA), contextualized the evolution of oncology care providers, saying, “In the past 15 years, there’s been an increasing diversity and complexity of pooled stakeholders.”

Pharmacists work in a variety of roles in oncology pharmacy, many of them without specific training in oncology. Colleges of pharmacy provide a median of 42 hours didactic oncology coursework.⁸ In addition, approximately 15% of students take a required or elective oncology Advanced Pharmacy Practice

SEO keywords

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FIGURE 1. ROLE OF ONCOLOGY PHARMACISTS IN THE HEMATOLOGY/ONCOLOGY PHARMACY ASSOCIATION⁶



Experiences typically lasting 4 to 6 weeks.⁸ Pharmacists may elect to pursue additional training through a Post Graduate Year (PGY) 1 Pharmacy Practice Residency and/or PGY2 Oncology Pharmacy Residency. As of May 31, 2022, there were 122 PGY2 Oncology Pharmacy Residency programs and over 200 oncology pharmacist residency positions in the United States listed in the American Society of Health-System Pharmacists (ASHP) Residency Directory.⁹ These experiences are organized, directed, accredited, 1-year programs that build upon knowledge, skills, attitudes, and abilities gained from

an accredited professional pharmacy degree program.¹⁰ In the experience of Leigh Boehmer, PharmD, BCOP, Chief Medical Officer, Association of Community Cancer Centers, “Far more often than not, you will not have a PGY2-trained board-certified oncology pharmacist (BCOP) in a community oncology practice. More likely,” he said, “you will find a PGY1-trained pharmacist or a pharmacist practicing in another area for 10 or more years who has transitioned to oncology pharmacy.”

BCOP is a credential awarded by examination to pharmacists who have demonstrated advanced knowledge and experience managing cancer-related and drug-related adverse effects (AEs) or clinical situations not encountered in other disease states due to the increasing number and complexity of drug therapies to treat and prevent cancer.¹¹ Approximately half of the HOPA membership reported achievement of BCOP.⁶ There are currently more than 3600 BCOPs, with a small percentage of those residing outside of the United States.^{11,12} Buie offered a brief definition of a BCOP, explaining, “A BCOP is often the point person for the patient who interfaces with staff working in the infusion pharmacy, pharmacists in specialty pharmacy, and with pharmacy technicians involved in prior authorization, to make sure that all of the patient care needs are met.”

Not All Oncology Pharmacists Are Created Equal

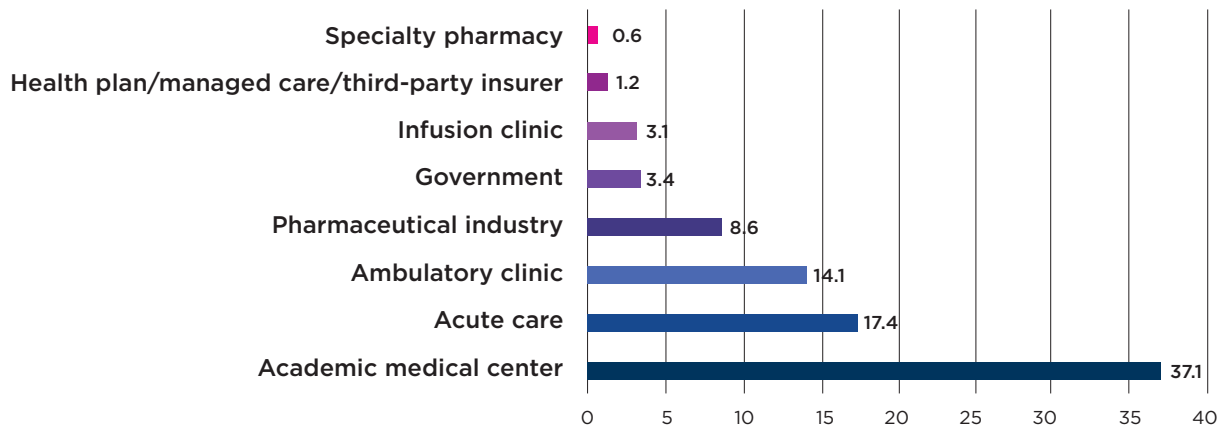
1. Infusion Center or Decentralized Hospital Oncology Pharmacist

The person most often portrayed as an oncology pharmacist is the one responsible for preparing chemotherapy for patients. Oncology pharmacists are responsible for sterile compounding of chemotherapy and ensuring the patient receives therapy appropriate for their disease indication, drug interactions have been addressed, and the dose is appropriate for the patient’s comorbidities and prior toxicity profile, organ function, and body weight.² They verify the chemotherapy and appropriate premedications have been prepared correctly by a pharmacy technician before releasing medication to the nursing staff. Pharmacists practicing in this role have often completed a competency or training program in oncology developed at their institution, and some have competed a PGY1 Pharmacy Residency.

Experts Interviewed

Leigh Boehmer, PharmD, BCOP, Chief Medical Officer at Association of Community Cancer Centers
 Larry W. Buie, PharmD, BCOP, FASHP, President at Hematology/Oncology Pharmacy Association
 Justin Klamerus, MD, MMM, President, Karmanos Cancer Hospital, Network & Specialty Pharmacy
 Emily Mackler, PharmD, BCOP, Director of POEM (Pharmacists Optimizing Oncology Care Excellence in Michigan) and Board Director, At Large at Hematology/Oncology Pharmacy Association
 MiKaela Olsen, DNP, APRN-CNS, AOCNS, FAAN, Clinical Program Director for Oncology at Johns Hopkins Hospital and Health System
 William Soliman, PhD, BCMAS, Founder, CEO, Accreditation Council for Medical Affairs

FIGURE 2. WORK LOCATION OF ONCOLOGY PHARMACISTS IN THE HEMATOLOGY/ONCOLOGY PHARMACY ASSOCIATION⁷



2. Inpatient Clinical Oncology Pharmacist

Working side-by-side with the care team in the hospital, an inpatient clinical oncology pharmacist often rounds with the medical team daily and provides medication-related services to all patients.² Often, many pharmacists serving in this role have completed both PGY1 Pharmacy Practice and PGY2 Oncology Specialty residencies and have achieved BCOP. They may perform or provide oversight for the team delivering medication reconciliation at admission and discharge. They also educate patients, verify all medication orders including those for anticancer therapy, and ensure appropriate follow-up is scheduled. Following a thorough patient review of laboratory and diagnostic data, medications, and clinical notes, they provide recommendations for changes in medications to the care team and answer drug information questions during patient care rounds.⁵ MiKaela Olsen, DNP, APRN-CNS, AOCNS, FAAN, Clinical Program Director for Oncology, Johns Hopkins Hospital and Health System, commented, “It’s so important to have our clinical oncology pharmacist on rounds on the inpatient side with their advanced knowledge to help with everything related to the care and the discharge of the patient, from toxicity management and drug-drug interactions to drug levels.”

3. Practice Management Oncology Pharmacist

While their title may vary (eg, clinical coordinators, leads, managers, assistant or associate directors, and directors), pharmacy practice managers are administrators that oversee personnel, facilities, inventory, and budgets to ensure smooth operation of the oncology pharmacy. Ambulatory operations pharmacists are frequently the decision makers within the practice, and they are involved in a variety of committees

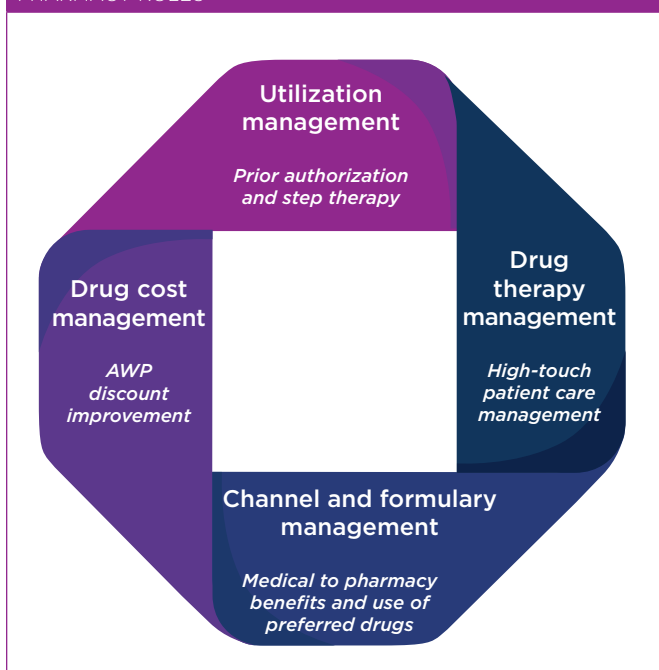
ranging from the Pharmacy and Therapeutics committee to Medication Safety and Clinical Practice committees. Olsen described them as, “The right-hand person to improve nursing workflow, patient flow, patient satisfaction, and to keep things running smoothly.”

Anticancer therapies account for 20% to 35% of nonfederal, hospital drug budgets, therefore practice management pharmacists play a key role in manufacturer and payer contracts, managing approvals of high-cost medications and reviewing the pipeline of investigational agents to determine budget impacts.^{2,13} Klamerus offered insight based on his practice, offering, “One example is the compliance and regulatory piece with the 340B Drug Pricing Program becoming more and more complex; pharmacy leadership really runs that for our health system.”

Practice management oncology pharmacists guide development and implementation of pharmacy services, guidelines, policies, and procedures including those that serve to fulfill Quality Oncology Practice Initiative (QOPI) metrics.^{2,14} Olsen shared, “Johns Hopkins is embarking upon a huge project in its cancer center in collaboration with pharmacy to move chemotherapy (high-dose methotrexate and high-dose cytarabine) to the ambulatory setting using the National Comprehensive Cancer Network toolkit.”

Pharmacy has an integral role in systems project work and quality improvement projects. “Oncology pharmacists are one of the cancer program’s single greatest assets in terms of documentation and pilot projects used for Commission on Cancer Accreditation by the American College of Surgeons because of our ability to bring people together and come up with problem statements and projects that can address site-specific

FIGURE 3. BEST-PRACTICE STRATEGIES FOR MANAGED CARE PHARMACY ROLES²²⁻²⁴



issues,” underscored Boehmer.

Leaders in this capacity often pursue a master’s degree in health care administration or business administration in addition to BCOP and completion of a PGY1 and PGY2 Oncology Pharmacy Residency training. Boehmer shared views on the oncology pharmacist. “The oncology pharmacist is the prototype of a democratic health care clinician who can pull in all of the different perspectives and value equations of the operational, clinical, and administrative C-suite teams,” he said. “They work to marry the clinical and operational aspects of oncology patient care. Take, for example, rapid-rate rituximab infusion. This improves patients’ quality of life by reducing time spent in clinic, reduces chair time and nursing time, and is really a good thing for everyone.”

4. Ambulatory Clinical Oncology Pharmacist

Not all oncologists are lucky enough to have an oncology pharmacist sitting beside them in the clinic, but those who do find enormous value in their assistance managing drug-drug interactions, adjusting doses for patients with organ dysfunction, and managing chemotherapy-induced AEs (eg, nausea/vomiting, constipation/diarrhea, peripheral neuropathy, infections).² Most pharmacists serving in this capacity have completed both PGY1 Pharmacy Practice and PGY2 Oncology Specialty residencies and have achieved BCOP.

Collaborative practice agreements are often used to delegate

prescribing privileges and laboratory monitoring to ambulatory clinical oncology pharmacists.^{15,16} In Klamerus’ practice, pharmacists have touchpoints in several areas. He shared, “We are embedding pharmacists within our ambulatory clinics for specialty medication management, not only in oncology but in neurology and even primary care.”

With the shift of almost one-fourth of all chemotherapy to oral regimens, ambulatory clinical oncology pharmacists are essential partners in patient education, routing medications to the appropriate pharmacy, managing prior authorizations, and monitoring medication adherence and patient-reported outcomes.^{15,17} Emily Mackler, PharmD, BCOP, Director of Pharmacists Optimizing Oncology Care Excellence in Michigan and Board Director, At Large, HOPA, explained this concept. In her observation, one of the biggest impacts from having an oncology pharmacist in the clinic is through enhancing patient confidence and ability for self-care management, especially with oral oncolytics and immunotherapy. “Oncology has changed over the past decade from a closed system where patients are managed in an infusion clinic by an oncologist to one with a lot of external influences, as the patient has to take medication on their own at home and their medications might come from multiple different pharmacies,” she said.

Olsen also shared the model at her institution. “The ambulatory care clinical pharmacists work closely within disease-specific teams to assess adherence and toxicities and improve outcomes in those areas, and they then coordinate filling the medication at the specialty pharmacy,” she said.

5. Specialty Pharmacy Oncology Pharmacist

Providing assistance navigating financial toxicity and monitoring patient-reported outcomes and medication adherence for patients with rare and/or complex chronic diseases is what makes a specialty pharmacist special.¹⁵ Specialty medications accounted for half of total pharmaceutical expenditures in the United States in 2020.¹³ Specialty pharmacists support prior authorization and navigate financial assistance, monitor AEs and medication adherence, and provide patient and caregiver education.¹⁸ “Pharmacists in specialty pharmacy are increasingly being depended on to be the therapeutic contact in the growing area of oral medications for cancer treatment,” emphasized Klamerus.

Specialty pharmacy services are considered a high touch point service because the pharmacy proactively connects with the patient to monitor adherence, AEs, and drug-drug interactions while ensuring on-time medication refills.¹⁹ The specialty pharmacy team helps patients who utilize multiple health care providers for comorbid conditions and have frequent

admissions and discharges from health care facilities navigate these transitions of care.²⁰

Pharmacists practicing in specialty pharmacy most often complete an internally developed training program; having a BCOP available in the organization to be involved with practice management and quality improvement for oral chemotherapy is recommended.² Pharmacists practicing in specialty pharmacy may be awarded a certified specialty pharmacist credential by examination after demonstration of intermediate knowledge and skill to provide competent specialty pharmacy services.²¹

6. Managed Care Pharmacist

Pharmacists in managed care draft strategies to optimize evidence-based prescribing, formulary management and adherence to National Comprehensive Cancer Network guideline recommendations.²² Managed care pharmacists develop and execute prior authorization and step therapy criteria, design drug benefit plans, provide medication therapy management services, and serve as medication experts to ensure high-quality and cost-effective care is provided to patients.²³ Pharmacists in managed care roles coordinate implementation of “best-practice strategies” in cancer care (FIGURE 3²²⁻²⁴).²⁴

Recent data indicate two-thirds of oncology providers sampled are using pathways or guidelines in some way to provide cancer care.²⁵ While oncology pathways may be developed by payers, health care organizations, or external vendors, all of them rely on pharmacist expertise for pathway development.

7. Academic Oncology Pharmacist

Many oncology pharmacists have a role in academia as professor or adjunct professor in a school of pharmacy or school of medicine or as an academic researcher.² These pharmacists help to expand the reach of oncology pharmacists by engaging pharmacy students and residents in the provision of pharmaceutical care for patients with cancer.²⁶ Boehmer emphasized, “At their core, virtually all oncology pharmacists are educators. They educate patients, nurses, nurse practitioners, physician assistants, medical and pharmacy students and residents, oncology fellows, and physicians.”

Oncology pharmacists serve patients with cancer in many other capacities. Their key roles include investigational drug pharmacists responsible for coordinating dispensing and appropriate use of investigational drugs in accordance with legal, professional, institutional, and sponsor requirements.²⁷ The support of an informatics pharmacist is critical to the safe and consistent provision of drug therapy.² Oncology pharmacists are also found in regulatory agencies and the

pharmaceutical industry within research and development, medical affairs, and the commercial teams; population health management; medical communications; legal offices; and national professional associations. In a humorous tone, Boehmer added, “It’s like 6 degrees of Kevin Bacon, if you look for new leadership opportunities in a parallel industry, you’ll find an oncology pharmacist.”

Specific Ways Oncology Pharmacists Add Value

Decrease Oncologist Workload

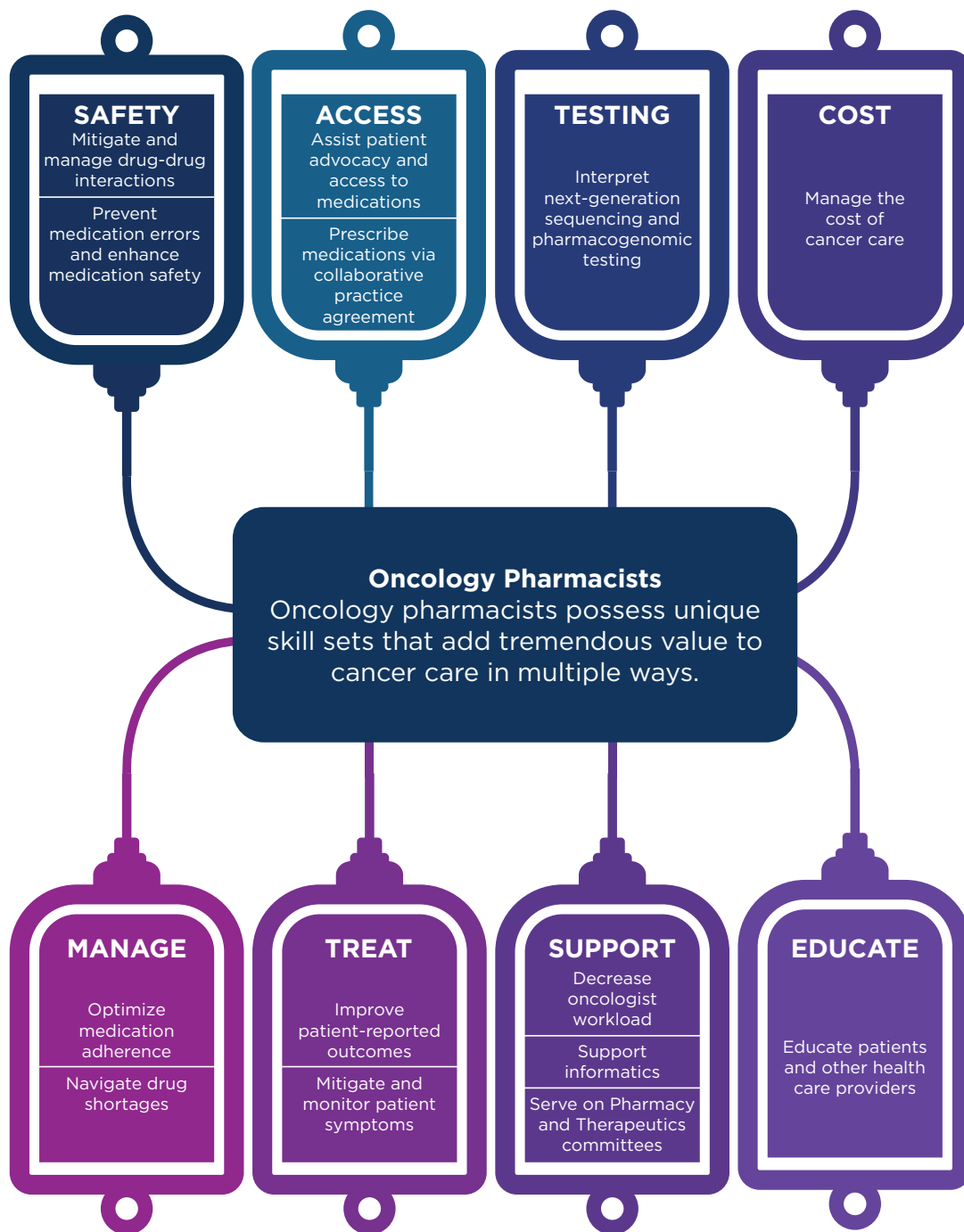
Data from the American Society of Clinical Oncology (ASCO) and Centers for Medicare and Medicaid Services (CMS) project a shortage of oncologists to adequately care for the growing population of patients with cancer.^{28,29} Oncology pharmacists have been proposed as one solution to alleviate the strain on providers.^{4,30} One study estimated that BCOPs could provide patient care for 2.6 million to 3.3 million of the projected 9.4 million to 15.4 million visits missed annually due to a shortage of oncologists.³⁰ In speaking with community oncologists in private practice, Klamerus noted, “An issue that they face and increasingly talk about is the difficulty they have in doing their work without the same level of oncology pharmacy support hospitals and health systems have. Many of those private practices are struggling to provide the same levels of safety, the same levels of oversight, the same levels of chemotherapy safe handling and admixture, and the same pace of rapid implementation of new therapies.”

Oncology pharmacists decrease physician and APP workload by performing tasks typically completed by physicians, including providing disease state and symptom management, interpreting next-generation sequencing results, providing immunizations, resolving delays in insurance coverage, obtaining coverage for off-label medications, and educating patients.³¹⁻³³ Nearly 75% of new drug approvals are in oncology, which poses many challenges that pharmacists can help to overcome including staying up-to-date with new therapies, educating patients, and implementing electronic health record changes. “Each of us knows cancer care is only getting more and more complex as we move forward,” Klamerus underscored. Oncology pharmacists add tremendous value to cancer care in multiple ways (FIGURE 4).

Manage Symptoms

Over time, pharmacists have moved out of the dispensing pharmacy and into direct patient care roles. A randomized, multicenter trial published in 2021 demonstrated the value of oncology pharmacists in managing symptoms for patients receiving oral oncolytic therapy.³⁴ Patients randomized

FIGURE 4. ONCOLOGY PHARMACISTS ADD VALUE IN CANCER CARE*



*This image was developed by PTCE and is synthesized from the evidence included in references 31-98.

to intensified pharmaceutical care received 4 additional counseling sessions covering medication management, AE prevention and management, and adherence counseling. Patients receiving intensified care from oncology pharmacists reported fewer overall medication AEs (HR, 0.44; 95% CI, 0.30-0.66) and fewer AEs related to oral oncolytic therapy (HR, 0.35; 95% CI, 0.22-0.54). There was a reduction in the combined end point of severe AEs (≥ 3), treatment discontinuation, unscheduled hospitalization, and death (HR, 0.48; 95% CI, 0.32-0.71; $P = .001$) in patients receiving intensified pharmaceutical care. Unscheduled hospital admissions were reported in 3% in the intervention group and 14% in the control group (OR, 0.13; 95% CI, 0.02-0.46; $P = .004$) and treatment discontinuation within 12 weeks was reported in 19% in the intervention group and 31% in the control group. Multiple other studies have demonstrated the value of oncology pharmacists in the care of oncology patients.^{2,3,35,36}

Improve Patient-Reported Outcomes

The value of patient-reported outcomes (PROs) has been recognized by providers and payers alike. In the proposal from the CMS Innovation Center for the successor program to the Oncology Care Model (OCM), called Oncology Care First (OCF), CMS included implementation of electronic PROs for symptom monitoring during cancer treatment as a new requirement.³⁷ Pharmacists in specialty pharmacies, ambulatory oncology clinics, and infusion clinics are poised to facilitate implementation of this requirement.¹⁴ Mackler described a model using PROs to screen for patients at higher risk for poor outcomes, coined Rapid-PRO, for patients to report common symptoms using the Edmonton symptom assessment scale, with 2 questions on medication adherence and an assessment of confidence in self-management of symptoms.³⁸ “This tool allows us to identify high-risk patients for the pharmacist to meet with,” she said.

Pharmacists are also spearheading projects using electronic reporting of PROs through text messaging. Hough and colleagues observed reductions in unplanned health care use in the 2-week period after receipt of highly emetogenic chemotherapy when patients reported symptoms of nausea/vomiting via text message survey and pharmacists responded if needed to address symptoms.³⁹

Prescribe Medications via Collaborative Practice Agreement

Approximately one-third to one-half of pharmacists surveyed report participation in a collaborative practice agreement

(CPA) with an oncologist to facilitate care of hematology/oncology patients.^{16,40,41} The most common functions pharmacists provide under a CPA include adjusting medications; ordering, interpreting, and monitoring lab tests; developing therapeutic plans; and educating patients.¹⁶ Pharmacists in oral oncolytic clinics frequently employ CPAs to refill medications and adjust doses based on disease indication, organ function, drug-drug interactions, or toxicity.⁴² Use of CPAs in this setting is associated with significant decreases in turnaround time to fill prescriptions (7 minutes vs 2.3 days) and increased oncologist satisfaction.⁴² Pharmacists also use CPAs to manage frequently encountered toxicities of chemotherapy.⁴³

Interpret Next-Generation Sequencing and Pharmacogenomic Testing

Pharmacists are increasingly at the forefront of efforts to drive precision medicine in oncology as providers struggle to translate the results of next-generation sequencing into patient care.^{32,44,45} Multiple practice models for molecular tumor boards have been described with pharmacists participating in triaging patients to a medication with an FDA-approved indication for a given genomic mutation and tumor type, to a genomic-matched medication FDA approved for a different tumor type, or to an early-phase clinical trial. In addition, some pharmacists aid in acquisition of off-label therapy.

Manage the Cost of Cancer Care

More often than not, the value of the oncology pharmacist is undocumented. “The cost of cancer care is spiraling out of control,” explained Boehmer. He shared specific strategies to manage costs of care through their positions on care teams, saying, “Oncology pharmacists are uniquely poised to help through adoption of biosimilars, cost-conscious prescribing, early identification and mitigation of treatment-related AEs so patients can stay on therapies, monitoring and assessment of adherence, and barriers to medication access and adherence.”

Mackler highlighted the role of pharmacists in a global manner. She cited an example from the US Oncology Network that showed review of chemotherapy orders by an oncology-trained pharmacist over a 10-week period resulted in 49.2% of orders needing modification.⁴⁶ Modifications included dose-rounding, product substitution or a clinical change to supportive care, anticancer medication dose or frequency, or need for additional monitoring. These measures led to a reduction in the total cost of care for medication expenses of \$462,305 resulting in a return on investment for the pharmacist compared with margin improvement of 590%. In her experience, too,

Mackler said, “Implementation of decision-making pathways, biosimilar adoption, dose-rounding, and other related aspects are tasks a pharmacist can do up front to streamline the process of medication utilization and make sure it’s as appropriate and safe for the patients as possible.”

Other examples of oncology pharmacists mitigating the rising cost of cancer care abound. An evaluation of the implementation of a pharmacist-managed interdisciplinary oral chemotherapy program in a community cancer center reported an estimated 50% to 60% increase in oral oncolytic prescriptions being filled within the health system, which was linked to an estimated increase in annual revenue of \$2.4 million.⁴⁷ The implementation of a hemostatic and antithrombotic stewardship program that employs a pharmacist to monitor and ensure appropriate clinical management of all patients receiving an intravenous direct thrombin inhibitor or coagulation factor and those receiving mechanical circulatory support or extracorporeal membrane oxygenation was associated with an annual cost avoidance of \$1,449,417.⁴⁸

On an individual patient level, pharmacist evaluation of polypharmacy in older adults with cancer led to discontinuation of an average of 3 medications per patient and avoidance of \$4282.27 in health care expenditures per patient.⁴⁹ Pharmacists also generate revenue billing for independent medication therapy management visits and patient education visits.^{31,50,51} Boehmer summed up the pharmacist’s ability to ensure the provision of cost-conscious care for patients, saying, “The value that oncology pharmacists bring to coordinated, more efficient, and more cost-conscious prescribing and cancer care, from a dollars-related return on investment, is something administrators in the industry really can’t overstate.”

Optimize Medication Adherence to Anticancer Therapy

A systematic review of 64 publications reported medication adherence to oral anticancer therapy varies widely between 46% and 100%.⁵² Across multiple malignancies, poor adherence to oral anticancer therapy is associated with worse disease outcomes, including lower likelihood of response to therapy and higher mortality.⁵² Studies of medication adherence in chronic myeloid leukemia (CML) indicate adherence is a major factor in molecular response rates and patient outcomes.^{53,54} In a prospective study of 87 patients with chronic phase CML, adherence less than 80% was the only factor predictive of a major molecular response.⁵³ Barr and colleagues reported that patients missing more than 8 consecutive days of ibrutinib for primary therapy of chronic lymphocytic leukemia had a shorter progression-free survival

than those patients missing fewer than 8 days.⁵⁵ Patients using oral therapies have less contact with the health care team, may lack adequate health literacy, and may be more reluctant to report AEs, which may lead to medication nonadherence. A report by the Michigan Oncology Quality Consortium Oral Oncolytic Collaborative highlighted 48% of patients discontinued their oral oncolytic therapy without consulting their physician prior to initiation of a pharmacy-led quality improvement initiative.⁵⁶ Following implementation of a tracking system, patient education includes self-care guidelines, a questionnaire to assess symptoms and adherence, and scheduled follow-up care; no patients discontinued medication on their own.

Although few randomized controlled trials have been conducted, current literature suggests pharmacist-directed interventions to promote medication adherence are effective in oncology patients.⁵⁷ Several published reports found that oral chemotherapy management programs resulted in a significant increase in medication and lab adherence and improved comprehension of the treatment plans.⁵⁸⁻⁶¹ In collaboration with ASCO, a quality improvement program was designed to improve adherence to oral oncolytic therapy by leveraging an oncology pharmacist to educate patients on treatment schedule, AEs, drug interactions, and safe handling.⁶² Pillboxes and calendars were provided to patients, and the pharmacist assisted with drug procurement. After 6 months, an improvement in adherence to oral oncolytic therapy from 37% pre-intervention to 85% post-intervention was observed and sustained throughout the 13-month study period.

Across the United States, pharmacists are part of the care team that identifies and manages AEs of oral oncolytic therapy.^{2,15} Some of the care delivery models include pharmacists within specialty pharmacies monitoring and identifying AEs of therapies while others incorporate oncology pharmacists in ambulatory care or infusion clinics. Pharmacist-directed programs, particularly those that integrate monitoring and routine follow-up, have been shown to be effective at improving medication adherence to oral oncolytic therapy.⁵⁷

Patient Advocacy and Access to Medications

Medication access and financial toxicity are significant barriers contributing to medication nonadherence. Oral oncolytic therapies are considered specialty medications by most insurance companies and require dispensing by a specialty pharmacy. The process of sending a prescription to a pharmacy is often convoluted by requirement of a prior authorization and/or appeal, routing to a predetermined specialty pharmacy, and solutions to lower the co-pay

via patient assistance application.⁶³⁻⁶⁵ This process can be frustrating, difficult to understand, and time consuming, all of which lead to delays in initiation of therapy.⁶³⁻⁶⁵ Soliman explained potential delays further, saying, “When a product has been prescribed, about a quarter of the time, it doesn’t get filled. Oncology pharmacists play an important role in changing that.”

A multisite study evaluating audio recordings of routine oncology appointments found financial issues were raised in 28% of visits; however, 40% of cost concerns were not acknowledged by clinicians, and only 1% of patients were referred to social services for support.⁶⁶ A study of the impact of financial toxicity in patients receiving oral anticancer medications found 49% of patients abandoned their therapy if their co-pay was \$2000 (a 5-fold increase over those with a co-pay less than \$10).⁶⁷ Similarly, 18% of patients delayed treatment initiation if their co-pay was greater than \$2000 compared with 3% of patients with a co-pay \$10 or less. A study in patients with lung cancer reported a median average monthly out-of-pocket (OOP) medication cost for an oral tyrosine kinase inhibitor (TKI) was \$1432 for the lowest 3 quartiles of patients and \$2888 for patients in the highest quartile.⁶⁸ The increase in OOP cost was associated with inferior survival (HR, 1.85; 95% CI, 1.11-3.10), decreased TKI medication adherence (OR, 0.28; 95% CI, 0.10-0.76), and higher TKI discontinuation rate (OR, 8.75; 95% CI, 2.59-29.52). The lifetime OOP costs for Medicare patients receiving oral therapies are expected to reach \$57,000, representing a 519% increase.⁶⁹

Buie shared other ways pharmacists can spearhead efforts to ensure patient access to medications. “Pharmacists are the best-suited persons to help get patients their medications,” he said. He went on to explain that this might be through navigating financial services at their institution, working with patient assistance foundations or making sure the prior authorization process is completed and the patient is able to start a medication that may save their life.

A recent study in patients receiving oral therapy for prostate cancer found that patients with OOP costs less than \$100 per prescription were filled in a median of 5 days; however, patients who needed to fill prescriptions through a patient assistance program had a median of 30.5 days to treatment initiation.⁷⁰ Ambulatory care pharmacists and specialty pharmacies have designed successful processes to expedite therapy initiation and lower OOP medication costs using multiple mechanisms to lower costs.^{58,70-73} Mackler noted the biggest role oncology pharmacists play in mitigating financial toxicity is helping practices identify the best resources and shared other approaches oncology pharmacists can take. “This may mean referral to social work

to assess insurance coverage options more comprehensively, or enrollment in a foundation grant or a patient assistance program,” she said. “It may also be altering the chemotherapy, for example, minimizing multiple strengths of the same drug to limit co-pays, or changing to a biosimilar with better coverage on their insurance plan.”

Oncology pharmacists advocate for individual patients with cancer and for the global needs of this population. HOPA issues briefs on legislative policies that affect patients with cancer, supports initiatives that advance the role of the hematology/oncology pharmacist, and publishes position statements on a variety of topics affecting patients with cancer and the pharmacists who care for them.⁷⁴ In addition, HOPA forms coalitions with others in support of patients with cancer, including the Cancer Leadership Council, Commission on Cancer, Health Professions and Nursing Education Coalition, One Voice Against Cancer, Patient Access to Pharmacist Care Coalition, and Patients Equal Access Coalition.

Support Informatics

The standard of cancer care evolves rapidly as new drugs are approved by the FDA and new regimens are proven effective and incorporated into national guidelines. This information must be rapidly assimilated into the electronic medical record (EMR) for patients to rapidly benefit from the research. Oncology pharmacists are often the point person responsible for ensuring the EMR remains up-to-date.³ “A clinical pharmacy specialist and a nurse work collaboratively to develop all of our chemotherapy order sets,” explained Olsen.

An evaluation of the conversion of oral chemotherapy to electronic prescribing through Epic Beacon was associated with a dramatic increase in pharmacist review of orders, resulting in improved documentation of interventions and errors and a decreased need for clarification of orders.⁷⁵ In addition to developing treatment plans for chemotherapy, Olsen explained they have developed nurse-pharmacy, evidence-based algorithms to diagnose and manage all oncologic emergencies and some algorithms for toxicities of chemotherapy (eg, immune-related AEs). She added, “I don’t know how we would have done that without our oncology pharmacists’ help.”

Moving forward, pharmacists are spearheading efforts to leverage EMR decision support tools to implement precision medicine in cancer therapy.⁷⁶⁻⁷⁸ Klamers underscored, “We rely on pharmacists for our IT processes to both reduce patient harm and increase safety through order set development for the electronic health record, bar code administration, and other technologies that are advancing the area of patient safety and medication adherence.”

Educate Patients and Health Care Providers

“Oncology pharmacists are, first and foremost, educators. They educate staff and other clinicians, stakeholders, and communities about cancer screenings, cancer prevention, and earlier detection,” reiterated Boehmer. A diagnosis of cancer is overwhelming for patients and a lot of new information is rapidly disseminated about their diagnosis and treatment plan. Pharmacist-led education improves patients’ understanding of their medications and their ability to mitigate AEs.⁷⁹⁻⁸¹ It has also been associated with a reduction in anxiety and depression and improvement in quality of life in patients with cancer.^{82,83}

Oncology pharmacist provision of patient counseling and education is a mechanism to fulfill 25% of QOPI metrics.¹⁴ Provision of chemotherapy education by oncology pharmacists is associated with increased or high rates of patient satisfaction and improved learning outcomes.³ Buie commented on the importance of the oncology pharmacist, beginning early in the patient’s treatment course. “For patients, especially those getting chemotherapy for the first time, knowing that somebody was dedicated just to their medications really relieves a lot of anxiety,” he said.

Oncology pharmacists play an important role in education and training of physicians, APPs, nurses, and students and residents in multiple disciplines.^{2,36} Boehmer emphasized, “The rate and the chronicity of new data on cancer drugs, treatment classes, combination regimens, even if limited to the 4 most common cancers—lung, colorectal, breast, and prostate—is just staggering how much information comes out every single week.”

Pharmacists with BCOP serve as key educators and resources for pharmacists practicing in infusion clinics, specialty pharmacies, and those outside of oncology in the community setting. Boehmer continued, “I can’t say enough about how important it is to have an oncology pharmacist as a partner to help cull the data, interpret it, and make it more available for community oncology clinicians.” Lifelong learning is important because, as Boehmer explained, “Oncology is changing, like literally every minute.”

Mitigate Drug-Drug Interactions

Pharmacists are key to the management of drug-drug interactions (DDIs) and avoidance of AEs associated with DDIs. An estimated 4% of cancer deaths are attributed to AEs incurred by DDIs.⁸⁴ Patients with cancer may receive numerous concomitant drugs, such as other anticancer agents, antiemetics, analgesics, and prophylactic anti-infectives. DDIs have been reported in 78% to 89% of patients receiving cancer therapy, with potential outcomes ranging from therapeutic failure to increased toxicity and unplanned hospitalization.⁸⁴⁻⁸⁶

Pharmacists across the spectrum of cancer care are involved in mitigation of DDIs, especially because of the variability in electronic databases to accurately identify relevant DDIs.⁸⁷

Prevent Medication Errors and Enhance Medication Safety

Oncology pharmacists serve a critical role in identification and prevention of chemotherapy medication errors.^{34,35,88,89} Klamerus shared his observations, saying, “It’s difficult for me to imagine a place where we use a drug where pharmacists aren’t co-leading those processes in quality improvement and patient safety.”

Two prospective, randomized studies have demonstrated the value of oncology pharmacists in preventing medication errors. Durr and colleagues observed fewer unresolved medication errors in oral oncolytic therapy in patients receiving intensified pharmaceutical care (HR, 0.10; 95% CI, 0.02-0.28).³⁴ Medication reconciliation performed by oncology pharmacists resulted in a decrease in the incidence of medication reconciliation errors that reached the patient from 30% to 4% (RR, 0.13; 95% CI, 0.04-0.43; $P = .0009$).⁹⁰ Approximately 60% of medication errors occur during transitions of care.⁹¹ Leveraging pharmacist involvement in multiple transition of care services (medication history, medication reconciliation, follow-up) for patients with cancer reduces errors and the need for hospital readmission.⁹² “As health systems and providers,” explained Klamerus, “we all know the impact of drug errors, including prescribing errors. That whole realm of medication error management often falls within the purview of pharmacy.”

Pharmacists are also relied upon to develop guidelines for safe handling of hazardous medications at both the institutional and global levels in oncology.^{89,93,94} Olsen reflected on the integral role oncology pharmacists play, noting, “Our pharmacists and nurses collaboratively wrote our entire health systems’ safe handling policy.”

Manage Drug Shortages

More than 60% of institutions surveyed between December 2019 and July 2020 reported at least 1 cancer drug shortage per month, a staggering increase of 34% over 2018.⁹⁵ Oncology drug shortages contribute to delays in chemotherapy, dose modification or omission, changes to the planned combination chemotherapy regimen, and medication errors. As the drug experts, oncology pharmacists are relied upon to manage drug shortages to minimize impact to patient care and optimize medication safety.^{2,96} Olsen expressed her gratitude for the support provided to her by pharmacists, sharing, “It has been phenomenal to have a pharmacist assigned with me as the

clinical practice director for urgent care. The pharmacist and I work collaboratively to make sure they have the right antibiotics in stock so we don't have sepsis failures and to ensure we have all the right emergency medicines we need."

Serve on Pharmacy and Therapeutics Committee/ Manage Formulary

Oncology pharmacists are members of the Pharmacy and Therapeutics committee and facilitate decision making regarding which products health care facilities will utilize.^{2,40} "Oncology pharmacists are team players and have a role in business analytics and determining formulary agents in consideration of the local patient population," explained Boehmer.

According to Olsen, "When a physician comes forward and says, 'I want to use this drug to treat my patients,' it's the pharmacist who does all of the literature and clinical review and then presents to the P&T committee about the rationale for why we should or should not bring this drug into the formulary. Then, the oncology pharmacist works with the P&T committee to obtain patient-specific approval for any type of non-FDA-approved indications."

Klamerus explained, "Oncology pharmacists are absolutely essential to facilitate the appropriate review and scrutiny new medications go through when we bring them into therapeutic use in our health systems and clinics, especially because of the number of new mediations and drug classes in oncology."

Conclusion

Without a doubt, oncology pharmacists enhance the quality of cancer care for patients.^{2,3,15,35,36,97} Multiple studies support positive outcomes associated with oncology pharmacy care.³ Klamerus underscored, "Oncology pharmacists are absolutely essential and core professionals within cancer care organizations."

Regardless of practice setting, oncology pharmacists are the experts in medications used to treat cancer and they use multiple skills to improve cancer care in a plethora of ways. When asked for her final thoughts, Olsen summed up the feelings of many, saying, "I couldn't do anything I do without them right by my side."

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REFERENCES

1. Kaiser RF. The pharmacist's place in cancer control. *Public Health Rep.* 1948;63(35):1111-1114.
2. Hematology/Oncology Pharmacy Association. Further Defining the scope of hematology/

3. Segal EM, Bates J, Fleszar SL, et al. Demonstrating the value of the oncology pharmacist within the healthcare team. *J Oncol Pharm Pract.* 2019;25(8):1945-1967. doi:10.1177/1078155219859424
4. Knapp K, Ignoffo R. Response to "State of Physician and Pharmacist Oncology Workforce in the United States in 2019". *JCO Oncol Pract.* 2021;17(5):297-298. doi:10.1200/OP.21.00152
5. Hematology/Oncology Pharmacy Association. Press room. Accessed November 19, 2021. www.hoparx.org/about/press-room
6. Golbach AP, McCullough KB, Soefje SA, Mara KC, Shanafelt TD, Merten JA. Evaluation of Burnout in a National Sample of Hematology-Oncology Pharmacists. *JCO Oncol Pract.* 2021;0(0):OP2100471. doi:10.1200/OP.21.00471
7. Royce TJ, Schenkel C, Kirkwood K, Levit L, Levit K, Kircher S. Impact of Pharmacy Benefit Managers on Oncology Practices and Patients. *JCO Oncol Pract.* 2020;16(5):276-284. doi:10.1200/JOP.19.00606
8. Kwon J, Ledvina D, Newton M, Green MR, Ignoffo R. Oncology pharmacy education and training in the United States Schools of Pharmacy. *Currents in Pharmacy Teaching and Learning.* 2015;7(4):451-457. doi:10.1016/j.cptl.2015.04.005
9. American Society of Health-System Pharmacists. Residency directory. Accessed May 7, 2022. https://accreditation.ashp.org/directory/#/program/residency
10. American College of Clinical Pharmacy. Residency training programs. Accessed November 19, 2021. www.accp.com/resandfel/resandfel.aspx
11. Board of Pharmaceutical Specialties. Oncology pharmacy. Accessed November 19, 2021. www.bpsweb.org/bps-specialties/oncology-pharmacy/#1517747602846-f1cc6832-2470151778001577715178540776891517858333825
12. Board of Pharmaceutical Specialties. Growth of pharmacist board certification. Accessed Nov 19, 2021. www.bpsweb.org/2018/05/03/growth-of-pharmacist-board-certification/
13. Tichy EM, Hoffman JM, Suda KJ, et al. National trends in prescription drug expenditures and projections for 2021. *Am J Health Syst Pharm.* 2021;78(14):1294-1308. doi:10.1093/ajhp/zxab160
14. Vulaj V, Hough S, Bedard L, Farris K, Mackler E. Oncology Pharmacist Opportunities: Closing the Gap in Quality Care. *J Oncol Pract.* 2018;14(6):e403-e411. doi:10.1200/JOP.2017.026666
15. Mackler E, Segal EM, Muluneh B, Jeffers K, Carmichael J. 2018 Hematology/Oncology Pharmacist Association Best Practices for the Management of Oral Oncolytic Therapy: Pharmacy Practice Standard. *J Oncol Pract.* 2019;15(4):e346-e355. doi:10.1200/JOP.18.00581
16. Holle LM, Harris CS, Chan A, et al. Pharmacists' roles in oncology pharmacy services: Results of a global survey. *J Oncol Pharm Pract.* 2017;23(3):185-194. doi:10.1177/1078155216629827
17. Dusetzina SB, Huskamp HA, Winn AN, Basch E, Keating NL. Out-of-Pocket and Health Care Spending Changes for Patients Using Orally Administered Anticancer Therapy After Adoption of State Parity Laws. *JAMA Oncol.* 2018;4(6):e173598. doi:10.1001/jamaoncol.2017.3598
18. Schwartz RN, Eng KJ, Frieze DA, et al. NCCN Task Force Report: Specialty Pharmacy. *J Natl Compr Canc Netw.* 2010;8 Suppl 4:S1-12. doi:10.6004/jnccn.2010.0127
19. Bagwell A, Kelley T, Carver A, Lee JB, Newman B. Advancing Patient Care Through Specialty Pharmacy Services in an Academic Health System. *J Manag Care Spec Pharm.* 2017;23(8):815-820. doi:10.18553/jmcp.2017.23.8.815
20. Zuckerman AD, Carver A, Cooper K, et al. An Integrated Health-System Specialty Pharmacy Model for Coordinating Transitions of Care: Specialty Medication Challenges and Specialty Pharmacist Opportunities. *Pharmacy (Basel).* 2019;7(4):doi:10.3390/pharmacy7040163
21. Certified Specialty Pharmacist (CSP) Certification. National Association of Specialty Pharmacy. Accessed May 9, 2022. https://naspnet.org/certification

22. Tombleson R. Impact of emerging clinical trends on overall cost of care and the role of the managed care pharmacist. *Am J Manag Care*. 2021;27(5 Suppl):S97-S103. doi:10.37765/ajmc.2021.88627
23. Academy of Managed Care. What is managed care. Accessed January 24, 2023. www.amcp.org/about/managed-care-pharmacy-101
24. Kaddis AA. Evolving strategies for cost-effective cancer management. The Lynx Group, LLC. Updated May 28, 2014. Accessed January 24, 2023. www.valuebasedrheumatology.com/vbcc-issues/2012/october-2012-vol-3-no-7/3299-vbcc-3299
25. Jain A, Das A, Roffman J, Jeshnani R, et al. Identifying treatment pathways: the decision-makers of the future. Published September 2020. Accessed May 7, 2022. www.zs.com/content/dam/pdfs/Identifying-treatment-pathways.pdf
26. Bates JS, Buie LW, Lyons K, et al. A Study of Layered Learning in Oncology. *Am J Pharm Educ*. 2016;80(4):68. doi:10.5688/ajpe80468
27. Holle LM, Segal EM, Jeffers KD. The Expanding Role of the Oncology Pharmacist. *Pharmacy (Basel)*. 2020;8(3)doi:10.3390/pharmacy8030130
28. Shih YT, Kim B, Halpern MT. State of Physician and Pharmacist Oncology Workforce in the United States in 2019. *JCO Oncol Pract*. 2021;17(1):e1-e10. doi:10.1200/OP.20.00600
29. Yang W, Williams JH, Hogan PF, et al. Projected supply of and demand for oncologists and radiation oncologists through 2025: an aging, better-insured population will result in shortage. *J Oncol Pract*. 2014;10(1):39-45. doi:10.1200/JOP.2013.001319
30. Ignoffo R, Knapp K, Barnett M, et al. Board-Certified Oncology Pharmacists: Their Potential Contribution to Reducing a Shortfall in Oncology Patient Visits. *J Oncol Pract*. 2016;12(4):e359-68. doi:10.1200/JOP.2015.008490
31. Alexander MD, Rao KV, Khan TS, et al. ReCAP: Pharmacists' Impact in Hematopoietic Stem-Cell Transplantation: Economic and Humanistic Outcomes. *J Oncol Pract*. 2016;12(2):147-8. doi:10.1200/JOP.2015.008797
32. Walko C, Kiel PJ, Kolesar J. Precision medicine in oncology: New practice models and roles for oncology pharmacists. *Am J Health Syst Pharm*. 2016;73(23):1935-1942. doi:10.2146/ajhp160211
33. Valgus J, Jarr S, Schwartz R, Rice M, Bernard SA. Pharmacist-led, interdisciplinary model for delivery of supportive care in the ambulatory cancer clinic setting. *J Oncol Pract*. 2010;6(6):e1-4. doi:10.1200/JOP.2010.000033
34. Durr P, Schlichtig K, Kelz C, et al. The Randomized AMBORA Trial: Impact of Pharmaceutical Care on Medication Safety and Patient-Reported Outcomes During Treatment With New Oral Anticancer Agents. *J Clin Oncol*. 2021;39(18):1983-1994. doi:10.1200/JCO.20.03088
35. Coutsouvelis J, Siderov J, Tey AY, et al. The impact of pharmacist-led strategies implemented to reduce errors related to cancer therapies: a systematic review. *Journal of Pharmacy Practice and Research*. 2020;50(6):466-480. doi:10.1002/jppr.1699
36. Holle LM, Bilse T, Alabelewe RM, et al. International Society of Oncology Pharmacy Practitioners (ISOPP) position statement: Role of the oncology pharmacy team in cancer care. *J Oncol Pharm Pract*. 2021;27(4):785-801. doi:10.1177/10781552211017199
37. Centers for Medicare & Medicaid Services. Oncology Care First Model: informal request for information. Accessed January 24, 2023. <https://innovation.cms.gov/Files/x/ocf-informalrifi.pdf>
38. Subbiah IM, Charone MM, Roszik J, et al. Association of Edmonton Symptom Assessment System Global Distress Score With Overall Survival in Patients With Advanced Cancer. *JAMA Netw Open*. 2021;4(7):e2117295. doi:10.1001/jamanetworkopen.2021.17295
39. Hough S, McDevitt R, Nachar VR, et al. Chemotherapy Remote Care Monitoring Program: Integration of SMS Text Patient-Reported Outcomes in the Electronic Health Record and Pharmacist Intervention for Chemotherapy-Induced Nausea and Vomiting. *JCO Oncol Pract*. 2021;17(9):e1303-e1310. doi:10.1200/OP.20.00639
40. Ignoffo RJ, Knapp KK, Seung A, et al. Trends in the delivery of care to oncology patients in the United States: Emphasis on the role pharmacists on the healthcare team. *J Oncol Pharm Pract*. 2021;27(1):5-13. doi:10.1177/1078155220907674
41. Bryk A, Koontz S, Mayor J, et al. Characterization of collaborative practice agreements held by hematopoietic stem cell transplant pharmacists. *J Oncol Pharm Pract*. 2019;25(3):558-566. doi:10.1177/1078155217745145
42. Wright AL, Matta SF, Kerr JR. Expansion of pharmacist practice in oral oncolytic therapy with a collaborative practice agreement. *J Oncol Pharm Pract*. 2020;26(8):1886-1893. doi:10.1177/1078155220905004
43. Homan MJ, Reid JH, Nachar VR, et al. Implementation and outcomes of a pharmacist-led collaborative drug therapy management program for oncology symptom management. *Support Care Cancer*. 2021;29(11):6505-6510. doi:10.1007/s00520-021-06239-0
44. Arnall JR, Petro R, Patel JN, Kennedy L. A clinical pharmacy pilot within a Precision Medicine Program for cancer patients and review of related pharmacist clinical practice. *J Oncol Pharm Pract*. 2019;25(1):179-186. doi:10.1177/1078155217738324
45. Raheem F, Kim P, Grove M, Kiel PJ. Precision Genomic Practice in Oncology: Pharmacist Role and Experience in an Ambulatory Care Clinic. *Pharmacy*. 2020;8(1):32.
46. Kula J, Hough S, Howell J. Impact of a central review oncology clinical pharmacist in a community oncology practice. *Journal of Clinical Oncology*. 2021;39(28_suppl):68-68. doi:10.1200/JCO.2020.39.28_suppl.68
47. Mancini R, Vu B, Modlin J, Wilson DB, Kastor LM. Implementation of a pharmacist-managed interdisciplinary oral chemotherapy program in a community cancer center. *J Hematol Oncol Pharm*. 2011;1(2):23-30.
48. Reardon DP, Atay JK, Ashley SW, Churchill WW, Berliner N, Connors JM. Implementation of a Hemostatic and Antithrombotic Stewardship program. *J Thromb Thrombolysis*. 2015;40(3):379-82. doi:10.1007/s11239-015-1189-3
49. Whitman A, DeGregory K, Morris A, Mohile S, Ramsdale E. Pharmacist-led medication assessment and deprescribing intervention for older adults with cancer and polypharmacy: a pilot study. *Support Care Cancer*. 2018;26(12):4105-4113. doi:10.1007/s00520-018-4281-3
50. Valgus JM, Faso A, Gregory KM, et al. Integration of a clinical pharmacist into the hematology-oncology clinics at an academic medical center. *Am J Health Syst Pharm*. 2011;68(7):613-9. doi:10.2146/ajhp100414
51. Watkins JL, Landgraf A, Barnett CM, Michaud L. Evaluation of pharmacist-provided medication therapy management services in an oncology ambulatory setting. *J Am Pharm Assoc (2003)*. 2012;52(2):170-4. doi:10.1331/JAPhA.2012.11171
52. Greer JA, Amoyal N, Nisotel L, et al. A systematic review of adherence to oral antineoplastic therapies. *Oncologist*. 2016;21(3):354-376. doi:10.1634/theoncologist.2015-0405
53. Marin D, Bazeos A, Mahon F-X, et al. Adherence is the critical factor for achieving molecular responses in patients with chronic myeloid leukemia who achieve complete cytogenetic responses on imatinib. *Journal of Clinical Oncology*. 2010;28(14):2381-2388. doi:10.1200/jco.2009.26.3087
54. Noens L, Van Lierde M-A, De Bock R, et al. Prevalence, determinants, and outcomes of nonadherence to imatinib therapy in patients with chronic myeloid leukemia: the ADAGIO study. *Blood*. 2009;113(22):5401-5411. doi:10.1182/blood-2008-12-196543
55. Barr PM, Brown JR, Hillmen P, et al. Impact of ibrutinib dose adherence on therapeutic efficacy in patients with previously treated CLL/SLL. *Blood*. 2017;blood-2016-12-73. doi:10.1182/blood-2016-12-737346
56. McNamara E, Redoutey L, Mackler E, Severson JA, Petersen L, Mahmood T. Improving

- oral oncolytic patient self-management. *Journal of Oncology Practice*.2016;12(9):e864-e869. doi:10.1200/jop.2016.011304
57. Rosenberg SM, Petrie KJ, Stanton AL, Ngo L, Finnerty E, Partridge AH. Interventions to enhance adherence to oral anti-neoplastic agents: a scoping review. *J Natl Cancer Inst*. 2020;112(5):443-465. doi:10.1093/jnci/djz244
58. Sweiss K, Wirth SM, Sharp L, et al. Collaborative physician-pharmacist-managed multiple myeloma clinic improves guideline adherence and prevents treatment delays. *J Oncol Pract*. 2018;14(11):e674-e682. doi:10.1200/JOP.18.00085
59. Muluneh B, Schneider M, Faso A, et al. Improved Adherence Rates and Clinical Outcomes of an Integrated, Closed-Loop, Pharmacist-Led Oral Chemotherapy Management Program. *J Oncol Pract*. 2018;14(6):e324-e334. doi:10.1200/JOP.17.00039
60. Nhean S, Kostoff D, Yang JJ, Vogel V, Rybkin, II. Impact of oral chemotherapy management program on capecitabine toxicity management. *JCO Oncol Pract*. 2021;17(7):e1021-e1029. doi:10.1200/OP.20.00947
61. Patel JM, Holle LM, Clement JM, Bunz T, Niemann C, Chamberlin KW. Impact of a pharmacist-led oral chemotherapy-monitoring program in patients with metastatic castrate-resistant prostate cancer. *J Oncol Pharm Pract*. 2016;22(6):777-783. doi:10.1177/1078155215612541
62. Curry MA, Chineke I, Redelico T, et al. Adherence to oral anticancer medications after implementation of an ambulatory adherence program at a large urban academic hospital. *JCO Oncol Pract*. 2020;16(4):e350-e356. doi:10.1200/jop.19.00167
63. Dorff TB, Mendelsohn M, Christian A, Kim H. Navigating specialty pharmacies to get oral agents to patients in a timely manner. *Journal of Clinical Oncology*. 2019;37(27_suppl):220-220. doi:10.1200/JCO.2019.37.27_suppl.220
64. Nicolai JL, Roman DL, Julius JM, Nadour RW. Potential obstacles in the acquisition of oral anticancer medications. 2017;13(1):e29-e36. doi:10.1200/jop.2016.012302
65. Agarwal A, Freedman RA, Goicuria F, et al. Prior authorization for medications in a breast oncology practice: navigation of a complex process. *Journal of Oncology Practice*. 2017;13(4):e273-e282. doi:10.1200/jop.2016.017756
66. Warsame R, Kennedy CC, Kumbamu A, et al. Conversations about financial issues in routine oncology practices: a multicenter study. *J Oncol Pract*. 2019;15(8):e690-e703. doi:10.1200/JOP.18.00618
67. Doshi JA, Li P, Huo H, Pettit AR, Armstrong KA. Association of Patient Out-of-Pocket Costs With Prescription Abandonment and Delay in Fills of Novel Oral Anticancer Agents. *Journal of Clinical Oncology*. 2018;36(5):476-482. doi:10.1200/jco.2017.74.5091
68. Goulart BHL, Unger JM, Chennupati S, Fedorenko CR, Ramsey SD. Out-of-pocket costs for tyrosine kinase inhibitors and patient outcomes in EGFR- and ALK-positive advanced non-small-cell lung cancer. *JCO Oncol Pract*. 2021;17(2):e130-e139. doi:10.1200/OP.20.00692
69. Zackon AYL, Ayers AA, Yeager KA, et al. Maximizing the effectiveness of oral therapies in lymphoid cancers: research gaps and unmet needs. *Leukemia & Lymphoma*. 2019;1-9. doi:10.1080/10428194.2019.1594217
70. Jeong AY, Schwartz EB, Roman AR, et al. Characterizing out-of-pocket payments and financial assistance for patients prescribed abiraterone and enzalutamide at an Academic Cancer Center Specialty Pharmacy. *JCO Oncol Pract*. 2021;0(0):OP2100168. doi:10.1200/OP.21.00168
71. Seymour EK, Daniel L, Pointer E, Julian J, Smith ST, Schiffer CA. How to effectively decrease patient co-payments of high-cost drugs through innovation: lessons from the Karmanos Specialty Pharmacy. *JCO Oncology Practice*. 2022;18(1):e137-e151. doi:10.1200/op.21.00207
72. Farano JL, Kandah HM. Targeting financial toxicity in oncology specialty pharmacy at a large tertiary academic medical center. *J Manag Care Spec Pharm*. 2019;25(7):765-769. doi:10.18553/jmcp.2019.25.7.765
73. Nicolai JL, Roman DL, Julius JM, Nadour RW. Potential Obstacles in the Acquisition of Oral Anticancer Medications. *J Oncol Pract*. 2017;13(1):e29-e36. doi:10.1200/JOP.2016.012302
74. Advocacy Activities. Hematology/Oncology Pharmacy Association. Accessed May 9, 2022. www.hoparx.org/advocacy/advocacy-activities
75. Finn A, Bondarenka C, Edwards K, Hartwell R, Letton C, Perez A. Evaluation of electronic health record implementation on pharmacist interventions related to oral chemotherapy management. *J Oncol Pharm Pract*. 2017;23(8):563-574. doi:10.1177/1078155216665247
76. Ubanyionwu S, Formea CM, Anderson B, Wix K, Dierkhising R, Caraballo PJ. Evaluation of prescriber responses to pharmacogenomics clinical decision support for thiopurine S-methyltransferase testing. *Am J Health Syst Pharm*. 2018;75(4):191-198. doi:10.2146/ajhp170280
77. Hicks JK, Stowe D, Willner MA, et al. Implementation of clinical pharmacogenomics within a large health system: from electronic health record decision support to consultation services. *Pharmacotherapy*. 2016;36(8):940-8. doi:10.1002/phar.1786
78. Hicks JK, Howard R, Reisman P, et al. Integrating Somatic and germline next-generation sequencing into routine clinical oncology practice. *JCO Precis Oncol*. 2021;5doi:10.1200/po.20.00513
79. Lin M, Hackenyos D, Savidge N, et al. Enhancing patients' understanding of and adherence to oral anticancer medication: Results of a longitudinal pilot intervention. *J Oncol Pharm Pract*. 2021;27(6):1409-1421. doi:10.1177/1078155220960800
80. McKee M, Frei BL, Garcia A, Fike D, Soefje SA. Impact of clinical pharmacy services on patients in an outpatient chemotherapy academic clinic. *J Oncol Pharm Pract*. 2011;17(4):387-94. doi:10.1177/1078155210389217
81. Crespo A, Tyszka M. Evaluating the patient-perceived impact of clinical pharmacy services and proactive follow-up care in an ambulatory chemotherapy unit. *Journal of Oncology Pharmacy Practice*. 2017;23(4):243-248. doi:10.1177/1078155216634180
82. Periasamy U, Mohd-Sidik S, Akhtari-Zavare M, Rampal L, Ismail SIF, Mahmud R. Effects of Counseling on Quality of Life among Cancer Patients in Malaysia: A Randomized Controlled Trial. *Iran J Public Health*. 2020;49(10):1902-1911. doi:10.18502/ijph.v49i10.4693
83. Mohd-Sidik S, Akhtari-Zavare M, Periasamy U, Rampal L, Fadhilah SI, Mahmud R. Effectiveness of chemotherapy counselling on self-esteem and psychological affects among cancer patients in Malaysia: Randomized controlled trial. *Patient Educ Couns*. 2018;101(5):862-871. doi:10.1016/j.pec.2018.01.004
84. Ismail M, Khan S, Khan F, et al. Prevalence and significance of potential drug-drug interactions among cancer patients receiving chemotherapy. *BMC Cancer*. 2020;20(1):335. doi:10.1186/s12885-020-06855-9
85. Beinse G, Reitter D, Segaux L, et al. Potential drug-drug interactions and risk of unplanned hospitalization in older patients with cancer: a survey of the prospective ELCAPA (ELderly CAncer PATients) cohort. *J Geriatr Oncol*. 2020;11(4):586-592. doi:10.1016/j.jgo.2019.07.023
86. Prely H, Herledan C, Caffin AG, et al. Real-life drug-drug and herb-drug interactions in outpatients taking oral anticancer drugs: comparison with databases. *J Cancer Res Clin Oncol*. 2021;148(3):707-718. doi:10.1007/s00432-021-03645-z
87. Bossaer JB, Eskens D, Gardner A. Sensitivity and specificity of drug interaction databases to detect interactions with recently approved oral antineoplastics. *J Oncol Pharm Pract*. 2021;1078155220984244. doi:10.1177/1078155220984244
88. Goldspiel B, Hoffman JM, Griffith NL, et al. ASHP guidelines on preventing medication errors with chemotherapy and biotherapy. *Am J Health Syst Pharm*.2015;72(8):e6-e35. doi:10.2146/sp150001

89. Pardhan A, Vu K, Gallo-Hershberg D, Forbes L, Gavura S, Kukreti V. Evolving best practice for take-home cancer drugs. *JCO Oncol Pract*. 2021;17(4):e526-e536. doi:10.1200/OP.20.00448
90. Vega TG, Sierra-Sánchez JF, Martínez-Bautista MJ, García-Martín F, Suárez-Carrascosa F, Baena-Cañada JM. Medication Reconciliation in Oncological Patients: A Randomized Clinical Trial. *J Manag Care Spec Pharm*. 2016;22(6):734-40. doi:10.18553/jmcp.2016.15248
91. Bethishou L, Herzik K, Fang N, Abdo C, Tomaszewski DM. The impact of the pharmacist on continuity of care during transitions of care: A systematic review. *J Am Pharm Assoc (2003)*. 2020;60(1):163-177.e2. doi:10.1016/j.japh.2019.06.020
92. Nguyen PAA, Enwere E, Gautreaux S, et al. Impact of a pharmacy-driven transitions-of-care program on postdischarge healthcare utilization at a national comprehensive cancer center. *Am J Health Syst Pharm*. 2018;75(18):1386-1393. doi:10.2146/ajhp170747
93. Celano P, Fausel CA, Kennedy EB, et al. Safe Handling of Hazardous Drugs: ASCO Standards. *J Clin Oncol*. 2019;37(7):598-609. doi:10.1200/JCO.18.01616
94. Goodin S, Griffith N, Chen B, et al. Safe handling of oral chemotherapeutic agents in clinical practice: recommendations from an international pharmacy panel. *J Oncol Pract*. 2011;7(1):7-12. doi:10.1200/jop.2010.000068
95. Hudson-Disalle S, DeRemer DL, Buie LW, Hamm M, Pilz J, McBride A. National survey on the effect of oncology drug shortages in clinical practice: a Hematology Oncology Pharmacy Association (HOPA) survey. *Journal of Clinical Oncology*. 2021;39(15_suppl):e13609-e13609. doi:10.1200/JCO.2021.39.15_suppl.e13609
96. Hematology/Oncology Pharmacy Association. The Value of oncology pharmacists op-ed headline: with drug shortages and errors on the rise, oncology pharmacists are vital to navigate treatment in the era of a pandemic. Accessed Oct 1, 2021. www1.prweb.com/prfiles/2021/03/22/17814869/Value%20of%20Hem-Onc%20Pharmacists%20Op-Ed%202021.10.21_FINAL.pdf
97. Dillmon MS, Kennedy EB, Anderson MK, et al. Patient-centered standards for medically integrated dispensing: ASCO/NCODA standards. *J Clin Oncol*. 2020;38(6):633-644. doi:10.1200/JCO.19.02297
98. Hematology/Oncology Pharmacy Association. Scope of hematology/oncology pharmacy practice. Accessed September 28, 2021. www.hoparx.org/images/hopa/resource-library/professional-tools/HOPA13_ScopeofPracticeBk.pdf



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