



CODEN [USA]: IAJ PBB

ISSN : 2349-7750

INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

Available online at: <http://www.iajps.com>

A Systematic Review

ROLE OF PHARMACISTS IN IMPROVING MEDICATION SAFETY IN PATIENTS WITH CANCER: A SYSTEMATIC REVIEW

Bashayer Mohammed Alshehail ¹, Maryam Abdulmonem Bukhamsin ², Ibtihal Adel Almashhadi ³, Kawthar Essa Alkhalifah ⁴, Zahra Abdulraouf Alrashed ⁴, May Mohammed Al.Idrissi ³, Atheer Abdulmajeed Alabbad ⁴, Zainab Abdulrzzak Aldajani ⁴, Nourah mohammed almuseleem ⁴, Joud basem albuali ⁴

¹Pharm.D, BCIDP, KSA.

²Imam Abdulrahman bin Faisal University, KSA.

³Taibah University, Medinah, KSA.

⁴Imam Abdurahman bin Faisal University, KSA

Abstract:

Objectives: To evaluate the role of pharmacists in improving medication safety in cancer patients, examining the effectiveness of interventions led by pharmacists and their impact on patient outcomes. **Methods:** To locate research that met the inclusion criteria, a thorough computerized search of relevant databases was carried out. A comprehensive search was carried out on PubMed, SCOPUS, Science Direct, Cochrane Library, and Web of Science to locate relevant material. **Results:** The dataset comprised seven studies involving 11,329 cancer patients, with 4332 (38.2%) being male. Pharmacist involvement in oncology care, particularly in medication management, significantly enhances patient safety and treatment outcomes. Strategies like medication charting, opioid management, and chemotherapy verification prevent errors and improve well-being. Older cancer patients especially benefit from pharmaceutical care, with interventions identifying and addressing drug-related problems (DRPs). Collaboration between pharmacists, oncologists, and interdisciplinary teams optimizes medication use, ensures compliance, and reduces treatment risks across both inpatient and outpatient settings. **Conclusion:** The role of pharmacists in improving drug safety and treatment outcomes in oncology care is undeniable. Their interventions, particularly in managing complex regimens and addressing DRPs, have proven to be crucial for patient well-being. Strengthening collaboration between pharmacists and other healthcare providers can further enhance patient outcomes, especially for vulnerable populations such as the elderly. As the healthcare landscape continues to evolve, the role of pharmacists should be expanded and standardized to maximize their positive impact on patient care.

Keywords: Pharmacists; Medication Safety; Medication errors; Adverse Drug Reactions; Pharmacological Interventions; Systematic review.

Corresponding author:

Bashayer Mohammed Alshehail,
Pharm.D, BCIDP, KSA.

QR code



Please cite this article in press Bashayer Mohammed Alshehail et al., Role Of Pharmacists In Improving Medication Safety In Patients With Cancer: A Systematic Review., Indo Am. J. P. Sci, 2024; 11 (11).

INTRODUCTION:

Cancer treatment is a multifaceted and complex process that often involves a combination of chemotherapy, targeted therapy, immunotherapy, and supportive care. With the intricate nature of cancer therapies, medication safety has become a paramount concern [1]. This is where pharmacists play a crucial role in improving medication safety for patients battling cancer. Their expertise not only helps in preventing medication errors but also enhances the overall therapeutic outcomes, ensuring that patients receive the safest and most effective treatments available [2].

Pharmacists are trained professionals with expert knowledge in pharmacology, drug interactions, and patient care. Their understanding of how different medications work, including the specific dosages and potential side effects associated with cancer treatments, positions them as vital members of the healthcare team [3]. In oncology, where treatment regimens may involve numerous drugs with overlapping toxicities, pharmacists are essential in reviewing medication orders to detect possible drug interactions and contraindications. This proactive approach minimizes the risk of adverse effects and ensures medications are tailored to each patient's individual needs [4].

One of the key responsibilities of pharmacists is to educate patients about their medications. In the context of cancer treatment, this task takes on added importance. Patients often experience anxiety and confusion regarding their treatment plans and potential side effects. Pharmacists can provide counseling on the proper administration of medications, such as the importance of adhering to prescribed dosing schedules and the necessity of reporting any side effects promptly. By empowering patients with knowledge, pharmacists enhance adherence to treatment regimens, thereby optimizing therapeutic outcomes and increasing overall medication safety [5].

Pharmacists are also integral to the continuous monitoring of patients' responses to therapy. They can assess laboratory results, observe for signs of toxicity, and evaluate patients for adherence to their medication plans. In many healthcare systems, pharmacists initiate follow-up visits or phone calls to check on patients after initiating a new therapy or modifying existing ones [6]. This ongoing support helps in catching potential issues early, allowing for timely interventions that can avert complications. Such follow-up is particularly critical in oncology, where

the balance of efficacy and safety can shift rapidly based on a patient's response to treatment [7].

The collaborative role of pharmacists extends beyond patient interactions. They are essential members of the multidisciplinary healthcare team, working closely with physicians, nurses, and other healthcare professionals to develop comprehensive treatment plans for cancer patients. Pharmacists contribute to clinical decision-making by providing insights on medication selection, dosing adjustments, and the necessity of supportive care options. This collaborative approach not only helps in mitigating risks associated with medications but also fosters a more integrated healthcare delivery model, ensuring that all aspects of a patient's care are addressed [8].

In addition to direct patient care, pharmacists play a pivotal role in developing and implementing medication safety protocols within healthcare institutions. They help establish guidelines for the safe handling of chemotherapy agents, including their preparation and administration. By advocating for policies that promote medication safety, such as double-check systems and the use of standardized order sets, pharmacists significantly contribute to creating a safer environment for patients undergoing cancer treatment [9].

The study addresses the alarming rise in medication errors among cancer patients, stressing the serious adverse consequences these errors can have. Additionally, the complexity of medication regimens for cancer patients is highlighted, as they often involve multiple drugs with intricate interactions and complicated dosing schedules. The distinctive role of pharmacists is also emphasized; as experts in medication management, they have the potential to identify and prevent errors, thereby improving patient outcomes. Despite the complexity of cancer treatment, there is a lack of clear evidence regarding the effectiveness of pharmacists in preventing medication errors and improving patient safety. The aim of this study is to systematically review the literature to assess the role of pharmacists in improving medication safety in patients with cancer.

Study Objectives:

1. To identify and select relevant studies examining the role of pharmacists in medication safety for cancer patients.
2. To extract data from the selected studies on the interventions implemented, outcomes achieved, and challenges encountered.

3. To synthesize the findings of the included studies to identify common themes and patterns.
4. To draw conclusions regarding the effectiveness of pharmacists in improving medication safety for cancer patients.

METHODS:

The PRISMA standards [10] were used in this systematic review to examine the contributions of pharmacists in enhancing medication safety for cancer patients. Relevant English-language studies were identified through an electronic search of databases such as PubMed, Web of Science, SCOPUS, and Science Direct to identify the role of pharmacists in this context. The search strategy will feature keywords related to medication safety and the involvement of pharmacists. Two reviewers independently screened and selected studies, extracted data, and employed appropriate tools to assess the quality of each study.

Eligibility Criteria

Inclusion Criteria:

1. **Study design:** Randomized controlled trials (RCTs), cohort studies (prospective and retrospective in nature), case-control studies, and cross-sectional studies.
2. **Population:** Adult cancer patients (18 years and older) receiving pharmacological treatment.
3. **Intervention:** Pharmacist-driven interventions aimed at improving medication safety, such as medication reviews and patient education.
4. **Outcomes:** Reports on medication safety outcomes, including adverse drug reactions and medication errors.
5. **Language:** Published in English.
6. **Publication Date:** Articles published within the last 5 years.

Exclusion Criteria:

1. Studies of poor methodological quality, including those lacking a control group or appropriate statistical analyses, were excluded.
2. Research not assessing pharmacists' impact on medication safety.
3. Animal studies or in vitro studies that do not involve human subjects were excluded.
4. Single case reports, narrative reviews, editorials, or opinion pieces without new data were disregarded.

Data extraction

Rayyan [11] was utilized to authenticate the search results, ensuring precision throughout the process. The retrieved titles and abstracts were evaluated for relevance based on the established inclusion and exclusion criteria. The research team meticulously reviewed all studies that met the criteria. Any disputes were resolved through consensus. A pre-designed data extraction form was employed to log essential information such as study titles, authors, publication year, study location, participant demographics, gender distribution, medication type, cancer type if mentioned, and primary outcomes. An impartial tool was created to assess the likelihood of bias in the studies.

Data Synthesis Strategy

Summary tables were generated using data from relevant studies to deliver a qualitative assessment of findings and key elements. After completing the data collection for the systematic review, the most suitable approach for analyzing the information from the included studies was selected.

Risk of Bias Assessment

The JBI [12] critical appraisal tool for prevalence studies was employed to evaluate the quality of the included research. This tool consists of nine questions, with a score of one given for affirmative responses and zero for negative, ambiguous, or irrelevant answers. The final scores were categorized as follows: scores below 4 indicated low quality, between 5 and 7 moderate qualities, and above 8 high qualities. Independent reviewers assessed the quality of the papers, and any disagreements were settled through discussion.

RESULTS:

Systematic Search Outcomes

The comprehensive search yielded 1211 studies, with 695 duplicate entries excluded. After screening the remaining 516 manuscripts, 432 were rejected based on their titles and abstracts. Out of the 84 required reports, 6 could not be retrieved. Four papers were abstracts, two were editor's letters, and 35 were rejected due to inaccurate study results. Following the full-text screening, 19 articles were discarded due to incorrect population types, leaving 10 studies for further review. The ten research publications that make up this review meet the eligibility criteria. The method used to choose the literature is shown in a diagram in **Figure 1**.

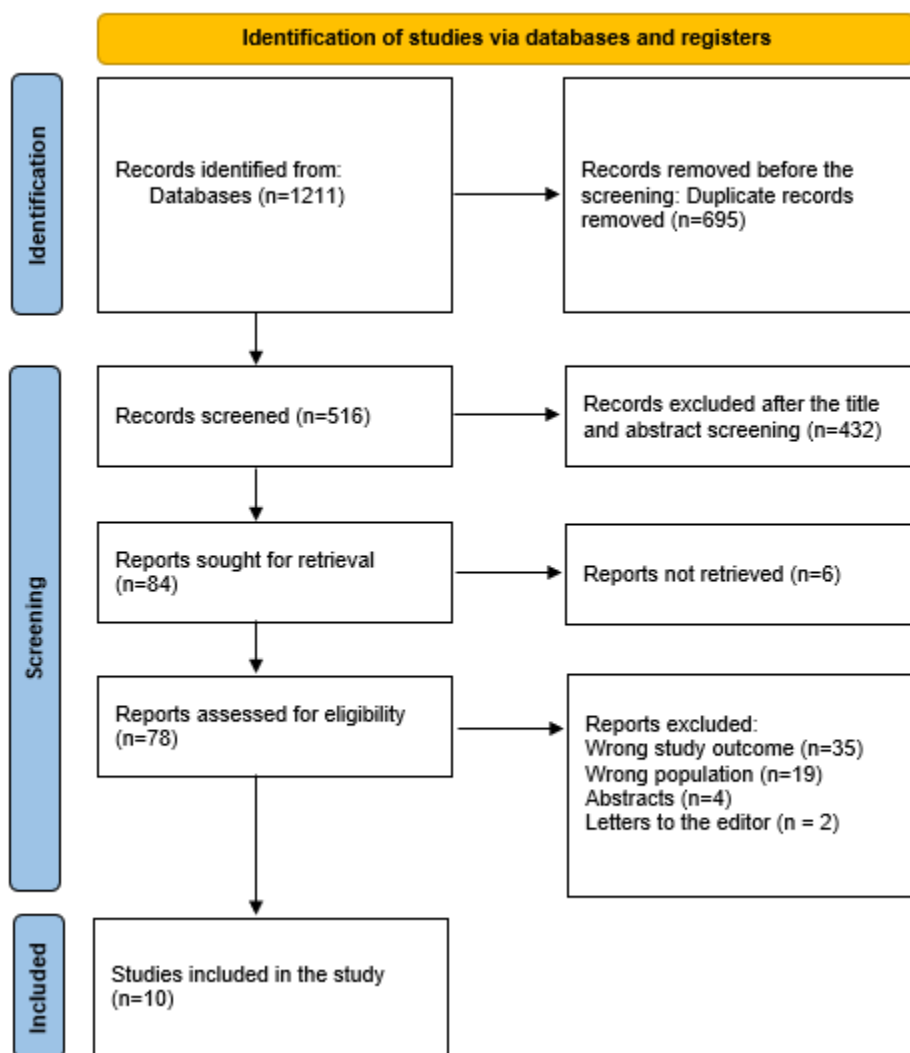


Figure 1: A PRISMA flowchart is employed to depict an overview of the decisions made throughout the study selection process.

Sociodemographics and clinical parameters of the comprised participants and studies

Table 1 provides the sociodemographic details from the research articles. The dataset comprised seven studies involving 11,329 cancer patients, with 4332 (38.2%) being male. The study designs included six retrospective cohorts [14, 15, 17, 20, 21, 22], three prospective cohort studies [13, 18, 19], and one interventional study [16]. Geographically, two studies were conducted in Australia [13, 17], two in India [14, 16], two in China [20, 22], one in Brazil [15], one in the Netherlands [18], one in France [19], and one in the USA [21].

Table (2) shows the main outcomes

The implementation of a pharmacist medication charting paradigm was shown to be effective as a drug

safety strategy in oncology units. This approach ensures the prevention of medication errors, thereby promoting patient safety and enhancing treatment outcomes [13]. In oncology settings, addressing opioid-related problems is a prevalent issue. Clinical pharmacists play a critical role in managing these problems by ensuring the proper use of opioid medications. This improves patient well-being and enhances safety in opioid treatment [14, 22]. Chemotherapy regimens often present challenges in terms of DRPs and nonconformities. Pharmacists' involvement in verifying these treatments significantly contributes to avoiding potential harm and ensuring safer care for patients, including both adult and juvenile oncology patients [15]. Pharmaceutical care tailored for older cancer patients assists in identifying DRPs through collaboration with oncologists. This

collaborative approach helps address DRPs and provides patients with enlightenment regarding their conditions, thus improving treatment efficacy [16]. Patients receiving OAMs benefit from specialist pharmacist consultations, which protect them from high risks such as overdosing. The interdisciplinary staff ensures the safe administration of OAMs [17, 20]. In elderly cancer patients, the risk of inappropriate

medication usage is high. A pharmacist-led medication review proves to be an effective tool in identifying medication errors and optimizing therapy for such patients [18, 19]. During hospitalization, medication reconciliation facilitated by pharmacists significantly reduces the risk of medication errors for patients receiving oral oncolytic treatments [21].

Table (1): Sociodemographic parameters of the comprised research.

Study ID	Study design	Country	Participants (n)	Mean age	Males (%)
Tong et al., 2024 [13]	Prospective cohort	Australia	416	56.8 ± 18.1	216
Anwar et al., 2024 [14]	Retrospective cohort	India	9463	45	3400
Venancio et al., 2024 [15]	Retrospective cohort	Brazil	362	0 to >60	163
Fariya et al., 2023 [16]	Interventional study	India	186	65 to >85	89
Soggee et al., 2023 [17]	Retrospective cohort	Australia	247	63	116
van Loveren et al., 2021 [18]	Prospective observational study	The Netherlands	150	72	88
Choukroun et al., 2021 [19]	Prospective cohort	France	51	83	22
Zhang et al., 2021 [20]	Retrospective cohort	China	173	49.4 ± 22.3	83
Heffner et al., 2020 [21]	Retrospective cohort	USA	81	67	28
Ding et al., 2020 [22]	Retrospective cohort	China	200	60 ± 10.6	127

Table (1): Clinical characteristics and results of the incorporated studies.

Study ID	Medication type	Main outcomes	JBI
Tong et al., 2024 [13]	NS	The partnered pharmacist medication charting paradigm was effectively implemented in oncology units as a drug safety strategy.	High
Anwar et al., 2024 [14]	Opioids	The study of clinical pharmacist treatments on opioid medication use in cancer patients is a problem that is particularly prevalent in Pakistani oncology settings. The findings highlight clinical pharmacists' critical role in resolving opioid problem drugs, hence enhancing patient safety and improving opioid use for patient well-being.	Moderate
Venancio et al., 2024 [15]	Chemotherapy	Pharmaceutical strategies implemented during the verification of chemotherapy regimens made it possible to identify and prevent DRPs and other nonconformities, hence avoiding potential harm to patients. Thus, the pharmaceutical treatments used in this study have contributed to safer oncological treatment for both adult and juvenile patients.	Moderate
Fariya et al., 2023 [16]	NS	Pharmaceutical care for older cancer patients helped to identify numerous DRPs, which were then addressed in cooperation with oncologists. Cancer specialists and pharmacists should collaborate to detect and treat DRPs, as well as enlighten patients about their condition.	Moderate
Soggee et al., 2023 [17]	OAMs	Patients who are administered OAM regimens benefit from specialist pharmacist-led patient consultations, which safeguard them against high and excessive risks. Interdisciplinary oncology services staff facilitated a specialized pharmacist-led consultation for those on OAM regimens.	Moderate
van Loveren et al., 2021 [18]	NS	In elderly cancer patients, the incidence of potentially inappropriate and omitted medication, as well as subsequent follow-up, is high. A pharmacist-led thorough medication review is a useful tool for identifying these medication errors and optimizing patients' therapy.	Moderate
Choukroun et al., 2021 [19]	NS	A medication review by a clinical pharmacist and a geriatrician is an excellent way to detect and prevent DRPs in older cancer outpatients.	Moderate
Zhang et al., 2021 [20]	OAMs	The involvement of clinical pharmacists in the treatment of polypharmacy tumor patients, in conjunction with the independent OAM management system, facilitated the identification and resolution of DRPs, particularly improving patient medication compliance, therefore enhancing drug efficacy, safety, and rational use.	Moderate
Heffner et al., 2020 [21]	oral oncolytic therapies	The inability to completely confirm patients' home regimens through documentation review poses a significant danger to appropriate drug administration upon hospital admission. Medication reconciling transactions completed by pharmacists help to reduce the number of errors that may arise during hospitalization in cancer patients receiving oral oncolytic treatments.	Moderate
Ding et al., 2020 [22]	Opioids	Multidisciplinary approaches, including pharmacists, have a direct influence on managing moderate to severe cancer pain in opioid-naïve patients. Pharmacists should be viewed as valuable members of a multidisciplinary team in order to obtain improved clinical outcomes in cancer pain treatment.	Moderate

NS=Not-specified, OAMs=oral antineoplastic medicines

DISCUSSION:

The integration of clinical pharmacists into oncology care has proven beneficial across various aspects of patient management. Their role in ensuring medication safety, particularly in complex therapies like opioids and chemotherapy, highlights their value in preventing DRPs. In both adult and elderly cancer populations, pharmacists contribute to reducing medication errors and enhancing patient outcomes. Pharmacist-led interventions have not only improved drug adherence but also reduced the likelihood of treatment complications, showcasing the importance of collaboration between healthcare professionals. In line with our results, **Maleki et al.** reported that all included studies used informative practicing model concepts, with treatments for medication-related issues such as drug dose optimization, reduced drug interactions, and unexpected drug reaction reporting. The majority of trials found symptom relief, particularly nausea and discomfort. In four trials on radiation cohorts, pharmacist engagement was linked to enhanced symptoms, fulfillment, and well-being measures [23]. **Tan et al.** also found that pharmacist-led clinical pathways/order groups can improve drug efficacy, safety, and financial results [24].

We found that in oncology settings, addressing opioid-related problems is a prevalent issue. Clinical pharmacists play a critical role in managing these problems by ensuring the proper use of opioid medications. This improves patient well-being and enhances safety in opioid treatment [14, 22]. **Maleki et al.** reported that pharmacist measures included modifying opioid dose or formulation, identifying DRPs and drug duplicates, communicating directly with community care practitioners and actions to increase adherence, patient oral and written counseling, and action/care strategies [23].

This review found that patients receiving OAMs benefit from specialist pharmacist consultations, which protect them from high risks such as overdosing [17, 20]. In elderly cancer patients, the risk of inappropriate medication usage is high. A pharmacist-led medication review proves to be an effective tool in identifying medication errors and optimizing therapy for such patients [18, 19]. Similarly, **Fentie et al.** found that pharmacist-led treatments can enhance DRPs among patients with cancer. As a result, incorporating pharmacists into multimodal direct cancer care will be critical for optimizing pharmaceutical use, improving safety for patients and treatment results, and optimizing the overall delivery of healthcare [25].

The findings underscore the importance of including pharmacists as an integral part of oncology care teams. Healthcare providers should advocate for expanded roles for pharmacists, particularly in settings where polypharmacy or high-risk medications are involved. Their ability to identify DRPs and intervene effectively can prevent serious complications and improve the overall quality of care. By enhancing patient education and ensuring medication adherence, pharmacists can also alleviate the burden on other healthcare professionals, leading to more efficient care delivery. Future research should focus on expanding the role of pharmacists in other therapeutic areas and exploring their impact in diverse healthcare environments. Larger-scale studies across different countries would help determine the generalizability of these findings.

Strengths and limitations

One of the primary strengths of these interventions is the tailored approach pharmacists provide in addressing the individual needs of patients, particularly in oncology settings where treatment regimens are complex. Another advantage is the multidisciplinary collaboration, ensuring that various healthcare professionals work together to improve treatment safety and efficacy. The studies highlight a broad range of benefits, from preventing medication errors to enhancing patient compliance, thus making pharmacists invaluable in both acute and long-term care.

While the positive outcomes of pharmacist involvement are clear, there are some limitations to the generalizability of these findings. Many of the studies are specific to certain regions or healthcare settings, which might not reflect the experiences in other parts of the world. Additionally, the scope of pharmacist interventions may be limited by healthcare infrastructure or resources, particularly in underfunded systems. The variability in training and the availability of clinical pharmacists across regions also means that not all patients may benefit from these strategies equally.

CONCLUSION:

The role of pharmacists in improving drug safety and treatment outcomes in oncology care is undeniable. Their interventions, particularly in managing complex regimens and addressing DRPs, have proven to be crucial for patient well-being. Strengthening collaboration between pharmacists and other healthcare providers can further enhance patient outcomes, especially for vulnerable populations such as the elderly. As the healthcare landscape continues to evolve, the role of pharmacists should be expanded

and standardized to maximize their positive impact on patient care.

REFERENCES:

1. Shams M, Abdallah S, Alsadoun L, Hamid YH, Gasim R, Hassan A. Oncological Horizons: The Synergy of Medical and Surgical Innovations in Cancer Treatment. *Cureus*. 2023;15(11):e49249. Published 2023 Nov 22. doi:10.7759/cureus.49249
2. Dalton K, Byrne S. Role of the pharmacist in reducing healthcare costs: current insights. *Integr Pharm Res Pract*. 2017;6:37-46. Published 2017 Jan 25. doi:10.2147/IPRP.S108047
3. Rahayu SA, Widiyanto S, Defi IR, Abdulah R. Role of Pharmacists in the Interprofessional Care Team for Patients with Chronic Diseases. *J Multidiscip Healthc*. 2021;14:1701-1710. Published 2021 Jul 5. doi:10.2147/JMDH.S309938
4. Lopez-Martin C, Garrido Siles M, Alcaide-Garcia J, Faus Felipe V. Role of clinical pharmacists to prevent drug interactions in cancer outpatients: a single-centre experience. *Int J Clin Pharm*. 2014;36(6):1251-1259. doi:10.1007/s11096-014-0029-4.
5. Lively A, Minard LV, Scott S, Deal H, Lambourne T, Giffin J. Exploring the perspectives of healthcare professionals in delivering optimal oncology medication education. *PLoS One*. 2020;15(2):e0228571. Published 2020 Feb 12. doi:10.1371/journal.pone.0228571
6. Chalasani SH, Syed J, Ramesh M, Patil V, Pramod Kumar TM. Artificial intelligence in the field of pharmacy practice: A literature review. *Explor Res Clin Soc Pharm*. 2023;12:100346. Published 2023 Oct 21. doi:10.1016/j.rcsop.2023.100346
7. Chehelgerdi M, Chehelgerdi M, Allela OQB, et al. Progressing nanotechnology to improve targeted cancer treatment: overcoming hurdles in its clinical implementation. *Mol Cancer*. 2023;22(1):169. Published 2023 Oct 9. doi:10.1186/s12943-023-01865-0
8. Lee KMK, Koeper I, Johnson ME, Page A, Rowett D, Johnson J. Multidisciplinary perspectives on roles of hospital pharmacists in tertiary settings: a qualitative study. *Int J Qual Health Care*. 2024;36(1):mzad110. doi:10.1093/intqhc/mzad110
9. Alim U, Austin-Bishop N, Cummings G. Pharmacists in a complex chronic disease management clinic. *Can J Hosp Pharm*. 2016;69(6):480-482. doi:10.4212/cjhp.v69i6.1612
10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*. 2021 Apr 1;88:105906.
11. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. *Systematic reviews*. 2016 Dec;5:1-0.
12. Munn Z, Aromataris E, Tufanaru C, Stern C, Porritt K, Farrow J, Lockwood C, Stephenson M, Moola S, Lizarondo L, McArthur A. The development of software to support multiple systematic review types: the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). *JBI evidence implementation*. 2019 Mar 1;17(1):36-43.
13. Tong EY, Edwards GE, Hua PU, Mitra B, Dyk EV, Yip G, Coutsouvelis J, Siderov J, Tran Y, Dooley MJ. Implementation of Partnered Pharmacist Medication Charting in haematology and oncology inpatients. *Journal of Oncology Pharmacy Practice*. 2024 Jun;30(4):636-41.
14. Anwar A, Malik N, Siddiqui A, Shrestha S, Bhutta OA, Mazhar S, Khan MR, Usman HM. Examining clinical pharmacist interventions and identifying opioid medication-related issues in patients with cancer. *Journal of Oncology Pharmacy Practice*. 2024 Aug 28:10781552241279027.
15. Venancio RG, Magliano ED, Barreto ED. Analysis of pharmaceutical interventions in chemotherapy prescriptions of adult and pediatric patients at an oncology reference institute. *Journal of Oncology Pharmacy Practice*. 2024 Mar 5:10781552241230630.
16. Fariya S, Mary Martin Daniel PJ, Raj JS, Sureshkumar K, Suthakar M, Muhasaparur Ganesan R. Implementation of pharmaceutical care service to elderly cancer patients in a tertiary care hospital in South India. *Journal of Oncology Pharmacy Practice*. 2023 Dec;29(8):1836-43.
17. Soggee J, Hunt M, O'Callaghan B, Lam WS, Cannell P, Boardman G, Sunderland B, Czarniak P. Specialist pharmacist consultations with cancer patients in a pharmacist-led anticancer clinic. *Asia-Pacific Journal of Clinical Oncology*. 2023 Aug;19(4):507-16.
18. van Loveren FM, Imholz AL, van't Riet E, Taxis K, Jansman FG. Prevalence and follow-up of potentially inappropriate medication and potentially omitted medication in older patients

- with cancer–The PIM POM study. *Journal of Geriatric Oncology*. 2021 Jan 1;12(1):80-4.
19. Choukroun C, Leguelinel-Blache G, Roux-Marson C, Jamet C, Martin-Allier A, Kinowski JM, Le Guillou C, Richard H, Antoine V. Impact of a pharmacist and geriatrician medication review on drug-related problems in older outpatients with cancer. *Journal of geriatric oncology*. 2021 Jan 1;12(1):57-63.
 20. Zhang J, Xu R, Zhao X, Wang Y, Zhu W, Xiao M, Hu H, Tang L, Shen Z, Guo C. The effectiveness of an independent anti-neoplastic medication therapy management system in ambulatory cancer patients. *Translational Cancer Research*. 2021 Apr;10(4):1703.
 21. Heffner C, Dillaman M, Hill J. Pharmacist-driven medication reconciliation reduces oral oncologic medication errors during transitions of care. *American Journal of Health-System Pharmacy*. 2020 Dec 1;77(Supplement_4):S100-4.
 22. Ding H, Zheng X, Kong S, Gong L, Ding Q, Huang P. Multidisciplinary intervention incorporating pharmacists in management of opioid-naïve patients with moderate to severe cancer pain. *European Journal of Cancer Care*. 2020 May;29(3):e13225.
 23. Maleki S, Alexander M, Fua T, Liu C, Rischin D, Lingaratnam S. A systematic review of the impact of outpatient clinical pharmacy services on medication-related outcomes in patients receiving anticancer therapies. *Journal of Oncology Pharmacy Practice*. 2019 Jan;25(1):130-9.
 24. Tan Z, Yu Z, Chen K, Liu W, Zhao R. Effects of pharmacist-led clinical pathway/order sets on cancer patients: A systematic review. *Frontiers in Pharmacology*. 2021 May 21;12:617678.
 25. Fentie AM, Huluka SA, Gebremariam GT, Gebretekla GB, Abebe E, Fenta TG. Impact of pharmacist-led interventions on medication-related problems among patients treated for cancer: A systematic review and meta-analysis of randomized control trials. *Research in Social and Administrative Pharmacy*. 2024 Feb 14.