

# Rapid Synthesis

Identifying Models and Approaches to Enhance  
the Role of Pharmacists in Cancer Care

30 March 2023



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**Rapid Synthesis:  
Identifying Models and Approaches to Enhance the Role of Pharmacists in Cancer Care  
30-day response**

30 March 2023

#### McMaster Health Forum

The McMaster Health Forum's goal is to generate action on the pressing health-system issues of our time, based on the best available research evidence and systematically elicited citizen values and stakeholder insights. We aim to strengthen health systems – locally, nationally, and internationally – and get the right programs, services and drugs to the people who need them.

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#### Timeline

Rapid syntheses can be requested in a three-, 10-, 30-, 60- or 90-business-day timeframe. This synthesis was prepared over a 30-business-day timeframe. An overview of what can be provided and what cannot be provided in each of the different timelines is provided on McMaster Health Forum's Rapid Response program webpage ([www.mcmasterforum.org/find-evidence/rapid-response](http://www.mcmasterforum.org/find-evidence/rapid-response)).

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#### Conflict of interest

The authors declare that they have no professional or commercial interests relevant to the rapid synthesis. The funder played no role in the identification, selection, assessment, synthesis or presentation of the research evidence profiled in the rapid synthesis.

#### Merit review

The rapid synthesis was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

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## KEY MESSAGES

### Question

- What are the features and impacts on patient access to cancer care of models and team-based approaches that enhance the role of pharmacists in cancer care for patients in early diagnosis, treatment, and palliative cancer care?

### Why the issue is important

- Oncology pharmacists have been involved in the care of cancer patients for over 50 years, providing the safety checks needed to dispense cancer-related medications in pharmacy settings.
- However, with advancements in dispensing technology and training, the roles of oncology pharmacists have continued to expand, making them a more integral member of healthcare teams.
- In addition, as oncology practice has broadened, pharmacists have gained more opportunities to support the management of the complex needs of cancer patients through credentialing, expanded prescribing authority, and access to specialized knowledge and expertise gained at oncology pharmacy residency programs.
- Given these advancements, models and approaches that enhance the role of pharmacists in cancer care can enable oncology pharmacists to play a more integral role in the care of patients with cancer and potentially improve clinical and economic outcomes in oncology care.

### What we found

- We identified four systematic reviews, one rapid review, and 25 primary studies that explored the features and impacts of models and team-based approaches that enhance the role of pharmacists in cancer care.
- We grouped the models and approaches identified from the evidence based on those focused on pharmacists working in outpatient/community settings and those focused on incorporating pharmacists into multidisciplinary teams.
- Models and approaches that focused on pharmacists working in outpatient/community settings generally included interventions related to symptom assessments and consultations, drug-related problems, patient adherence, and the administration of medication.
- Benefits of incorporating oncology pharmacists into multidisciplinary teams included enhanced patient knowledge about medication, support in developing and adjusting medication regimens, ensuring medication safety, assisting in the financial review of patients' medications, and alleviating workloads of other providers.
- Across jurisdictions, pharmacists provided cancer care and support in community and outpatient settings, cancer clinics, hospitals, and palliative-care settings.
- Models integrating pharmacists into cancer care identified in the jurisdictional scans we conducted leveraged pharmacists to: provide patient consultations and education; to assist with decision-making, advice, and consultations with other providers as part of a broader oncology team; and for the provision of administrative and clinical support to assist cancer care providers.
- In the jurisdictional scans, we also found that these models often leveraged new technology platforms and other information communication technologies to streamline service provision, integrate pharmaceutical patient data into electronic health records, and enable patient monitoring and real-time response efforts.
- Overall, the evidence and experiences we identified revealed that there are potential opportunities to enhance the role of oncology pharmacists in a variety of oncology care settings that can lead to increased efficiency and reduced costs for organizations, as well as improve the quality of care for cancer patients.

## **QUESTION**

What are the features and impacts on patient access to cancer care of models and team-based approaches that enhance the role of pharmacists in cancer care for patients in early diagnosis, treatment, and palliative cancer care?

## **WHY THE ISSUE IS IMPORTANT**

For over 50 years, oncology pharmacists have been involved in the care of cancer patients by primarily providing the safety checks needed to dispense cancer-related medications in pharmacy settings.(1) However, with the advancements in dispensing technology and training for pharmacists in direct patient care, the roles of oncology pharmacists have continued to expand, making them a more integral member of healthcare teams. As oncology practice has broadened, pharmacists have gained more opportunities to support the management of the complex needs of cancer patients through credentialing, expanded prescribing authority granted by state and/or institution regulations, and access to specialized knowledge and expertise gained at oncology pharmacy residency programs.(2) Models and approaches that enhance the role of pharmacists in cancer care can enable oncology pharmacists to play a more integral role in the care of patients with cancer, and potentially improve clinical and economic outcomes in oncology care.

## **WHAT WE FOUND**

We identified five evidence syntheses (four systematic reviews and one rapid review), and 25 primary studies relevant to the question that were identified from a targeted search for relevant literature (see Box 2 for our search strategy). In addition, we conducted a jurisdictional scan to identify experiences from several countries (Australia, New Zealand, France, Spain, Portugal, the United Kingdom, and the United States - federally and in the states of Oregon, California and New York).

We outline in narrative form below our key findings from the identified evidence and jurisdictional scan. An overview of the features (populations served, services provided, funding model features and delivery components) and impacts of models and approaches identified from the included evidence documents are provided in Table 1. In addition, details about features and experiences with models identified from the jurisdictional scan are provided in Table 2. Additional details from the research evidence are provided in Appendices 1 (for evidence syntheses) and 2 (for primary studies).

### **Key findings from the research evidence**

We grouped the models and approaches identified from the evidence based on those focused on pharmacists working in outpatient/community settings and those focused on incorporating pharmacists into multidisciplinary teams. We iteratively developed these categories to provide a cohesive structure to the narrative, but recognize that the models and approaches are not mutually exclusive and may overlap across

### **Box 1: Background to the rapid synthesis**

This rapid synthesis mobilizes both global and local research evidence about a question submitted to the McMaster Health Forum's Rapid Response program. Whenever possible, the rapid synthesis summarizes research evidence drawn from systematic reviews of the research literature and occasionally from single research studies. A systematic review is a summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select and appraise research studies, and to synthesize data from the included studies. The rapid synthesis does not contain recommendations, which would have required the authors to make judgments based on their personal values and preferences.

Rapid syntheses can be requested in a three-, 10-, 30-, 60- or 90-business-day timeframe. An overview of what can be provided and what cannot be provided in each of these timelines is provided on the McMaster Health Forum's Rapid Response program webpage ([www.mcmasterforum.org/find-evidence/rapid-response](http://www.mcmasterforum.org/find-evidence/rapid-response)).

This rapid synthesis was prepared over a 30-business-day timeframe and involved four steps:

- 1) submission of a question from a policymaker or stakeholder (in this case, The Canadian Partnership Against Cancer)
- 2) identifying, selecting, appraising and synthesizing relevant research evidence about the question
- 3) drafting the rapid synthesis in such a way as to present concisely and in accessible language the research evidence
- 4) finalizing the rapid synthesis based on the input of at least two merit reviewers.

categories. In addition, we also provide insights from a recent report that details opportunities for expanded roles of pharmacists in oncology care.

*Pharmacists working in outpatient/community settings*

In the evidence we identified that described models and approaches where pharmacists were integrated into cancer care in outpatient and community settings, pharmacists supported cancer patients requiring antitubercular treatments, oral anticancer therapies, and treatment for chemotherapy-induced nausea and vomiting. Overall, funding models were often not specified. One primary study noted that a program providing clinical pharmacist services at hematology-oncology clinics was funded through a clinical innovation award,(3) while another primary study focusing on integrating SMS-based patient-reported outcomes into electronic health records for chemotherapy was funded through a university cancer centre.(4) No long-term funding mechanisms were identified from the evidence to support models that focused on pharmacists working in outpatient/community settings.

Pharmacist interventions in outpatient oncology settings were explored in two of the evidence syntheses (one of high quality and one of low quality) we identified.(5; 6) The evidence syntheses highlighted that services provided by pharmacists in these settings included interventions for drug-related problems (i.e., drug dose optimization, drug interaction, adverse drug reaction, adjustments of supportive medications), symptom assessments and consultations, patient adherence, and the administration of medication. Both evidence syntheses concluded that there is positive evidence that outpatient pharmacy services can improve patient outcomes, especially medication safety.

One primary study underscored the importance of medication-management processes for community pharmacies that serve cancer patients undergoing antitubercular treatments by highlighting the development of new technology platforms to better integrate electronic medical records with medication-related information.(7) Community pharmacies were responsible for collecting patient information on conventional and supplementary drugs used at home to be sent directly to the cancer institute’s medical records through the technology platform.

The health systems specialty pharmacy (HSSP) approach was identified in another primary study where the HSSP team obtained insurance approvals for patients in need of oral anticancer therapies, coordinated how medication will be dispensed, and identified procurement pathways and hospital policies for inpatient administration.(8) Overall, the HSSP team provided cancer patients with timely and affordable treatments across various care sites and allowed for direct communication and collaboration to facilitate optimal patient care.

Another primary study found that integrating a clinical pharmacist into hematology-oncology clinics helped achieve goals set by physician, nursing, and pharmacy leaders by assisting them with educating patients on the signs and symptoms of thrombosis as well as adjusting pain management regimens and resolving chemotherapy order errors.(3) Finally, clinical pharmacists in a chemotherapy remote-monitoring program

**Box 2: Identification, selection and synthesis of research evidence**

We identified research evidence (systematic reviews and primary studies) by searching (on 16 January 2023 and on 1 February 2023) Health Systems Evidence ([www.healthsystemsevidence.org](http://www.healthsystemsevidence.org)) and PubMed. In Health Systems Evidence, we searched for overviews of systematic reviews, systematic reviews and systematic reviews using two searches. First, we searched by combining the disease filter for cancer and the provider filter for pharmacists. Second, we conducted an open search by combining the terms cancer AND pharma\*. In PubMed, we searched for: (cancer OR oncol\*) and pharmacist AND integrat\* AND (model or team).

The results from the searches were assessed by one reviewer for inclusion. A document was included if it fit within the scope of the questions posed for the rapid synthesis.

For each systematic review we included in the synthesis, we documented the focus of the review, key findings, last year the literature was searched (as an indicator of how recently it was conducted), methodological quality using the AMSTAR quality appraisal tool (see the Appendix for more detail), and the proportion of the included studies that were conducted in Canada. For primary research (if included), we documented the focus of the study, methods used, a description of the sample, the jurisdiction(s) studied, key features of the intervention, and key findings. We then used this extracted information to develop a synthesis of the key findings from the included reviews and primary studies.

using SMS patient-reported outcomes helped enable real-time patient management and develop interventions for patient episodes.(4)

#### *Pharmacists working in multidisciplinary teams*

Most of the evidence syntheses and primary studies we identified focused on the roles of pharmacists working in multidisciplinary cancer care teams. Services provided by pharmacists varied based on the different types of care needs of patients, specifically medication management, cancer pain management, precision medicine, and palliative care. Pharmacists also provided care for specific forms of cancer, including head and neck cancer, ovarian cancer, and neurological cancer. Funding for the models or approaches that were identified from the evidence were not specified. We describe below our findings about the services provided by pharmacists in multidisciplinary teams, followed by the findings of a report that described quality indicators for potential pharmacist involvement in oncology practices more generally.

#### Medication management

Medication management was a focus of cancer care models in two primary studies we identified. In one study, services provided by multi-professional cancer medication management (MCMM) teams consisting of clinical pharmacists and nurses included patient education and counselling, tumour therapy screenings, home medication authorization and administration, and tasks related to the prevention of drug-related problems.(9) The study highlighted that the MCMM model can serve as a tool to trigger expansion of existing approaches to multi-professional communication. In the other primary study, which assessed the social interactions of pharmacists working in multidisciplinary teams that managed patients using oral anticancer medications, the expertise of pharmacists in pharmacotherapy, toxicities, monitoring, and pharmaco-economics helped to address projected cancer management needs and optimize care.(10) The study also emphasized that patient, organizational and social-systems considerations identified using measurement tools like Kaplan 4Cs can help healthcare systems to prepare for workforce changes in cancer care management that includes increased utilization of oncology pharmacists.

A study from 2011 reported on an oncology pharmacist specialist being recruited for a community hospital's interdisciplinary oncology program, and found that the role of the pharmacist was essential to reducing costs and improving quality of patient care.(11) Prior to this program, it was noted that clinical pharmacists lacked defined structure in regards to communication with medical oncologists and nurses, but following implementation, the study identified a 45% reduction in total errors in relation to chemotherapy drugs. A similar finding was made in a medium-quality evidence synthesis that concluded that a pharmacist intervention program to support the management of patients undergoing anti-cancer therapy services was both clinically and financially beneficial.(12) We also found evidence indicating that the integration of pharmacists into ambulatory oncology practices enhanced patient knowledge about medication, helped to develop and adjust medication regimens, ensured medication safety, assisted in the financial review of patients' medications, and ultimately saved providers time.(13-15)

#### Cancer pain management

A medium-quality evidence synthesis evaluated pharmacist involvement in cancer pain management and identified that the most common interventions reported were medication review, education, adverse drug reactions detection and management, pain assessment, and dosing recommendations.(16) Two primary studies we identified indicated that the integration of a clinical pharmacist into the cancer pain management team can improve patient knowledge and misconceptions about pain medications, such as opioids, and can also improve pain management and adherence in cancer treatment.(17; 18) Specifically, results from a pre-post test showed a significant decrease in the mean pain scores between pre- and post- education assessments, respectively (4.76 ( $\pm$ 2.54) and 3.13 ( $\pm$ 2.80) (Paired sample *t* test;  $p=0.004$ ), along with an increase in adherence (3.16–3.55;  $p=0.027$ ).(18) Moreover, it was found that safety and efficacy in cancer pain

pharmacotherapy were mainly promoted through the pharmaceutical consultation and medication recommendations of clinical pharmacists.

### Precision medicine

A low-quality evidence synthesis (a rapid review) and three primary studies assessed how pharmacists were incorporated into precision medicine practices that serve patients with metastatic solid tumours. The evidence synthesis highlighted that in some cancer centres, pharmacists served as coordinators of Molecular Tumour Boards (MTBs) or assisted with other roles such as management of drug services and providing comprehensive patient education.(19) This was supported by the findings of the two primary studies in which oncology pharmacists routinely reviewed patient medications, made clinical recommendations to MTBs, led the development and implementation of the precision medicine practices, and were principal investigators of relevant research studies.(20-22) The studies highlighted that pharmacists shifting to targeted medicine approaches can provide them with new opportunities in the field of oncology.

### Palliative care

In palliative-care settings, pharmacists can also be responsible for medication management, including assessing potential drug interactions, adverse effects, duplications in therapy, lack of efficacy, and untreated conditions.(23) We also found a pilot study exploring the care of elderly cancer patients with breast, gastrointestinal, or lung cancer receiving first-line chemotherapy that indicated that seeing a pharmacist during their second or third chemotherapy infusion lead to improvements in not only medication management, but also vaccination rates for pneumonia and influenza among elderly cancer patients.(24) Finally, where curative options were no longer possible, pharmacists have also been integrated into the hospital and community to support hospice care as part of broader palliative efforts.(25) The evidence indicated that pharmacists were found to be beneficial for cancer patients receiving hospice care by providing consultation services for both patients and individual members of the broader palliative care team.(25)

### Care for specific forms of cancer

According to a 2021 primary study, head and neck cancer patients at a hospital in Japan benefited from the incorporation of a pharmacist into their care teams by having the pharmacist readily available to provide education and consultation services on medication management every week.(26) Another primary study found that oncology pharmacists providing support to patients who underwent radical surgery for ovarian cancer addressed the physical and mental issues of patients, helped to formulate treatment policies, reduced physician workloads by supporting patient mental health and developing treatment plans, and enabled safe outpatient treatment which reduced medical costs.(27) Two primary studies focused on integrating pharmacy specialists into neuro-oncology subspecialty clinics and found that pharmacy specialists can be useful for conducting assessments of clinical practice workflow and identifying patient care-related issues.(28; 29) Ultimately, pharmacist assessments can lead to improvements that support physician workflow and maximize patient-facing encounters by physicians.

Lastly, results of a 2018 evaluation of Quality Oncology Practice Initiative (QOPI) measures for potential pharmacist involvement in oncology practices found that pharmacy oncologists practising in multidisciplinary healthcare settings are capable of meeting 77% of the QOPI measures that make up six of the 16 Merit-Based Incentive Payment Systems linked to reimbursement.(30)

### *Opportunities for expanded roles of pharmacists in oncology care*

We also identified a 2022 evaluation report that described potential opportunities for expanding the role of oncology pharmacists in a variety of clinical care settings, namely inpatient acute-care settings, ambulatory clinical practice, specialty pharmacy dispensing sites, and community oncology practice.(31) The report notes that in inpatient acute-care settings, pharmacists can monitor resource needs to ensure optimal patient

outcomes and reduce medication-associated errors, resulting in cost savings. The report also referenced the use of tools such as the hematology/oncology pharmacist allocation (HOPA) tool and leveraging their metrics to assist organizations in justifying clinical pharmacist positions in acute care.

According to the report, integrated pharmacies or in-office medication dispensing sites can increase efficiency and reduce costs for organizations, and the addition of oncology pharmacy residents to clinical staff can contribute to clinical and administrative resources of oncology practices. The latter was echoed in a 2019 primary study we found that highlighted the contributions of pharmacy residents and students participating in a layered learning practice model where key pharmacy performance indicators remained relatively consistent while pharmacists were supervising learners.<sup>(32)</sup> Lastly, in ambulatory clinical practice, pharmacists can help to improve care quality by optimizing drug therapy, providing patient education and symptom management, and developing and implementing guidelines.<sup>(31)</sup> Billing for pharmacist services can also present opportunities for direct revenue generation.

### **Key findings from the jurisdictional scan**

Similar to the findings from the included evidence documents, our jurisdictional scans identified that the countries reviewed have focused on supporting patient education, providing consultations and decision-making support to other oncology providers as part of multidisciplinary cancer care teams, alleviating workloads of other providers by providing outpatient support to reduce the need for patients to access services in clinics, and supporting inpatient services through clinical and administrative support (e.g., assisting with dose calculations or exploring insurance options).

#### *Populations served and services provided that include a role for pharmacists in cancer care*

Findings from our jurisdictional scans highlight that models leveraging pharmacists in cancer care tend to utilize pharmacists for the following activities: screening and early detection, treatment support, information and education provision to support patient decision-making, and contributing to multidisciplinary teams in the delivery of care and in executing administrative tasks.

Many of the models we identified focused on leveraging pharmacists to advance cancer screening and referral efforts for the general population. For example, in Spain, pharmacies are seen as a key player in [screening and early detection of colon cancer](#) and have subsequently greatly increased the proportion of the population screened. Similar efforts to promote early detection/diagnosis cancer initiatives have taken place in the [U.K.](#) and several regions across Portugal (e.g., Districts of [Leiria](#), [Aveiro](#), and [Coimbra](#)). In the U.S., [community pharmacists](#) play an important role in providing BRCA genetic testing and early diagnosis of colorectal cancer, and subsequently providing counselling and referrals.

Across jurisdictions, pharmacists are also being leveraged to support patients receiving cancer treatments in both inpatient and outpatient settings to support treatment efforts and help manage pain. For example, in France, as part of the [Community Pharmacy Contribution](#) to Europe's Beating Cancer Plan, community pharmacists support patients undergoing cancer treatment by assessing patients' knowledge of the treatment and for possible medicine interaction risks, while providing follow-up support and monitoring for adherence and side effects. In the U.K., The [breast cancer treatment service](#) developed by LloydsPharmacy Healthcare Centre in partnership with Lincolnshire and Goole NHS Foundation Trust provides services that are co-located in community pharmacies to allow pharmacists to assist patients with IV immunotherapy, and S/C haematology and oncology treatments closer to their homes. In the U.S., [oncology pharmacists](#) directly provide medication therapy management and direct patient care for individuals with cancer. [Oncology pharmacists](#) in the U.S. and [community pharmacists](#) in the U.K. also play a role in supporting palliative care populations.

One of the core roles of pharmacists integrated into cancer care models and teams was to provide patient consultations and education. In France, [pharmacists conduct initial interviews with cancer patients](#) to ensure

they understand treatments and assess potential risks for drug interactions. In the U.S., [community pharmacists](#) also provide counselling to patients during cancer screening. Similarly, in the U.K., community pharmacists provide face-to-face consultations with people receiving [Risk Estimation for Additional Cancer Testing \(REACT\)](#). U.S.-based oncology pharmacists often play a role in providing patient education for cancer inpatients at specialty clinics.

Another key role of pharmacists identified in our jurisdictional scan includes providing advice to healthcare providers and participating in decision-making processes about patient care plans with the broader oncology team. At the [New York Oncology Hematology \(NYOH\)](#), pharmacists trained in cancer treatment assist physicians to develop individualized treatment regimens, while the [Hematology/ Oncology Specialty Residency](#) at Stanford Medicine trains pharmacy residents to educate healthcare professionals and assist them in inpatient and outpatient oncology settings.

Finally, pharmacists provide administrative and clinical support to cancer care teams in oncology settings. For example, in Australia, pharmacists at [Cancer Care Associates](#) help prescribers with dose calculations in addition to providing patient consultations and follow-ups. In the U.S., pharmacists at [New York Oncology Hematology \(NYOH\)](#) centres assist physicians with patient care plans and support insurance coverage options.

*System arrangements used to enable an enhanced role for pharmacists in cancer care*

Across our jurisdictional scans, most of the system arrangements we identified focused on using financial and delivery arrangements to enable an enhanced role for pharmacists in cancer care. The limited insights about governance arrangements were largely related to pharmacist associations or other accrediting organizations certifying cancer-specific training for pharmacists.

For financial arrangements that enable enhanced roles for pharmacists in cancer care, we did not identify many innovative funding models enabling pharmacist integration into cancer care approaches, and descriptions about funding models were often limited. However, some models we identified reported some information about funding for the model itself or the medications or services provided through the model.

In terms of funding the models themselves, [early detection for colon cancer programs](#) leveraging pharmacists in Spain and the regional training initiatives for pharmacists in Portugal are funded by regional health authorities in each province or district, respectively.

In terms of funding arrangements for medications and services, a variety of public and private insurance plans were identified. For example, in the context of models integrating pharmacists into multidisciplinary teams, pharmacists often played a role in exploring funding options for patient medications. At [New York Oncology Hematology centres](#), pharmacy staff explore [insurance coverage options](#) for patients. In France, [billing expenses](#) for medications and services provided by pharmacists as part of the [Community Pharmacy Contribution](#) to Europe's Beating Cancer Plan are directed towards the national health insurance system. Finally, [New Zealand's Pharmaceutical Management Agency \(Pharmac\)](#), which manages public spending on over 1,000 different medicines in hospitals and pharmacies (including newly funded cancer medicines that are often hard to access), coordinates with pharmacists and other health professional groups to coordinate drug availability and prescriptions across providers. Pharmac is responsible for deciding which medications or products are funded on behalf of the New Zealand Ministry of Health and provides guidance for prescribers and pharmacists about which subsidized medicines are available for patients.

In terms of delivery arrangements to enable enhanced roles for pharmacists in cancer care, many of the jurisdictions we searched highlighted training initiatives to better train pharmacists to provide cancer care services or integrate pharmacists into oncology settings and teams. In Portugal, several districts (e.g., Districts of [Leiria](#), [Aveiro](#), and [Coimbra](#)) have put on regional training initiatives in partnership with the Portuguese League Against Cancer. The training aims to better incorporate pharmacists into primary and secondary

cancer prevention efforts by improving their knowledge about cancer, including causes and risk factors, warning signs and symptoms, early diagnosis, screening programs, and risk of infertility in cancer patients. In the U.K., [the Boots Macmillan Information Pharmacists \(BMIP\) program](#) offers online training for community pharmacists to provide information about cancer diagnosis, treatment and medications. The [Accelerate, Coordinate, Evaluate \(ACE\) program](#), also based in the U.K., trains community pharmacists to provide support for people with cancer, especially palliative-care patients. In California, the [Hematology/Oncology Specialty Residency](#) at Stanford Medicine is accredited by the American Society of Health System Pharmacists (ASHP) and provides education and hands-on practical training in inpatient oncology, malignant hematology, chemotherapy, blood and marrow transplantation (BMT), and cancer cell therapy, as well as supporting outpatient settings.

Pharmacists have also been integrated directly into multidisciplinary cancer care teams in inpatient settings such as speciality clinics. In the U.S., approximately 4,100 [oncology pharmacists](#) provide medication-therapy management and direct patient care for individuals with cancer, including treatment assessment and monitoring. At [NYOH](#) centres, pharmacists trained in cancer treatment work with physicians to create individualized treatment regimens for patients, and investigate insurance coverage for medications through Medicare, supplemental plans, and co-payment assistance programs. In New Zealand, hospital pharmacists accredited by the [Pharmaceutical Society of New Zealand](#) provide help and advice to hospital patients, including oncology patients, in all aspects of their medicines, while in Australia, pharmacists at [Cancer Care Associates](#) conduct initial consultations and follow-ups throughout the course of treatment to tailor treatment regimens and monitor patient progress. Online platforms may have the potential to play an important role in integrating pharmacists and pharmacy services into specialty clinics. In the U.S., a partnership between the National Cancer Care Alliance (NCCA) and [HouseRx](#) allows NCCA member clinics to leverage HouseRx's technology platform and pharmacy services to dispense specialty medications directly to patients. NCCA clinics will receive a one-time custom analysis to showcase opportunities to streamline access to specialty medications.

**Table 1: Overview of the evidence on features and impacts of models and approaches to enhance the role of pharmacists in cancer care**

Models identified from evidence documents	Features of the models identified	Impacts identified from evaluations of the models identified
<b>Pharmacists working in outpatient/community settings</b>		
<p><a href="#"><u>Development, implementation, and early experience with a program providing clinical pharmacist services at hematology-oncology clinics (3)</u></a></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients of hematology-oncology clinics of a university teaching hospital</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• A pharmacist was hired to provide outpatient supportive care consultation service at a university teaching hospital, which included assisting primary oncologists with the management of adult patients with problematic cancer symptoms or its treatment</li> <li>• The pharmacist also educated patients receiving chemotherapy on signs and symptoms of thrombosis as well as adjusting pain management regimens and resolving chemotherapy order errors</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• The program was funded through a clinical innovation award</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• Four goals of the program that was facilitated by the pharmacist was to 1) improve management of supportive care, 2) enhance the education of patients receiving complicated chemotherapy regimens, 3) improve efficiency within the chemotherapy infusion unit, and (4) develop an experiential learning opportunity for pharmacy students and residents</li> </ul>	<ul style="list-style-type: none"> <li>• Overall, the integration of a clinical pharmacist practitioner into the hematology-oncology clinics helped achieve goals set by physician, nursing, and pharmacy leaders</li> </ul>
<p><a href="#"><u>Integration of SMS text patient-reported outcomes in the electronic health</u></a></p>	<p><i>Population served</i></p>	<ul style="list-style-type: none"> <li>• The chemotherapy remote care monitoring program enabled real-time patient management, and clinical pharmacists were key team members who helped manage</li> </ul>

<p><u>record and pharmacist intervention for chemotherapy (4)</u></p>	<ul style="list-style-type: none"> <li>• High-risk patients for chemotherapy-induced nausea and vomiting (CINV) being treated at a chemotherapy remote-care monitoring program</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Clinical pharmacists monitored and triaged patient responses and developed interventions for patient episodes meeting predefined threshold criteria</li> <li>• Pharmacists also provided education to patients</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• The program was funded by the University of Michigan Rogel Cancer Center</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• High-risk patients for CINV who were enrolled in the program received a daily text message survey after chemotherapy administration to report symptoms for seven days</li> <li>• Pharmacists received patient responses meeting the threshold for real-time review, which automatically routed to a shared inbox</li> </ul>	<p>patient symptoms and significantly reduced unplanned healthcare utilization</p>
<p><u>Assessing the effect of outpatient clinical pharmacy services on medication-related outcomes in cancer care (5)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients receiving anticancer therapies at outpatient clinical pharmacies</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Pharmacy services included interventions for drug-related problems (i.e., drug dose optimization, drug interaction, adverse drug reaction, adjustments of supportive medications), adherence and understanding assessments, and symptom assessments</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• The authors concluded that there is positive evidence that outpatient pharmacy services can improve patient outcomes, especially medication safety; however, the overall effectiveness could not be determined</li> </ul>

<p><u>Describing the effectiveness of oncology services delivered by clinical pharmacists (6)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients receiving outpatient oncology services from clinical pharmacists</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• The majority of pharmacist interventions consisted of clinical consultations, correction of prescription errors, and the administration of medication</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• The authors concluded that pharmacist-based services improved identification of treatment and medication issues, delivered satisfactory services, and improved symptoms among patients with cancer</li> <li>• Clinical pharmacy services also resulted in some cost savings</li> </ul>
<p><u>New integrated model to improve medication reconciliation in oncology linking a cancer institute with community pharmacies (7)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Cancer patients undergoing antineoplastic treatments that are served by community pharmacies (CPs)</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Services focused on providing accurate medication reconciliation in oncology</li> <li>• Community pharmacies are involved in collecting essential information from patients on conventional and supplementary drugs used at home</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• A new IT platform with the same format as the electronic medical records of the cancer institute is used by the pharmacist to collect patient information, including drug packages or other products used at home, paper referrals, or prescriptions from specialists</li> <li>• Data is sent directly to the cancer institute medical records through the IT platform where</li> </ul>	<ul style="list-style-type: none"> <li>• The results of this study underscore the importance of medication management processes for community pharmacies, which are often neglected by oncologists because of the pressures of everyday clinical activity</li> </ul>

	<p>the oncologist downloads the information and performs the coordination process</p>	
<p><u>How health systems specialty pharmacies (HSSP) can address common challenges of novel oncology and hematology treatments (8)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients in need of treatment with oral anticancer therapies</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• A health systems specialty pharmacy (HSSP) team may consist of inpatient and outpatient pharmacists, physicians, nurse practitioners, physician assistants, and a pharmacy and therapeutics committee</li> <li>• The HSSP team serves to obtain insurance approval, coordinate how medication will be dispensed, and identify procurement pathways and hospital policies for inpatient administration</li> <li>• The HSSP pharmacist communicates with the pharmacy to provide information needed to coordinate delivery</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• HSSP team member roles and responsibilities for inpatient initiation and outpatient persistence of novel therapies are defined across the HSSP pharmacist/technician, inpatient pharmacist, outpatient pharmacist, inpatient prescribing team (e.g., MD, NP, PA, etc.), outpatient prescribing team (e.g., MD, NP, PA, etc.) and pharmacy and therapeutics committee</li> <li>• The pharmacy and therapeutics committee reviews treatment plans for effectiveness and safety, and compares costs to potential alternative therapies</li> </ul>	<ul style="list-style-type: none"> <li>• Overall, the HSSP multidisciplinary processes address the growing need for cancer patients to receive timely and affordable treatments across various care sites and allow for direct communication and collaboration to facilitate optimal patient care</li> <li>• No evaluation of the impact of pharmacists in the HSSP approach was conducted</li> </ul>
<p><b>Pharmacists working in multidisciplinary teams</b></p>		

<p><u>Task allocation in the multi-professional cancer medication-management model focusing on the role of the pharmacist, patient education and counselling (9)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Clinical pharmacists and nurses working together on tasks for cancer medication management, including patient education and counselling, regardless of the practice setting</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Services provided by MCMM teams were related to patient education and counselling, the prevention of drug-related problems, and authorization and administration</li> <li>• Pharmacists were primarily integrated into the multi-professional cancer medication management model to provide patient education and counselling as well as prevention of drug-related problems</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• Pharmacists were identified as mainly supporting patient education by providing information on tumour therapy and possible adverse effects, complementary cancer therapies, medication, food and dietary supplements to avoid, and financial aspects of the therapy</li> <li>• Pharmacists also developed and prepared the tumour therapy for administration, and provided screening for interactions between tumour therapy, supportive therapy and home medication</li> </ul>	<ul style="list-style-type: none"> <li>• Pharmacists were integrated into the MCMM model to provide patient education and counselling as well as prevention of drug-related problems, but it was recognized that the full potential of the therapist was not recognized in the application of the MCMM model</li> <li>• The MCMM model was appreciated by professionals involved, and the model can serve as a tool to trigger expansion of existing approaches to multi-professional communication</li> </ul>
<p><u>Self-administration and adherence to oral anticancer medications through evolving interprofessional roles and pharmacist workforce (10)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients who use oral anticancer medications (OAMs) and intravenous anticancer treatments</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• As part of a multidisciplinary team, pharmacists help to develop therapeutic plans, collaborate</li> </ul>	<ul style="list-style-type: none"> <li>• The evaluation found that knowledgeable oncology clinical pharmacists bring with them expertise in pharmacotherapy, toxicities, monitoring, and pharmaco-economics, which can optimize cancer care and address projected cancer management needs</li> </ul>

	<p>with the rest of the oncology team, be involved with drug development, patient counselling and education, and assist with research</p> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• Kaplan 4Cs in the context of social interactionism denotes socio-technical relationships in the healthcare setting and the changes in how departments are linked by computer systems, management and organizational control, and care delivery prompted by technology within the organizational context</li> </ul>	<ul style="list-style-type: none"> <li>• Patient, organizational and social-systems considerations using Kaplan 4Cs can help healthcare systems to prepare for workforce changes in cancer care management that includes increased utilization of oncology pharmacists</li> </ul>
<p><a href="#"><u>Interdisciplinary oncology practice model in a community hospital(11)</u></a></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Oncology patients at the community hospital</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• All pharmacists had a distributive role in oncology and a clinical role in pharmacy protocols</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The program focused on making the following changes: standardized order forms, creating collaborative agreements, improving oncology nursing and pharmacy processes, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• The study highlighted that prior to this program, clinical pharmacists lacked defined structure in regards to communication with medical oncologists and nurses, specifically on patient-care issues and drug information</li> <li>• Furthermore, the intervention found the role of the clinical pharmacist to be essential in reducing costs and improving quality of patient care</li> <li>• The authors found a 45% reduction in total errors in relation to chemotherapy drugs, and the most common error was found to be missing information.</li> </ul>
<p><a href="#"><u>Integration of pharmacists in the management of patients undergoing anticancer therapy services (12)</u></a></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• One study described that board-certified oncology pharmacists had eight skills that related to anticancer therapy services and management,</li> </ul>	<ul style="list-style-type: none"> <li>• In terms of outcomes, adherence and patient satisfaction improved based on a pharmacist-intervention program, but a qualitative study found patients prefer nurse-led to pharmacist-led services citing concerns of training for pharmacists to undertake clinical reviews</li> </ul>

	<p>but are often limited by collaborative practice agreements with physicians</p> <ul style="list-style-type: none"> <li>• Another study indicated that pharmacists are trained as independent prescribers, and therefore had greater inclusion in advanced clinical placement (ACP) services</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• No additional information</li> </ul>	
<p><i>Integrating pharmacists in ambulatory oncology practice:</i></p> <p><a href="#"><u>Clinical and economic impact of pharmacist interventions in an ambulatory hematology-oncology department (13)</u></a></p> <p><a href="#"><u>Evaluation of the Role and Impact of Ambulatory Clinical Pharmacists in an Academic Comprehensive Cancer Center (14)</u></a></p> <p><a href="#"><u>Integration of 19 ambulatory-care centres into an oncology network through workflow modifications, training, and a hybrid pharmacy services model (15)</u></a></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• All cancer patients at a teaching hospital who received a first injectable immune- and/or chemotherapy regimen</li> <li>• Providers and nurses of cancer patients at Duke Cancer Center</li> <li>• Cancer patients at 19 community-based physician practice sites and the University of Pittsburgh Medical Center</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• The roles of pharmacists were generally to provide information to patients and to improve knowledge about their medication</li> <li>• Pharmacists placed chemotherapy orders for patients, wrote prescriptions, were consulted to develop and adjust medication regimens, educated patients, and assisted in the financial review of patients' medications</li> <li>• Pharmacists worked to ensure medication safety and addressed associated regulatory requirements, were stationed at cancer centres or facilitated remote order verifications, and attended meetings to discuss workflow plans with nursing and medical staff</li> </ul> <p><i>Funding model features</i></p>	<ul style="list-style-type: none"> <li>• The study concluded that having the two full-time clinical pharmacists in the ambulatory hematology-oncology program was both clinically and economically beneficial to the oncology department of the hospital</li> <li>• Pharmacists ultimately saved providers time and allowed them to focus on treating patient illnesses</li> <li>• Overall, 19 ambulatory-care centres were successfully integrated into the oncology network through workflow modifications, staff training, and a hybrid pharmacy-services model ensuring that two pharmacists checked antineoplastic orders in accordance with regulatory and quality standards</li> </ul>

	<ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The network was developed through 1) the development of oncology medication protocols, 2) interdisciplinary efforts that modified oncology care workflows, 3) implementing a hybrid practice model to optimize clinical pharmacy resources, and 4) focused staff-training programs</li> </ul>	
<p><u>Pharmacist involvement in managing pain in patients with cancer (16)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Cancer patients with pain</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• The most common interventions reported were medication review, education, adverse drug reactions (ADR) detection and management, pain assessment, and dosing recommendations</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• The authors reported significant reduction in pain and ADR, and improved quality of life</li> </ul>
<p><u>Integrating clinical pharmacists into a hospital cancer unit to support cancer pain patients (17)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Cancer pain patients admitted to a teaching hospital in China</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Services involved the management of medication adherence, drug-related problems, pain relief, and analgesics adverse events in cancer pain patients</li> <li>• Pharmacists were integrated into the care team for cancer pain patients by providing assessments and patient education, as well as consultations for physicians</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul>	<ul style="list-style-type: none"> <li>• The results showed that the medication education of CPs led to a change in patients' attitudes towards opioids and improved their medication adherence</li> <li>• The researchers also found that the safety and efficacy in cancer pain pharmacotherapy were mainly promoted through the pharmaceutical consultation and medication recommendations of the CPs</li> </ul>

	<p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• Clinical pharmacists provided a comprehensive pain assessment and medication education for all enrolled patients</li> <li>• Patients were also monitored during a 28-day follow-up for analgesic efficacy and safety daily during hospitalization, and were scheduled for reassessment and medication education via telephone after discharge</li> </ul>	
<p><u>Clinical pharmacist patient education in a multidisciplinary pain unit (18)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients diagnosed with cancer prescribed opioid analgesics</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• The intervention consisted of a clinical pharmacist working collaboratively with physicians and nurses in the pain unit to provide patient education on opioid treatments</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• A clinical pharmacist and pain specialist physician jointly designed a patient information booklet about opioid analgesics</li> <li>• Patients' beliefs about opioids were assessed before and after the intervention, as well as their level of adherence to opioid treatment</li> </ul>	<ul style="list-style-type: none"> <li>• The results of the study indicated that the integration of a clinical pharmacist into the pain management team can improve patient knowledge and misconceptions about opioids, and also improve pain management and adherence in cancer treatment</li> </ul>
<p><i>Precision medicine programs that incorporate oncology pharmacists</i></p> <p><u>Precision medicine initiatives in oncology pharmacy practice (19)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• In some cancer centres, pharmacists can be coordinators of Molecular Tumour Boards (MTBs) or assist with other roles such as management of drug services and providing comprehensive patient education</li> </ul>	<ul style="list-style-type: none"> <li>• The study highlights that pharmacy practice is invaluable in precision medicine, and that pharmacists can be important members of interprofessional precision oncology teams The inclusion of the clinical pharmacist as a resource for healthcare professionals and a point-of-contact and support for patients was feasible and acceptable to both oncologists and patients</li> </ul>

<p><u>To examine the integration of a clinical pharmacist into a Precision Medicine Program for oncology patients</u> (20)</p>	<ul style="list-style-type: none"> <li>Pharmacists can also perform routine phone calls to follow up with patients about their treatment plans, verify chemotherapy regimens, check for drug-drug interactions, and provide additional resources if needed</li> <li>The pharmacist served as a drug resource for the program’s molecular tumour board, as well as for oncologists seeking precision-based oncologic strategies</li> <li>The pharmacist dispensed drugs in collaboration with the specialty pharmacy and provided assistance to drug oncology patients receiving precision-based therapies</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>N/A</li> </ul>	
<p><u>Precision Genomic Practice in Oncology: Pharmacist Role and Experience in an Ambulatory Care Clinic</u> (21)</p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>Patients with metastatic solid tumours at an Indiana ambulatory clinic</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>The precision oncology ambulatory clinic used a molecular tumour board (MTB) approach to evaluate tumours at the molecular level in order to guide patient-specific therapy</li> <li>Patients at the Indiana clinic met with a pharmacist and PGY-2 oncology pharmacy residents for 30-45 minutes to educate them on genomic findings</li> <li>The oncology pharmacist reviews patient medications, makes recommendations, takes part in weekly meetings, and documents recommendations made by the tumour board</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>Not specified</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists in precision medicine can be involved in interpreting tumour genome sequencing results, managing anticoagulant use, leading patient education and obtaining off-label drug therapy, but their specific roles may vary depending on the practice setting</li> <li>The study highlights that this shift to targeted medicine approaches provides pharmacists with new opportunities in the field of oncology, but pharmacists may lack some of the education for adequate knowledge to interpret genomic tests and targeted therapies</li> <li>The study recommends improvement be made to transform the pharmacy education system and prepare pharmacists for opportunities in precision medicine</li> </ul>

	<p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The MTB at the Indiana hospital is comprised of a medical oncologist, a medical and genetic scientist, an oncology pharmacist, pharmacy residents, nurses, and other scientists</li> </ul>	
<p><u>Three precision medicine practice models developed by oncology pharmacists (22)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients of solid tumour and hematologic practices</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Precision medicine incorporates a forum of interprofessional teams that include pharmacists who discuss tumour somatic mutations to guide patient-specific treatment</li> <li>• Pharmacists involved in the precision medicine practice models led the development and implementation of the models, routinely made clinical recommendations, and were principal investigators of relevant research studies</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The precision medicine practice models described were 1) a clinic, 2) a clinical consultation service, and 3) a molecular tumour board (MTB)</li> <li>• At the referral clinic from where Indiana University’s genomic program operates, a coordinating team that includes an oncology clinical pharmacist reviews the medical history and tumour-sequencing results of patients with advanced or rare solid malignancies, and presents them to a multidisciplinary tumour board that may include oncology pharmacists, oncology nurses, and medical oncologists</li> </ul>	<ul style="list-style-type: none"> <li>• While all three precision medicine practice models incorporated pharmacists at different phases of implementation, there was no evaluation conducted of the impact of pharmacists in these models</li> </ul>

	<ul style="list-style-type: none"> <li>• The clinical consultation service provided by the Moffitt Cancer Center’s DeBartolo Family Personalized Medicine Institute (DFPMI) provides personalized medicine services by offering direct clinical translation of genomic testing results for patients by pharmacists and other cancer specialists, as well as financial strategists</li> <li>• At the University of Wisconsin where the MTB model was implemented, a clinical pharmacist and medical oncologist met every other week to assess clinical cases of adult patients with solid-tumour cancer via consultations, and subsequently make recommendations</li> <li>• Implementation strategies for all the models include interprofessional involvement, integration into clinical workflow, institutional support, and selection of the model based on payer mix</li> </ul>	
<p><u>The contributions of the oncology pharmacist as part of the palliative treatment team (25)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Oncology patients receiving palliative care at an Amsterdam hospital</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Pharmacists kept records of all patient consultations and participated in team meetings and patient rounds</li> <li>• Pharmacists were also available for consultation with individual members of the palliative care team on a daily basis</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <p>N/A</p>	<ul style="list-style-type: none"> <li>• The outpatient pharmacist gave advice mostly on stopping a prophylactic drug and improving adherence, while the hospital pharmacist provided interventions pertaining to a switch in the route of administration</li> <li>• The results of the study demonstrated that including a team of pharmacists in the palliative-care team adds expertise to the team and can be beneficial to enhancing oncology patients’ care plans</li> </ul>
<p><u>Multidisciplinary palliative oncology clinic and the</u></p>	<p><i>Population served</i></p>	<ul style="list-style-type: none"> <li>• The use of the standardized pharmacy assessment by the pharmacist within the clinic helped understand and address</li> </ul>

<p><u>role of a pharmacist within the clinic (23)</u></p>	<ul style="list-style-type: none"> <li>• Patients receiving palliative care at a multidisciplinary oncology clinic in the U.S.</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Using a standardized pharmacy assessment, the pharmacist was responsible for reconciling medication, including assessing potential drug interactions, adverse effects, duplications in therapy, lack of efficacy, and untreated conditions</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <p>N/A</p>	<p>medication issues including duplicate therapies (in 46.7% of patients), lack of efficacy (94.7%), side effects (74.7%), untreated conditions (73.3%), and drug interactions (44%)</p> <ul style="list-style-type: none"> <li>• Additionally, the integration of the pharmacist into the team is thought to have assisted other disciplines in their own assessments</li> </ul>
<p><u>Integrating pharmacists to cancer care of elderly patients related to medication management and vaccination administration (24)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Elderly patients with breast, gastrointestinal, or lung cancer receiving first-line chemotherapy through pharmacy intervention or usual care</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• Patients assigned to the intervention group met with the pharmacist once during their second and third chemotherapy infusions</li> <li>• The intervention group met with a pharmacist once during their second or third chemotherapy infusion</li> <li>• Pharmacists assisted with patient medication management and vaccination administration</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <p>N/A</p>	<ul style="list-style-type: none"> <li>• While pilot studies are discouraged to determine preliminary efficacy of the intervention, there were some signals that indicated improvement in vaccination rates for pneumonia and influenza and fewer medication-management errors</li> </ul>
<p><u>Pharmacist-involved education program in a multidisciplinary team for oral mucositis (26)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Head and neck cancer patients</li> </ul> <p><i>Services provided and role of pharmacists</i></p>	<ul style="list-style-type: none"> <li>• The study found that patients managed by a pharmacist-involved education program in a multidisciplinary team (PEMT) had significantly less weight loss, use of lidocaine</li> </ul>

	<ul style="list-style-type: none"> <li>Pharmacists were brought in to help support patient knowledge and support other members of the care team</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>Pharmacists made a medication instruction manual and consulted with patients once a week</li> </ul>	<p>viscous, opioid dose, and rate of switch to fentanyl tape compared to care as usual</p>
<p><u>Oncology pharmacist participation in ovarian cancer treatment (27)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>Patients who underwent radical surgery for ovarian cancer</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>Three groups of patients were provided oncology care: 1) those managed by a certified oncologist, 2) those managed by a non-certified oncologist, and 3) those managed by a non-certified oncologist and an oncology pharmacist</li> <li>Services provided by an oncology pharmacist in the third group included consideration of the patient's regimen, guidance for patients before chemotherapy starts, continuous medical interviews through the chemotherapy period, and proposal to physicians considering chemotherapy management</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>The medical cost per chemotherapy cycle was the primary outcome and was calculated by the difference between the costs of surgery and post-operative complications and the total medical costs incurred from the date of initial examination to the completion of adjuvant chemotherapy</li> </ul>	<ul style="list-style-type: none"> <li>The study found that the patient group that was managed by the non-certified oncologist and oncology pharmacist had a significantly greater outpatient treatment rate, were administered an average of four more supportive therapy drugs per patient, and incurred less medical cost per chemotherapy cycle than the other two patient groups</li> <li>Oncology pharmacists in the study provided information to help address the physical and mental discomfort of patients, helped formulate treatment policies, and offered qualitative improvements to patient services and team medical care</li> <li>These pharmacists played a major role in cancer drug therapy management as well as reduced physician workloads and improved risk management</li> </ul>

<p><i>Integrating neuro-oncology pharmacy specialists</i></p> <p><u>Evaluating pharmacist value in neuro-oncology subspecialty clinics (28)</u></p> <p><u>Assessing the feasibility of integrating a pharmacist into a neuro-oncology clinic (29)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• A pharmacy specialist was temporarily integrated into a neuro-oncology clinic to evaluate the clinical practice and complete a 14-day clinical chart evaluation (29)</li> <li>• A pharmacist attended weekly multidisciplinary patient rounds at the clinic and was responsible to meet with patients who received chemoradiotherapy (30)</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• Screenings were completed for new therapies, drug-to-drug interactions, medication management, and advanced interventions related to chemotherapy dosing, scheduling with the physician, and side-effect analysis (29)</li> <li>• The pharmacist provided standardized counselling on chemotherapy administration including dose and time of treatment, side-effect management, dosing of supportive medications, drug interactions, communication with the hospital dispensary and community pharmacists to ensure prescriptions were provided, and any other medication-related questions raised by the patients</li> <li>• The pharmacist also followed up the next day and five days following the start of treatment to address medication-related questions (30)</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to the integration of the pharmacy specialist, the neuro-oncology physician workflow required five hours per week for evaluation of patient medications and chemotherapy planning, which ultimately limited the addition of seven patient-facing interactions per week</li> <li>• Having a pharmacy specialist to support physician workflow could maximize patient-facing encounters by physicians (29)</li> <li>• In addition to improvements of patient care and staff satisfaction, the pharmacist was able to identify a number of patient care-related issues including: 1) the need for another formal training session between the day after and the fifth day follow-up after treatment, 2) the need to address the possibility of missing chemotherapy orders due to the time lag between initial consultation and radiation, and 3) the lack of standardized dexamethasone tapering schedule and therefore inconsistent prescribing practices</li> <li>• Overall, a clinical pharmacist was found to be useful and was recommended to be a permanent member of the outpatient neuro-oncology clinic (30)</li> </ul>
<p><u>Evaluation of the impact of oncology specialists on QOPI measures of oncology practices (30)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Services provided and role of pharmacists</i></p>	<ul style="list-style-type: none"> <li>• The results of the analysis demonstrated that pharmacy oncologists practising in a multidisciplinary healthcare clinic are capable of meeting 77% of the QOPI measures that</li> </ul>

	<ul style="list-style-type: none"> <li>• Three pharmacists analyzed 177 Quality Oncology Practice Initiative (QOPI) measures for potential pharmacist involvement using the Hematology/Oncology Pharmacy Association Scope of Practice document along with a validated summary of services</li> <li>• Measures largely focused on optimizing drug therapy through the development and implementation of pharmacy guidelines and focused on patient counselling and symptom management</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The QOPI was developed by the American Society of Clinical Oncology (ASCO) to facilitate the improvement of quality oncology care</li> </ul>	<p>make up six of the 16 Merit-Based Incentive Payment System (MIPS) linked to reimbursement</p> <ul style="list-style-type: none"> <li>• This provides support for the addition of oncology pharmacists to clinical practices</li> </ul>
<b>Potential opportunities for expanding the roles of oncology pharmacists</b>		
<p><u>Potential opportunities to expand oncology pharmacist teams (31)</u></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Case examples presented in this report were based in the inpatient acute-care setting, ambulatory clinical practice, specialty pharmacy dispensing sites, and community oncology practice</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• In the inpatient acute care setting, justification for acute-care pharmacists include patient acuity, combining metrics, and chemotherapy regimens that need close monitoring; acute-care pharmacists can also monitor resource needs to ensure optimal patient outcomes and reduce medication-associated errors, resulting in cost savings</li> <li>• Utilizing tools like the hematology/oncology pharmacist allocation tool (HOPAT) and leveraging their metrics can assist organizations in justifying clinical pharmacist positions in acute care</li> <li>• In ambulatory clinical practice, pharmacists can help to improve care quality by optimizing drug therapy, providing patient education and symptom management, and developing and implementing guidelines; billing for pharmacist services can also present opportunities for direct revenue generation</li> </ul>

		<ul style="list-style-type: none"> <li>• Integrated pharmacies or in-office medication dispensing sites can also be beneficial to organizations in terms of increasing efficiency and reducing costs; additionally, oncology pharmacy residents can add clinical staff along with their contributions in clinical, quality and administrative projects</li> </ul>
<p><a href="#"><u>A layered learning practice model involving pharmacists supporting medical oncology services through 8 clinical pharmacy key performance indicators (32)</u></a></p>	<p><i>Population served</i></p> <ul style="list-style-type: none"> <li>• Patients receiving inpatient oncology services from hospital pharmacists participating in the layered learning practice model (LLPM)</li> </ul> <p><i>Services provided and role of pharmacists</i></p> <ul style="list-style-type: none"> <li>• The inpatient medical oncology service consists of an interdisciplinary team (including pharmacists) providing care to patients with acute-care needs</li> <li>• Pharmacists in the LLPM supervise pharmacy residents and students at different levels of training</li> </ul> <p><i>Funding model features</i></p> <ul style="list-style-type: none"> <li>• Not specified</li> </ul> <p><i>Delivery features (i.e., coordination, providers, settings and other supports)</i></p> <ul style="list-style-type: none"> <li>• The inpatient medical oncology service includes two full-time pharmacists who spend approximately 65% of their time providing direct patient-care services, 25% of their time conducting centralized pharmacy distribution tasks, and 10% of their time on administrative, educational, research, or quality improvement-based initiatives</li> </ul>	<ul style="list-style-type: none"> <li>• Despite a consistent trend of pharmacists to contribute less to overall patient care when pharmacy learners were present, the proportions of patients receiving clinical pharmacy key performance indicators were similar for scenarios with and without pharmacy learners present</li> </ul>

Table 2: Experiences from other countries on features and impacts of models and approaches to enhance the role of pharmacists in cancer care

Jurisdiction / Model or approach	Populations served and services provided that include a role for pharmacists in cancer care		System arrangements used to enable an enhanced role for pharmacists in cancer care*	
	Population served	Services provided and role of pharmacists	Funding model features	Delivery features (i.e., coordination, providers, settings and other supports)
<b>Australia</b>				
<a href="#">Cancer Care Associates</a>	<ul style="list-style-type: none"> <li>Patients receiving care at Cancer Care Riverina and Southside clinics</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists will conduct an initial consultation to understand the patient’s past medical history, and complete various checkpoint follow-ups throughout the course of the treatment (e.g., blood tests, dose calculations, and assessing for drug interactions)</li> </ul>	<ul style="list-style-type: none"> <li>Specific medication costs vary based on treatment and insurance coverage</li> </ul>	<ul style="list-style-type: none"> <li>The pharmacy will help to coordinate the ordering, compounding, dispensing, and supply of the prescribed medication</li> <li>On-site pharmacists and clinical trials</li> </ul>
<b>France</b>				
The <a href="#">Community Pharmacy Contribution</a> to Europe’s Beating Cancer Plan	<ul style="list-style-type: none"> <li>Patients undergoing oral cancer treatment</li> </ul>	<ul style="list-style-type: none"> <li>Pharmacists are involved in conducting an initial patient analysis and interview (to determine the patient’s understanding of the treatment and to assess for possible risks of medicine interaction), with subsequent thematic interview follow-ups to provide support and monitor for side effects and medicine adherence</li> <li>The first year consists of <a href="#">three interviews</a> with the pharmacist</li> </ul>	<ul style="list-style-type: none"> <li>Billing <a href="#">expenses</a> will be directed towards the national health insurance system</li> <li>During the first (i.e., ‘reference year’), remuneration per patient is 50 euros, while following interviews are 30 euros</li> </ul>	<ul style="list-style-type: none"> <li>Community pharmacists</li> <li>Regulatory approval by the National Union of Health Insurance Funds, the Federation of Pharmaceutical Unions of France, and the Union of Community Pharmacy Unions</li> </ul>

New Zealand				
<u>Pharmac</u>	<ul style="list-style-type: none"> <li>The <u>Pharmaceutical Management Agency (Pharmac)</u> is responsible for decisions on which medications or products are funded on behalf of the New Zealand Ministry of Health</li> </ul>	<ul style="list-style-type: none"> <li><u>Pharmac's primary responsibilities</u> are deciding on new medications to fund and managing the current health budget</li> <li>Pharmac is also interested in increasing access to previous and newly funded medicines to areas with little access</li> <li>Pharmac provides advice and guidance for prescribers and pharmacists, who put into practice the Pharmaceutical Schedule to determine which subsidized medicines are available for their patients</li> </ul>	<ul style="list-style-type: none"> <li>In 2020-21, <u>Pharmac managed \$1.04 billion</u> in spending on medicines in the community</li> <li>Currently, Pharmac funds around 1,000 different medicines in hospitals and pharmacies</li> </ul>	<ul style="list-style-type: none"> <li>Pharmac coordinates with doctors, clinicians and other prescribers, pharmacists, and health professional groups consisting of a combination of the above to help coordinate drug availability and prescriptions across providers</li> </ul>
<u>Hospital pharmacists</u>	<ul style="list-style-type: none"> <li>Hospital pharmacists, accredited by the <u>Pharmaceutical Society of New Zealand</u>, provide help and advice to hospital patients in all aspects of their medicines</li> </ul>	<ul style="list-style-type: none"> <li><u>Specialty areas</u> where hospital pharmacists work include cardiology, oncology and mental health</li> <li>Hospital pharmacists provide advice on best choices for medications, dose use, possible side effects and interactions</li> <li>Their role is also important for ensuring that patients understand their medications and for answering patients' questions</li> </ul>	<ul style="list-style-type: none"> <li>None identified</li> </ul>	<ul style="list-style-type: none"> <li>Hospital pharmacy and hospital settings</li> </ul>
Portugal				

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<p>Regional training initiatives for pharmacists (<a href="#">District of Leiria</a>, <a href="#">District of Aveiro</a>, and <a href="#">District of Coimbra</a>, as well as the Districts of Viseu, Castelo Branco and Guarda)</p>	<ul style="list-style-type: none"> <li>• Early diagnosis and detection</li> </ul>	<ul style="list-style-type: none"> <li>• The Portuguese League Against Cancer in partnership with Regional Associations of Pharmacists put on a series of credit-based courses in 2018 to help pharmacists improve their knowledge about cancer, including causes and risk factors, warning signs and symptoms, early diagnosis, screening programs and risk of infertility in cancer patients; the course aims to help pharmacists become more active in primary and secondary cancer prevention</li> </ul>	<ul style="list-style-type: none"> <li>• Initiatives are funded by the respective regions in which they take place</li> </ul>	<ul style="list-style-type: none"> <li>• Training initiatives were implemented across districts in Portugal, including the <a href="#">District of Leiria</a>, <a href="#">District of Aveiro</a>, and <a href="#">District of Coimbra</a></li> </ul>
<b>Spain</b>				
<p><a href="#">Early detection for colon cancer programs</a></p>	<ul style="list-style-type: none"> <li>• Screening and early detection of colon cancer</li> </ul>	<ul style="list-style-type: none"> <li>• The network of 22,198 pharmacies in Spain is considered an essential agent in <a href="#">screening and early detection of colon cancer</a>, as demonstrated by the programs that are being developed in Catalonia, the Balearic Islands, Murcia and Navarra, where pharmacies are <a href="#">the kit collection points for detecting fecal occult blood</a></li> <li>• This experience has exponentially increased the population screened in Spain</li> </ul>	<ul style="list-style-type: none"> <li>• This model is funded by the health department in each province</li> </ul>	<ul style="list-style-type: none"> <li>• Community pharmacists</li> <li>• <a href="#">General Council of Official Colleges of Pharmacists</a></li> </ul>

United Kingdom (U.K.)				
Should there be something in this cell???	<ul style="list-style-type: none"> <li>• Early diagnosis of cancer (e.g., potential people with cancer in <a href="#">England</a> based on the following symptoms: cough that lasts for three weeks or more, difficulty swallowing, blood in their urine)</li> </ul>	<ul style="list-style-type: none"> <li>• In 2022, <a href="#">NHS England</a> announced that they will be conducting a pilot study where community pharmacists will be able to assess and refer people with potential signs of cancer directly to a hospital</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>	<ul style="list-style-type: none"> <li>• While the <a href="#">details of the pharmacy pilot study are limited</a>, the chair of the Royal College of General Practitioners recommended that thresholds for referral are consistent, appropriate diagnostic tools are applied in the community, and a system is in place for same-day communication between pharmacists and their general practitioner</li> </ul>
<a href="#">REACT</a>	<ul style="list-style-type: none"> <li>• Early diagnosis of cancer</li> </ul>	<ul style="list-style-type: none"> <li>• A collaboration between the University of Manchester and Lloyds Pharmacy supported people to complete a <a href="#">Risk Estimation for Additional Cancer Testing (REACT)</a> questionnaire in community pharmacies, where trained pharmacists provided face-to-face consultations with people who completed the self-reported questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>	<ul style="list-style-type: none"> <li>• The <a href="#">REACT questionnaire</a> involved trained pharmacists to provide people with an estimate of their risk of cancer in community pharmacies, where those with high scores were referred to a general practitioner for follow-up</li> </ul>
<a href="#">Mole screening service</a>	<ul style="list-style-type: none"> <li>• Early diagnosis of cancer</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Mole screening service</a> provided in community pharmacies</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>
<a href="#">Breast cancer treatment service</a>	<ul style="list-style-type: none"> <li>• Self-management and treatment</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Breast cancer treatment service</a> developed by the LloydsPharmacy Healthcare Centre in partnership with Lincolnshire and Goole NHS Foundation Trust</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>	<ul style="list-style-type: none"> <li>• Located in community pharmacy and healthcare centres with nurse-administrated subcutaneous injections such as IV immunotherapy, S/C</li> </ul>

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		<ul style="list-style-type: none"> <li>Services are co-located in community pharmacies where pharmacists assist with IV Immunotherapy, S/C hematology and oncology treatments to allow patients to receive their cancer treatments closer to their homes</li> </ul>		hematology and oncology treatments (i.e., releasing 400 hours of chair time in the hospital)
<a href="#"><u>The Boots Macmillan Information Pharmacists (BMIP) program</u></a>	<ul style="list-style-type: none"> <li>Self-management and treatment</li> </ul>	<ul style="list-style-type: none"> <li><a href="#"><u>The Boots Macmillan Information Pharmacists (BMIP) program</u></a>, where community pharmacists are trained to provide information about cancer diagnosis, treatment, and medications</li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>	<ul style="list-style-type: none"> <li>The training program entails an online education component for community pharmacists</li> </ul>
<a href="#"><u>Utilizing community pharmacists to support people with cancer</u></a>	<ul style="list-style-type: none"> <li>Palliative care</li> </ul>	<ul style="list-style-type: none"> <li><a href="#"><u>Accelerate, Coordinate, Evaluate (ACE) program</u></a>, where community pharmacists are trained to provide support for people with cancer</li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>
<b>United States (U.S.) – Federal</b>				
<a href="#"><u>Clinical preventive services by community pharmacists</u></a>	<ul style="list-style-type: none"> <li>Early diagnosis for BRCA genetic testing and colorectal cancer</li> </ul>	<ul style="list-style-type: none"> <li><a href="#"><u>Counselling and referral by community pharmacists</u></a></li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>	<ul style="list-style-type: none"> <li>Community pharmacists could identify patients for cancer screening, provide education, and referrals</li> </ul>
<a href="#"><u>Oncology Pharmacy</u></a>	<ul style="list-style-type: none"> <li>Early diagnosis, treatment, palliative care</li> </ul>	<ul style="list-style-type: none"> <li><a href="#"><u>Oncology pharmacists</u></a> provide medication-therapy management and direct patient care for individuals with cancer including treatment assessment and monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>	<ul style="list-style-type: none"> <li>There are approximately 4,100 oncology pharmacists in the United States</li> <li>Pharmacists can apply to be board-certified in oncology pharmacy based on specific eligibility criteria</li> </ul>

				<ul style="list-style-type: none"> <li>Board of Pharmacy Specialties certifies training programs for oncology pharmacists</li> </ul>
<a href="#">HouseRx</a>	<ul style="list-style-type: none"> <li>Cancer patients at National Cancer Care Alliance (NCCA) member clinics</li> </ul>	<ul style="list-style-type: none"> <li>House Rx’s technology platform and pharmacy service allow clinics to dispense specialty medication directly to patients</li> <li>A partnership between the NCCA and House RX will allow NCCA member clinics to receive a one-time custom analysis to showcase opportunities to provide more patients with quicker access to specialty medications</li> </ul>	<ul style="list-style-type: none"> <li>Not reported</li> </ul>	<ul style="list-style-type: none"> <li>Insights will be derived from data from practices’ Electronic Health Records and Pharmacy Management Systems</li> </ul>
<b>United States (U.S.) – California</b>				
<a href="#">Hematology/Oncology Specialty Residency at Stanford Medicine</a>	<ul style="list-style-type: none"> <li>Pharmacy residents training to work in hematology/ oncology</li> </ul>	<ul style="list-style-type: none"> <li>Residents are trained to provide optimal care to patients with oncologic and/or hematologic disorders, while working effectively as a member of the healthcare team supporting cancer patients</li> <li>Residents are trained to educate healthcare professionals, students, patients and the community about effective and safe medicine use</li> <li>Residents receive hands-on practical training in inpatient oncology, malignant</li> </ul>	<ul style="list-style-type: none"> <li>Residents receive an annual stipend of approximately US\$81,000 with full benefits, including an excellent healthcare benefits package and 10 days paid time off (PTO)</li> </ul>	<ul style="list-style-type: none"> <li>The Hematology/Oncology Specialty Residency is accredited by the American Society of Health System Pharmacists (ASHP) and follows ASHP Residency Learning System</li> </ul>

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		<p>hematology, chemotherapy, blood and marrow transplantation (BMT), and cancer cell therapy</p> <ul style="list-style-type: none"> <li>• They also receive practical experience in outpatient settings supporting hematology, oncology, and BMT clinics</li> </ul>		
<b>United States (U.S.) – New York</b>				
<a href="#">New York Oncology Hematology (NYOH)</a>	<ul style="list-style-type: none"> <li>• Populations in the areas of Albany, Amsterdam, Clifton Park in Saratoga County, Hudson, and Troy, New York</li> </ul>	<ul style="list-style-type: none"> <li>• Pharmacists are specially trained in cancer treatment and work closely with physicians on patients’ individualized treatment regimens</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Pharmacy staff investigates</a> insurance coverage for medications, including Medicare, supplemental plans, co-payment assistance programs, as well as other options</li> </ul>	<ul style="list-style-type: none"> <li>• Patients of NYOH can have their prescriptions <a href="#">filled at some NYOH locations</a> or delivered to their doctor’s office or at home</li> </ul>
<a href="#">The Cancer Center at Lincoln Hospital</a>	<ul style="list-style-type: none"> <li>• Patients at Lincoln Hospital’s Cancer Center</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Pharmacy services at the Cancer Center</a> include board certified oncology pharmacists, pharmacotherapy specialists, and a pharmacy technician who collaborates with the oncology staff to coordinate the Indigent Patient Assistance Program (IPAP)</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Health insurance options</a> are available to patients through <a href="#">New York’s Health Plan Marketplace</a> <ul style="list-style-type: none"> <li>○ This is a resource where patients can shop for, compare, and enrol in health insurance programs, and can also apply for financial assistance that can lower the cost of health coverage</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Pharmacists are trained to assess the patient’s care regimen, provide comprehensive pharmaceutical care, and recommend supportive care therapies to the healthcare team</li> </ul>
<b>United States (U.S.) – Oregon</b>				
<a href="#">House Rx</a>	<ul style="list-style-type: none"> <li>• Cancer patients of the <a href="#">Oregon Oncology Specialists</a> treatment clinic</li> </ul>	<ul style="list-style-type: none"> <li>• House Rx’s technology platform and pharmacy service allow clinics to dispense specialty medication directly to patients</li> </ul>	<ul style="list-style-type: none"> <li>• None identified</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">House Rx recently partnered with Oregon Oncology Specialists</a> to increase access and delivery of cancer medications to patients</li> </ul>

		<ul style="list-style-type: none"> <li>Specialty cancer clinics such as Oregon Oncology Specialists <u>are adopting medically integrated dispensing models</u> to enable greater oversight, increase touchpoints with patients, and leverage the clinical expertise of pharmacists to help increase patient safety and the capacity of the clinic, while <u>minimizing waste and control costs</u> by adjusting medication prior to refills based on therapy change, dose change, or disease progression</li> </ul>		<ul style="list-style-type: none"> <li>Patients of Oregon Oncology Specialists receive dedicated support to access and manage treatments from House Rx, who integrate their work with that of the clinic's staff</li> <li>Physicians are supported by an 'in-house' pharmacy team to dispense key medication directly to patients</li> </ul>
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\*Note that we did not identify details about governance arrangements and have not included a column for it in the table

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## APPENDICES

The following tables provide detailed information about the systematic reviews and primary studies identified in the rapid synthesis. The ensuing information was extracted from the following sources:

- systematic reviews – the focus of the review, key findings, last year the literature was searched, and the proportion of studies conducted in Canada
- primary studies – the focus of the study, methods used, study sample, jurisdiction studied, key features of the intervention and the study findings (based on the outcomes reported in the study).

For the appendix table providing details about the systematic reviews, the fourth column presents a rating of the overall quality of each review. The quality of each review has been assessed using AMSTAR (A Measurement Tool to Assess Reviews), which rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial or governance arrangements within health systems. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered “high scores.” A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8).

All of the information provided in the appendix tables was taken into account by the authors in describing the findings in the rapid synthesis.

**Appendix 1: Summary of findings from systematic reviews and other types of reviews about the features and impacts of models and approaches to enhance the role of pharmacists in cancer care**

Type of review	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
Systematic reviews	<p><a href="#">Assessing the effect of outpatient clinical pharmacy services on medication-related outcomes in cancer care (5)</a></p> <p><i>Jurisdictions: Australia, Canada, United States, Japan, Spain, Germany</i></p>	<p>The systematic review assessed the effect of outpatient clinical pharmacy services on medication-related outcomes in patients receiving anticancer therapies. Pharmacy services included interventions for drug-related problems (i.e., drug dose optimization, drug interaction, adverse drug reaction, adjustments of supportive medications), adherence and understanding assessments, and symptom assessments. Interventions also included pharmacist-initiated prophylaxis, education, review and follow-up. While the quality of the studies were low to moderate level, the authors concluded that there is positive evidence that outpatient pharmacy services can improve patient outcomes; however, the overall effectiveness could not be determined. The authors also indicated that improvement in medication safety was the largest benefit.</p>	Literature last searched June 2017	9/10	3/13
	<p><a href="#">Examining the integration of pharmacists in the management of patients undergoing anticancer therapy services and its impact on patient experience and care provision (12)</a></p> <p><i>Jurisdiction: United States, United Kingdom, Germany, European countries</i></p>	<p>The review identified 15 studies that focused on advanced clinical practice (ACP) services, skills and qualifications, and the impact of these services on patient care and outcomes. Among these studies, six involved pharmacists only. There was limited information on ACP services in relation to pharmacists. In terms of skills and qualifications, one study from the United States described that board-certified oncology pharmacists had eight skills that related to anticancer therapy services and management, but are often limited by collaborative practice agreements with physicians. A study in the United Kingdom indicated that pharmacists are trained as independent prescribers, and therefore had greater inclusion in ACP services. In terms of outcomes, adherence improved based on a pharmacist intervention program, and found high levels of patient satisfaction. However, a qualitative study found patients prefer nurse-led to pharmacist-led services citing concerns of training for pharmacists to undertake clinical reviews.</p>	Literature last searched 10 April 2022	6/10	Not reported
	<p><a href="#">Describing the effectiveness of oncology services delivered by clinical pharmacists (6)</a></p> <p><i>Jurisdiction: United States</i></p>	<p>The systematic review focused on the effectiveness of outpatient oncology services delivered by clinical pharmacists in the United States. As expected, a feature of all pharmacist-patient encounters described in the included studies was in-depth medication review. The majority of pharmacist interventions consisted of clinical consultations, correction of prescription errors, and the administration of medication. Three of the eight included studies also reported positively on the economic impact of clinical pharmacy services, which resulted in cost savings when clinical pharmacists were utilized. The authors concluded that pharmacist-based services improved identification of treatment and medication issues, delivered satisfactory services, and improved symptoms among patients with cancer.</p>	Published 1 Oct 2017	2/11	Not reported
	<p><a href="#">Evaluating the impact of pharmacist involvement in managing pain in patients with cancer (16)</a></p>	<p>This recent systematic review evaluated pharmacist involvement in cancer pain management. The most common interventions reported were medication review, education, adverse drug reactions (ADR) detection and management, pain assessment, and dosing recommendations. The authors reported significant reduction in pain and ADR, and improved quality of life.</p>	Literature last searched 10 February 2021	7/11	0/64

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Type of review	Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	<i>Jurisdictions: North America, Africa, Australia</i>				
Rapid reviews	<p><a href="#">Reviewing precision medicine initiatives in oncology pharmacy practice (19)</a></p> <p><i>Review jurisdiction: Unknown</i></p>	<p>The study aims to highlight precision medicine strategies in cancer therapeutics, with an emphasis on oncology pharmacy practice. The study found that pharmacists can be important members of interprofessional teams in practice medicine. In some cancer centres, pharmacists can be coordinators of Molecular Tumour Boards (MTBs) or assist with other roles such as management of drug services and providing comprehensive patient education. For example, pharmacists perform routine phone calls to follow up with patients about their treatment plans and provide additional resources if needed. MTBs and precision medicine clinics require multidisciplinary approaches to be successful.</p> <p>Pharmacists also play an important role in verifying chemotherapy regimens and checking for drug-drug interactions. Additionally, a promising field in the realm of oncology is pharmacogenomics (PGx). PGx services are largely led by pharmacists in the U.S. The study highlights that pharmacy practice is invaluable in precision medicine, and that pharmacists can be important members of interprofessional precision oncology teams.</p>	Literature last searched August 2018	1/9	Not reported

**Appendix 2: Summary of findings from primary studies about the features and impacts of models and approaches to enhance the role of pharmacists in cancer care**

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p><a href="#">Evaluation of the impact of oncology specialists on QOPI measures of oncology practices (30)</a></p>	<p><i>Publication date:</i> June 2018 <i>Jurisdiction studied:</i> United States <i>Methods used:</i> Evaluation</p>	<p>N/A</p>	<p>This study evaluated the level of impact that an oncology specialist may have on the metric of the Quality Oncology Practice Initiative (QOPI) in terms of achievement and reimbursement in oncology practices. The QOPI was developed by the American Society of Clinical Oncology (ASCO) to facilitate the improvement of quality oncology care.</p> <p>Of the 200 QOPI measures that were reviewed by three pharmacists, 177 were analyzed for potential pharmacist involvement using the Hematology /Oncology Pharmacy Association Scope of Practice document along with a validated summary of services.</p>	<p>After analyzing the QOPI measures, pharmacists identified potential impact in 38% of the included metrics. Measures largely focused on optimizing drug therapy through the development and implementation of pharmacy guidelines. The majority of QOPI measures deemed actionable by a pharmacist focused on patient counselling and symptom management.</p> <p>The results of the analysis demonstrated that pharmacy oncologists practising in a multidisciplinary healthcare clinic are capable of meeting 77% of the QOPI measures that make up six of the 16 Merit-Based Incentive Payment Systems (MIPS) linked to reimbursement. This provides support for the addition of oncology pharmacists to clinical practices that are lacking them.</p>
<p><a href="#">Potential opportunities to expand oncology pharmacist teams (31)</a></p>	<p><i>Publication date:</i> September 2022 <i>Jurisdiction studied:</i> United States <i>Methods used:</i> Evaluation report</p>	<p>Case examples presented in this report were based in the inpatient acute-care setting, ambulatory clinical practice, specialty pharmacy dispensing sites, and community oncology practice</p>	<p>This study reports on the potential opportunities to add oncology pharmacist positions to clinical practice as justified by a few case scenarios.</p>	<p>In the inpatient acute care setting, justification for acute care pharmacists include patient acuity, combining metrics, and chemotherapy regimens that need close monitoring. Acute care pharmacists can also monitor resource needs to ensure optimal patient outcomes and reduce medication-associated errors, resulting in cost savings. Utilizing tools like the hematology/oncology pharmacist allocation tool (HOPAT) and leveraging their metrics can assist organizations in justifying clinical pharmacist positions in acute care.</p> <p>In ambulatory clinical practice, pharmacists can help to improve care quality by optimizing drug therapy, providing patient education and symptom management, and developing and implementing guidelines. Billing for pharmacist services can also present opportunities for direct revenue generation.</p> <p>Integrated pharmacies or in-office medication dispensing sites can also be beneficial to organizations in terms of increasing efficiency and reducing costs. Additionally, oncology pharmacy residents can add clinical staff along</p>

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
				with their contributions in clinical, quality and administrative projects.
<a href="#">The contributions of the oncology pharmacist as part of the palliative treatment team (25)</a>	<p><i>Publication date:</i> February 2020</p> <p><i>Jurisdiction studied:</i> The Netherlands</p> <p><i>Methods used:</i> Quantitative observational study</p>	The study was conducted at OLVG hospital in Amsterdam where approximately 220 new oncology patients are seen every year. The hospital pharmacy consists of an inpatient department with five hospital pharmacists who specialize in oncology and palliative care, and an outpatient department with two community trained pharmacists.	This study evaluated the contribution of two pharmacists – one hospital pharmacist and one community pharmacist – to the palliative care team of the OLVG hospital. Over the 13 months of the study, the pharmacists kept records of all patient consultations and participated in team meetings and patient rounds. They were also available for consultation with individual members of the palliative care team on a daily basis.	A total of 80 interventions were made by the hospital pharmacist and 36 were made by the outpatient pharmacist. The pharmacists actively participated in the care of 93% (107/115) of the patients with an average of 1.5 interventions per patient. The outpatient pharmacist gave advice mostly on stopping a prophylactic drug and improving adherence, while the hospital pharmacist provided interventions pertaining to a switch in the route of administration. The results of the study demonstrated that including a team of pharmacists in the palliative-care team adds expertise to the team and can be beneficial to enhancing oncology patients' care plans.
<a href="#">Evaluating pharmacist value in neuro-oncology subspecialty clinics (28)</a>	<p><i>Publication date:</i> December 2020</p> <p><i>Jurisdiction studied:</i> United States</p> <p><i>Methods used:</i> Prospective exploratory assessment</p>	N/A	For 30 days, a pharmacy specialist was temporarily integrated into a neuro-oncology clinic to evaluate the clinical practice and complete a 14-day clinical chart evaluation. Screenings were completed for new therapies, drug-to-drug interactions, medication coordination, and advanced interventions related to chemotherapy dosing, scheduling with the physician, and side-effect analysis. Time spent by the pharmacist was calculated and documented to support physician decision-making.	The evaluation revealed that approximately 75% of the pharmacist's time was spent on direct patient care while the remaining 25% was dedicated to practice site development. A total of 147 encounters with 338 interventions were completed by the pharmacy specialist during the 14-day data collection period. An average of 24 interactions were performed daily. Prior to the integration of the pharmacy specialist, the neuro-oncology physician workflow required five hours per week for evaluation of patient medications and chemotherapy planning, which ultimately limited the addition of seven patient-facing interactions per week. Having a pharmacy specialist to support physician workflow could maximize patient-facing encounters by physicians.
<a href="#">Clinical and economic impact of pharmacist interventions in an ambulatory hematology-oncology department (13)</a>	<p><i>Publication date:</i> July 2020</p> <p><i>Jurisdiction studied:</i> France</p> <p><i>Methods used:</i> Prospective study</p>	All cancer patients at a teaching hospital who received a first injectable immune and/or chemotherapy regimen over a one-year period were included in the study	This prospective study evaluated the clinical and financial impact of pharmacist interventions in an ambulatory hematology-oncology department of a teaching hospital. Two clinical pharmacists were recruited over a two-year period as part of the UMACOACH (Unité Médicale Ambulatoire de Cancérologie-Collaboration Assistance Chimiothérapie) program. Their roles were generally to provide information to patients and to improve knowledge about their	A total of 1,970 pharmacist interventions were performed for 558 patients. The clinical impact of the interventions was classified as minor, moderate, and major in 1,353 (68%), 385 (20%), and 148 (8%) cases, respectively. The overall cost savings was 175,563 euros that was calculated for 431 (66%) interventions, and the cost avoidance was 390,480 euros calculated from 128 of 148 (86%) interventions with a major clinical impact. After deducting the cost of employing a pharmacist from the average yearly cost savings (plus cost avoidance per pharmacist), it yielded a net benefit of 223,021 euros. The study concluded that having the two full-time

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p><a href="#">Evaluation of the Role and Impact of Ambulatory Clinical Pharmacists in an Academic Comprehensive Cancer Center (14)</a></p>	<p><i>Publication date:</i> November 2020 <i>Jurisdiction studied:</i> United States <i>Methods used:</i> Retrospective, descriptive study using a survey</p>	<p>Providers and nurses of cancer patients at Duke Cancer Center</p>	<p>medication. Pharmacist interventions were documented, and the clinical and economic impact of interventions were estimated. Over a six-month period (1 July to 31 December 2015), providers and nurses at Duke Cancer Centre were surveyed about the perceived contribution and impact of oncology pharmacists on patient care in ambulatory oncology clinics.</p>	<p>clinical pharmacists in ambulatory hematology-oncology was both clinically and economically beneficial to the oncology department of the hospital. The study found that there were 5,091 ambulatory oncology pharmacist interventions over the six-month period, and 3,967 patient encounters between nine clinic pharmacists. Overall, the respondents confirmed that clinical pharmacists add value to patient care and the healthcare team. In particular, pharmacists placed chemotherapy orders for patients, wrote prescriptions, and ordered labs, which ultimately saved providers time and allowed them to focus on treating patient illnesses. Pharmacists also were consulted to develop and adjust medication regimens, provide supportive care management, educate patients, and assist in the financial review of patients' medications.</p>
<p><a href="#">Self-administration and adherence to oral anticancer medications through evolving interprofessional roles and pharmacist workforce (10)</a></p>	<p><i>Publication date:</i> March 2018 <i>Jurisdiction studied:</i> United States <i>Methods used:</i> Qualitative evaluation</p>	<p>Patients who use oral anticancer medications (OAMs) and intravenous anticancer treatments, as well as the health professionals that support their use</p>	<p>A qualitative systems evaluation was conducted using theoretical frameworks for interdisciplinary teams in order to examine social interactionism during anticancer treatment and OAM using Kaplan 4Cs (communication, care, control, and context). Kaplan 4Cs in the context of social interactionism denotes socio-technical relationships in the healthcare setting, and the changes in how departments are linked by computer systems, management and organizational control, and care delivery prompted by technology within the organizational context. The aim of this evaluation was to prepare healthcare systems for changes in cancer management, including the increasing involvement of oncology pharmacists.</p>	<p>The evaluation found that knowledgeable oncology clinical pharmacists bring with them expertise in pharmacotherapy, toxicities, monitoring, and pharmaco-economics, which can optimize cancer care and address projected cancer management needs. As part of a multidisciplinary team, pharmacists help develop therapeutic plans, collaborate with the rest of the oncology team, and are involved with drug development, patient counselling and education, as well assisting with research.  The study highlights that patient, organizational, and social systems considerations using Kaplan 4Cs can help healthcare systems to prepare for workforce changes in cancer care management that includes increased utilization of oncology pharmacists. The authors also highlight that most pharmacists are limited by their formal education in haematology/oncology to assist with these teams.</p>
<p><a href="#">To examine the effects of integrating clinical pharmacists into a hospital cancer unit to support cancer pain patients (17)</a></p>	<p><i>Publication date:</i> 2020 <i>Jurisdiction studied:</i> China <i>Methods used:</i></p>	<p>42 cancer pain patients admitted to a teaching hospital in China</p>	<p>This study assessed medication adherence, drug-related problems, pain relief, and analgesics adverse events in cancer pain patients using a model of clinical pharmacy services. The intervention involved clinical pharmacists (CPs) who conducted face-to-face interviews with enrolled patients that consisted of a comprehensive pain</p>	<p>Clinical pharmacists' support and interventions for cancer pain patients were found to improve medication adherence and pain relief, as well as reduce adverse events. The results showed that the medication education of CPs led to change in patients' attitudes to opioids and improved their adherence. The researchers also found that the safety and efficacy in cancer pain pharmacotherapy were mainly promoted through the</p>

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	Prospective, single-arm intervention study		assessment and medication education for patients. During a 28-day follow-up, patients were monitored for analgesic efficacy and safety daily during hospitalization, and were scheduled for reassessment and medication education via telephone after discharge. CPs also provided consultations for physicians.	pharmaceutical consultation and medication recommendations of the CPs. These results demonstrated that integrating clinical pharmacy services into management of cancer pain is a promising model.
<a href="#">To evaluate the impact of a pharmacist-involved education program in a multidisciplinary team for oral mucositis (26)</a>	<i>Publication date:</i> 2021  <i>Jurisdiction studied:</i> Japan  <i>Methods used:</i> Retrospective survey of electronic medical records	53 head and neck cancer patients	This retrospective study assessed how a pharmacist-involved education program in a multidisciplinary team (PEMT) affected head and neck patients receiving concurrent chemoradiotherapy. The study was conducted in collaboration with the Medical Information Department of Niigata University Hospital, which provided access to electronic medical records of 53 patients. Pharmacists were brought in to help support patient knowledge and support other members of the care team. Pharmacists made a medication instruction manual and consulted with patients once a week.	The study found that patients managed by PEMT had significantly less weight loss and incidence of local anesthetic and opioid use when compared to the group that was not managed by PEMT. The group overseen by the multidisciplinary team had less weight loss, use of lidocaine viscous, opioid dose, and rate of switch to fentanyl tape compared to care as usual.
<a href="#">To describe and provide implementation considerations and recommendations for three precision medicine practice models developed by oncology pharmacists (22)</a>	<i>Publication date:</i> 2016  <i>Jurisdiction studied:</i> United States  <i>Methods used:</i> Multiple case study	Patients of solid tumour and hematologic practices	Three different implementation strategies for precision medicine practice models were described.  At the University of Wisconsin, the precision medicine molecular tumour board (PMMTB), which is directed by a clinical pharmacist and medical oncologist, meets every other week in a tumour conference format. The PMMTB is available to adult patients with solid-tumour cancer via consultations during which the PMMTB assesses the clinical case presented by the treating physician and subsequently makes recommendations.  The Indiana University precision genomics program (PGP) is coordinated by a medical and molecular genetic scientist and	Implementation strategies for the models include interprofessional involvement, integration into clinical workflow, institutional support, and selection of model based on payer mix.  Pharmacists involved in the MTB models were coleaders of the models, routinely made clinical recommendations, and were the principal investigators of the relevant research studies.

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
			<p>includes a coordinating team with an oncology clinical pharmacist and two nurse coordinators. The program operates as a referral clinic for patients with advanced or rare solid malignancies. After an initial visit with the medical oncologist and biopsy, the patient's medical history and tumour-sequencing results are presented to a multidisciplinary tumour board that may include oncology pharmacists, oncology nurses, and medical oncologists.</p> <p>The Moffitt Cancer Center's DeBartolo Family Personalized Medicine Institute (DFPMI) aims to develop, support, and integrate elements of personalized medicine. The personalized medicine clinical service and clinical genomics action committee (CGAC) were developed as avenues for direct clinical translation of genomic testing results and include pharmacists among many other cancer specialists as well as financial strategists.</p>	
<p><a href="#">To examine the integration of a clinical pharmacist into a Precision Medicine Program for oncology patients (20)</a></p>	<p><i>Publication date:</i> 2019</p> <p><i>Jurisdiction studied:</i> U.S.</p> <p><i>Methods used:</i> Case study</p>	<p>A clinical pharmacist integrated into a Precision Medicine Program for oncology patients</p>	<p>The pharmacist served as a drug resource for the program's molecular tumour board, as well as for oncologists seeking precision-based oncologic strategies. The pharmacist dispensed drugs in collaboration with the specialty pharmacy and provided assistance to drug oncology patients receiving precision-based therapies.</p>	<p>The inclusion of the clinical pharmacist as a resource for healthcare professionals and a point-of-contact and support for patients was feasible and acceptable to both oncologists and patients. The authors conclude that oncology clinical pharmacists should integrate into Precision Medicine Programs and systems directing this care, and develop their knowledge and understanding of genomics.</p>
<p><a href="#">To understand how health systems specialty pharmacies can address common challenges of novel oncology and hematology treatments (8)</a></p>	<p><i>Publication date:</i> 2022</p> <p><i>Jurisdiction studied:</i> U.S.</p> <p><i>Methods used:</i> Multiple case study</p>	<p>Patients in need of treatment with oral anticancer therapies</p>	<p>Health systems specialty pharmacies (HSSPs) have been implemented to help patients and providers navigate the logistical and financial barriers to oral anticancer treatment. An HSSP team can consist of inpatient and outpatient pharmacists, physician, nurse practitioner, physician assistant, and a pharmacy and therapeutics committee. The HSSP team serves to obtain insurance approval and identify procurement pathways and hospital policies for inpatient</p>	<p>HSSP team member roles and responsibilities for inpatient initiation and outpatient persistence of novel therapies are defined across the HSSP pharmacist/technician, inpatient pharmacist, outpatient pharmacist, inpatient prescribing team (e.g., MD, NP, PA, etc.), outpatient prescribing team (e.g., MD, NP, PA, etc.) and pharmacy and therapeutics committee.</p> <p>Overall, the HSSP multidisciplinary processes address the growing need for cancer patients to receive timely and affordable treatments across various care sites and</p>

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
			administration. It also coordinates how medication will be dispensed, and the HSSP pharmacist communicates with the pharmacy to provide information needed to coordinate delivery. The pharmacy and therapeutics committee reviews treatment plans for effectiveness and safety, and compares costs to potential alternative therapies.	allow for direct communication and collaboration to facilitate optimal patient care.
<a href="#"><u>To identify cancer patients' opinions and beliefs about opioids and assess the ability of education by a clinical pharmacist in a multidisciplinary pain unit to reduce patients' concerns and increase treatment adherence (18)</u></a>	<i>Publication date:</i> 2020  <i>Jurisdiction studied:</i> Turkey  <i>Methods used:</i> Before and after study	38 patients diagnosed with cancer prescribed opioid analgesics and who attended the pain unit of an oncology hospital in Turkey	The intervention consisted of a clinical pharmacist working collaboratively with physicians and nurses in the pain unit to provide patient education on opioid treatments. A clinical pharmacist and pain specialist physician jointly designed a patient information booklet about opioid analgesics. Patients' beliefs about opioids were assessed before and after the intervention, as well as their level of adherence to opioid treatment.	The results of the study indicated that the integration of a clinical pharmacist into the pain management team can improve patient knowledge and misconceptions about opioids, and also improve pain management and adherence in cancer treatment.
<a href="#"><u>To describe the operational aspects of a multidisciplinary supportive oncology clinic and evaluate the role of a pharmacist within the clinic (23)</u></a>	<i>Publication date:</i> 2012  <i>Jurisdiction studied:</i> U.S.  <i>Methods used:</i> Case study	Patients receiving advanced palliative care in a program at a supportive oncology clinic. With the clinic's palliative care team consisting of a nurse, pharmacist, dietitian, and social worker	This study explored the operational aspects of the multidisciplinary oncology clinic and the role of the pharmacist in the palliative care team. Using a standardized pharmacy assessment, the pharmacist was responsible for reconciling medication, including assessing potential drug interactions, adverse effects, duplications in therapy, lack of efficacy, and untreated conditions.	The use of the standardized pharmacy assessment by the pharmacist within the clinic helped understand and address medication issues including duplicate therapies (in 46.7% of patients), lack of efficacy (94.7%), side effects (74.7%), untreated conditions (73.3%), and drug interactions (44%). Additionally, the integration of the pharmacist into the team is thought to have assisted other disciplines in their own assessments.
<a href="#"><u>To define the task allocation in the multi-professional cancer medication-management model focusing on the role of the pharmacist, patient education and counselling (9)</u></a>	<i>Publication date:</i> 2011  <i>Jurisdiction studied:</i> U.S.  <i>Methods used:</i> Qualitative focus groups and Delphi method	Physicians, pharmacists, and nurses working with clinical pharmacists involved with local primary, secondary, and tertiary cancer care teams	In this study, the multi-professional cancer medication management (MCMM) model was defined by clinical pharmacists and nurses working together on tasks for drug therapy, regardless of the setting in which participants were working. In this study, local focus group meetings were conducted at the University of Bonn, in collaboration with partners, to identify MCMM tasks and allocate them to physicians, pharmacists and nurses. Professionals were also surveyed to assess their perceptions of	The study identified that in the local setting, there were 38 tasks identified as necessary in cancer medication management, of which 27 were identified as tasks that could be shared between the physician, pharmacist and nurse. There was a perception that the pharmacist could be fully responsible for three and support five of the patient education and counselling tasks, as well as be fully responsible for two and support four of the tasks related to the prevention of drug-related problems. The role of the pharmacist was ambiguous to some participants, as some demanded more responsibilities for the pharmacist while others demanded less.

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
			<p>multi-professional collaboration and their acceptance of the MCMM model.</p> <p>Pharmacists were identified as mainly supporting patient information on financial aspects of the therapy, patient information on complementary cancer therapies, patient support on medication compliance, and screening for interactions between tumour therapy, supportive therapy, and home medication. Pharmacists were also identified as solely responsible for the production of the tumour therapy, and mainly responsible for preparation of the tumour therapy for administration. Support for patient education was also provided by pharmacists on the tumour therapy and possible adverse effects, patient information about medication, food and dietary supplements to avoid, handing out patient diaries to document adverse effects, monitoring patient adherence to medication plans, and calculating the dose of the tumour therapy.</p>	<p>Overall, pharmacists were integrated into the MCMM model to provide patient education and counselling as well as prevention of drug-related problems, but it was recognized that the full potential of the therapist was not recognized in the application of the MCMM model. The model was appreciated by professionals involved, and it can serve as a tool to trigger expansion of existing approaches to multi-professional communication.</p>
<p><a href="#"><u>To describe the development, implementation, and early experience with a program providing clinical pharmacist services at hematology-oncology clinics (3)</u></a></p>	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> U.S.</p> <p><i>Methods used:</i> Case study</p>	<p>The hematology-oncology clinics of a university teaching hospital</p>	<p>The initiative was funded through a clinical innovation award to support the hiring of a full-time oncology pharmacist to initiate an adult oncology supportive care program. The outpatient supportive care consultation service was initiated, which involves a roving team of a pharmacist and full-time nurse, with an attending physician serving as back-up. The pharmacist also assisted primary oncologists with the management of adult patients with problematic cancer symptoms or its treatment.</p> <p>The pharmacist also educated patients receiving chemotherapy on signs and symptoms of thrombosis as well as adjusting pain management regimens and resolving chemotherapy order errors.</p>	<p>Four goals of the program that was facilitated by the pharmacist were to: 1) improve management of supportive care; 2) enhance the education of patients receiving complicated chemotherapy regimens; 3) improve efficiency within the chemotherapy infusion unit; and (4) develop an experiential learning opportunity for pharmacy students and residents.</p> <p>Overall, the integration of a clinical pharmacist practitioner into the hematology-oncology clinics helped achieve goals set by physician, nursing, and pharmacy leaders.</p>

Identifying Models and Approaches to Enhance the Role of Pharmacists in Cancer Care

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<a href="#">To assess a new integrated model to improve medication reconciliation in oncology linking a cancer institute with community pharmacies (7)</a>	<p><i>Publication date:</i> 2021</p> <p><i>Jurisdiction studied:</i> Italy</p> <p><i>Methods used:</i> Prospective interventional study</p>	Cancer patients undergoing antineoplastic treatments	<p>The aim of the integrated model was to create a partnership between a cancer institute and community pharmacies (CPs), while integrating the national information technology platform of the community pharmacies with electronic medical records of the cancer institute.</p> <p>Cancer patients selected a community pharmacist participating in the study to complete a pharmacological recognition assessment. A new information technology (IT) platform with the same format as the electronic medical records of the cancer institute was used by the pharmacist to collect the information provided by the patient, including drug packages or other products used at home, paper referrals, or prescriptions from specialists. The data was sent directly to the cancer institute medical records through the IT platform. The oncologist subsequently downloaded the pharmacological recognition form and performed the coordination process.</p>	<p>A total of 66 community pharmacies completed surveys for 134 patients, showing that on average patients used 5.9 drugs at home. Sixty percent of patients used non-conventional products or critical foods, and some potential interactions between non-conventional medications and cancer treatments were reported. The new integrated IT platform merging electronic medical records and information collected by community pharmacies was validated.</p> <p>The results of this study underscore the importance of coordination processes which are often neglected by oncologists because of the pressures of everyday clinical activity. A partnership with CPs could, therefore, lead to significant improvement in the situation.</p>
<a href="#">To assess the feasibility of integrating a pharmacist into a neuro-oncology clinic(29)</a>	<p><i>Publication date:</i> 2009</p> <p><i>Jurisdiction studied:</i> Canada</p> <p><i>Methods used:</i> Case study</p>	A pharmacist integrated into a multidisciplinary approach at a neuro-oncology clinic	A pharmacist attended weekly multidisciplinary patient rounds at the clinic and was responsible to meet with patients who received chemoradiotherapy. Standardized counselling was provided on chemotherapy administration including dose and time of treatment, side-effect management, dosing of supportive medications, drug interactions, communication with the hospital dispensary and community pharmacists to ensure prescriptions were provided, and any other medication-related questions raised by the patients. The pharmacist followed up the next day and five days following the start of treatment to address medication-related questions.	The pharmacists' most common interactions with other staff included discussion related to drug-related issues (interactions, chemotherapy dose modifications, etc.) and usually lasted less than 10 minutes. In addition to improvements of patient care and staff satisfaction, the pharmacist was able to identify a number of patient care-related issues including: 1) the need for another formal training session between the day after and the fifth day follow-up after treatment; 2) the need to address the possibility of missing chemotherapy orders due to the time lag between initial consultation and radiation; and 3) the lack of standardized dexamethasone tapering schedule and therefore inconsistent prescribing practices. Overall, a clinical pharmacist was found to be useful and was recommended to be a permanent member of the outpatient neuro-oncology clinic.
<a href="#">To describe the integration of 19</a>	<p><i>Publication date:</i> 2015</p>	19 community-based physician practice sites and	This study described the transition of a hybrid model of oncology pharmacy	Overall, 19 ambulatory care centres were successfully integrated into the oncology network through workflow

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<p><a href="#">ambulatory care centres into an oncology network through workflow modifications, training, and a hybrid pharmacy services model (15)</a></p>	<p><i>Jurisdiction studied:</i> U.S.</p> <p><i>Methods used:</i> Case study</p>	<p>the University of Pittsburgh Medical Center</p>	<p>services across a regional network of cancer centres, which included remote order verification. The network was developed through: 1) the development of oncology medication protocols; 2) interdisciplinary efforts that modified oncology care workflows; 3) implementing a hybrid practice model to optimize clinical pharmacy resources; and 4) focused staff training programs.</p> <p>Pharmacists worked to ensure medication safety and addressing associated regulatory requirements, were stationed at cancer centres or facilitated remote order verifications, and attended meetings to discuss workflow plans with nursing and medical staff.</p>	<p>modifications, staff training, and a hybrid pharmacy-services model ensuring that two pharmacists checked antineoplastic orders in accordance with regulatory and quality standards.</p>
<p><a href="#">To assess the impact of a layered learning practice model involving pharmacists supporting medical oncology services through eight clinical pharmacy key performance indicators (32)</a></p>	<p><i>Publication date:</i> 2019</p> <p><i>Jurisdiction studied:</i> Canada</p> <p><i>Methods used:</i> Retrospective observational study</p>	<p>Patients admitted under the medical oncology service at a hospital</p>	<p>This study aimed to assess clinical productivity of practice sites that implement the layered learning practice model (LLPM) over a period of six months, where pharmacy learners at different levels of training provide patient care under the supervision of a pharmacist. Three scenarios under the inpatient medical oncology service of a tertiary care centre were presented: 1) one or more pharmacists with one resident or one or more students; 2) one or more pharmacists with one or more students; and 3) one or more pharmacists only. The service includes two full-time pharmacists who spend approximately 65% of their time providing direct patient care services, 25% of their time conducting centralized pharmacy distribution tasks, and 10% of their time on administrative, educational, research, or quality improvement-based initiatives.</p>	<p>Despite a consistent trend of pharmacists to contribute less to overall patient care when pharmacy learners were present, the proportions of patients receiving clinical pharmacy key performance indicators were similar for scenarios with and without pharmacy learners present.</p>
<p><a href="#">To describe the integration of SMS text patient-reported</a></p>	<p><i>Publication date:</i> 2021</p>	<p>High-risk patients for chemotherapy-induced</p>	<p>A chemotherapy remote-care monitoring program was used to proactively identify patients experiencing chemotherapy-</p>	<p>The chemotherapy remote-care monitoring program enabled real-time patient management. Clinical pharmacists were key team members that helped manage</p>

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<a href="#">outcomes in the electronic health record and pharmacist intervention for chemotherapy (4)</a>	<i>Jurisdiction studied:</i> U.S.  <i>Methods used:</i> Case study	nausea and vomiting (CINV)	induced nausea and vomiting and intervene to avoid unplanned healthcare utilization. The program was funded by the University of Michigan Rogel Cancer Center. Pharmacists received patient responses meeting the threshold for real-time review, which automatically routed to a shared inbox. Clinical pharmacists monitored and triaged these messages and developed interventions for patient episodes meeting predefined threshold criteria.	patient symptoms. Additionally, unplanned healthcare utilization was significantly reduced.
<a href="#">Examining feasibility and preliminary efficacy of integrating pharmacists to cancer care related to medication management and vaccination administration (24)</a>	Pilot randomized controlled trial (four-week study period)	60 patients aged ≥65 years with breast, gastrointestinal, or lung cancer receiving first-line chemotherapy were assigned to the pharmacy intervention or usual care	This study explored the feasibility and efficacy of integrating pharmacists into the care of elderly adults with cancer to enhance vaccinations for pneumonia and influenza, as well as medication management. Patients assigned to the intervention group met with the pharmacist once during their second and third chemotherapy infusions. The intervention group met with a pharmacist once during their second or third chemotherapy infusion. Feasibility was defined as at least 75% or more patients enrolled into the study and received a pharmacist visit.	The study indicated potential feasibility to conduct a larger randomized controlled trial. While pilot studies are discouraged to determine preliminary efficacy of the intervention, there were some signals that indicated improvement in vaccination rates for pneumonia and influenza and fewer medication management errors. A future full randomized controlled trial is needed to demonstrate its true efficacy.
<a href="#">Precision Genomic Practice in Oncology: Pharmacist Role and Experience in an Ambulatory Care Clinic (21)</a>	<i>Publication date:</i> 2020  <i>Jurisdiction studied:</i> U.S.  <i>Methods used:</i> Observational prospective cohort study	101 patients at Indiana University Health-Simon Cancer Center with metastatic solid tumours, who progressed to one line of standard of care therapy	This study highlights the experiences of a specific precision medicine ambulatory clinic in Indiana and explores the role of pharmacists in precision oncology. The precision oncology clinic used a molecular tumour board (MTB) approach to evaluate tumours at the molecular level in order to guide patient-specific therapy. The MTB at the Indiana hospital is comprised of a medical oncologist, a medical and genetic scientist, an oncology pharmacist, pharmacy residents, nurses, and other scientists. Patients at the Indiana clinic met with the pharmacist and PGY-2 oncology pharmacy residents for 30-45 minutes to educate them on genomic findings.	The study highlights that with a rapid shift to targeted medicine approaches, there are many opportunities for pharmacists to use their skill set in hematology and oncology. Pharmacists in precision medicine can be involved in interpreting tumour genome sequencing results, managing anticoagulant use, leading patient education, and obtaining off-label drug therapy, but their specific roles may vary depending on the practice setting.  At the Indiana University Health-Simon Cancer Center (IUSCC), an oncology pharmacist specialist and two oncology-pharmacist residents serve as part of the multidisciplinary team that runs the IUSCC precision genomics program (PGP). The oncology pharmacist reviews patient medications, makes recommendations, takes part in weekly meetings, and documents recommendations made by the tumour board.

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				<p>The study highlights that this shift to targeted medicine approaches provides pharmacists with new opportunities in the field of oncology. However, pharmacists may lack some of the education for adequate knowledge to interpret genomic tests and targeted therapies. The study recommends improvement be made to transform the pharmacy education system and prepare pharmacists for opportunities in precision medicine.</p>
<p><a href="#">A Retrospective Study of the Effects of Oncology Pharmacist Participation in Treatment on Therapeutic Outcomes and Medical Costs (27)</a></p>	<p><i>Publication date:</i> 2017 <i>Jurisdiction studied:</i> Japan <i>Methods used:</i> Retrospective, observational study</p>	<p>71 patients analyzed who underwent radical surgery for ovarian cancer (24 study group and 47 control group)</p>	<p>The study explored the effect of physicians and oncology pharmacists collaborating to manage cancer chemotherapy. Three groups of patients were considered: 1) those managed by a certified oncologist; 2) those managed by a non-certified oncologist; and 3) those managed by a non-certified oncologist and an oncology pharmacist. Services provided by the oncology pharmacist included consideration of the patient's regimen, guidance for patients before chemotherapy starts, continuous medical interviews through the chemotherapy period, and proposal to physicians considering chemotherapy management. Multi-regression analysis was conducted to determine what factors significantly contributed to increased medical cost per chemotherapy cycle.</p>	<p>The authors conducted multiple regression analyses and found that collaborating with oncology pharmacists was the most important factor affecting outpatient treatment rate. The study found that the patient group that was managed by the non-certified oncologist and oncology pharmacist had a significantly greater outpatient treatment rate, were administered an average of four more supportive therapy drugs per patient, and incurred less medical cost per chemotherapy cycle than the other two patient groups. Oncology pharmacists in the study addressed the physical and mental problems of patients, helped formulate treatment policies, and offered qualitative improvements to patient services and team medical care. These pharmacists played a major role in cancer drug therapy management as well as reduced physician workloads and improved risk management. Furthermore, the medical costs for each chemotherapy cycle were lower in groups that focussed on treating patients with a multidisciplinary team including oncology pharmacists. Overall, these roles made oncology pharmacists effective in implementing therapeutic regimens.</p>
<p><a href="#">Development and implementation of an interdisciplinary oncology program in a community hospital (11)</a></p>	<p><i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> U.S. <i>Methods used:</i> Case study</p>	<p>Valley Medical Center in Washington, U.S. implemented an interdisciplinary practice model to provide structure around the roles of its 14-16 clinical pharmacists working in the inpatient setting. All pharmacists had a distributive role in oncology and a clinical</p>	<p>The study focussed on the assessment, development and implementation of Valley Medical Center's interdisciplinary practice model through an oncology pharmacy program. The focus of this program was to improve efficiency and decrease errors in relation to chemotherapy treatments. Data was collected on 96 chemotherapy orders before intervention and 75 orders after intervention, in order to assess changes in chemotherapy practice and cost savings.</p>	<p>The study highlighted that prior to this program, clinical pharmacists lacked defined structure in regard to communication with medical oncologists and nurses, specifically on patient care issues and drug information. To counteract this, the program focussed on making the following changes: standardized order forms, creating collaborative agreements, improving oncology nursing and pharmacy processes, etc. Furthermore, an oncology pharmacist specialist was recruited for the program, and the intervention found this role to be essential in reducing costs and improving quality of patient care. The authors found a 45% reduction in total error in relation</p>

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		role in pharmacy protocols.		<p>to chemotherapy drugs, and the most common error was found to be missing information.</p> <p>The study highlights that integration of pharmacists into an oncology care program reduces error rates and costs. However, the authors mention that the study has limited generalizability and their results may not apply to all models of pharmacy practice.</p>





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