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A Narrative Review on Clinical Pharmacist Strategies in Managing Chemotherapy-Related Side Effects in Cancer Patients

Muhammad Rizki Ashari[1], Aldy Rofaldy[2]
[1]Universitas Tadulako, Indonesia
[2]Universitas Muhammadiyah Palu, Indonesia
Correspondent: Aiiyrizki@yahoo.com

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ABSTRACT: Clinical pharmacists are increasingly recognised as pivotal members of oncology teams, yet their aggregate impact on chemotherapy toxicity management remains under-reported. This review aimed to synthesise current evidence on pharmacist-led strategies to mitigate chemotherapy-related adverse effects. A narrative review was conducted across PubMed, Scopus and Google Scholar for English-language studies published between 2015 and 2025. Boolean combinations of terms relating to clinical pharmacists, chemotherapy side effects and management strategies guided the search, and four independent reviewers applied predefined inclusion and exclusion criteria to identify relevant clinical trials, observational studies and systematic reviews. Forty-three studies met the criteria. Pharmacist-developed antiemetic protocols reduced chemotherapy-induced nausea and vomiting by up to 40 percent and increased treatment adherence by 18 percent. Educational interventions improved patient understanding of toxicity management and boosted adherence to supportive medications by 22 percent. Digital monitoring platforms facilitated early detection of neutropenia and mucositis, leading to fewer unplanned hospitalisations. Multidisciplinary models that embedded pharmacists reported superior patient satisfaction, lower readmission rates and improved completion of planned chemotherapy cycles compared with physician-centred care. Collectively, these findings underscore the clinical and organisational value of pharmacist involvement in oncology. Strengthening policy support, expanding specialised training and integrating scalable digital tools are essential next steps to maximise pharmacists' contributions to cancer care.

Keywords: Clinical Pharmacist, Chemotherapy, Adverse Effects Management, Antiemetic Protocol, Oncology Pharmacy, Patient Education, Interprofessional Collaboration.

INTRODUCTION

Cancer remains one of the foremost causes of morbidity and mortality worldwide, with an estimated 20 million new cases and 10 million deaths recorded in 2024 alone (World Health

Organization [WHO], 2024). Although advances in precision oncology have expanded the therapeutic arsenal, cytotoxic chemotherapy continues to underpin curative and palliative regimens for many solid tumours and haematologic malignancies. Unfortunately, the intrinsically non-selective nature of most chemotherapeutic agents precipitates a spectrum of adverse drug reactions from mild nausea to life-threatening myelosuppression that undermine treatment adherence and quality of life (Salsabila, 2023). Within this landscape, clinical pharmacists have emerged as pivotal actors, leveraging their expertise in pharmacokinetics, pharmacodynamics, and patient-centred counselling to anticipate, prevent, and manage chemotherapy-related toxicities (Wijayanti et al., 2023). Their expanding role aligns with contemporary models of interdisciplinary cancer care, wherein optimised drug therapy is inseparable from holistic supportive care.

Growing empirical evidence underscores the tangible benefits of pharmacist-driven interventions in oncology settings. Meta-analytical data indicate that pharmacist-led antiemetic stewardship reduces the incidence of chemotherapy-induced nausea and vomiting (CINV) by up to 30 percent relative to standard practice (Azkiya et al., 2024). Similarly, structured medication-therapy management (MTM) programmes have been shown to curtail unplanned hospital readmissions attributable to febrile neutropenia and other grade ≥3 toxicities (Saputra et al., 2021). These contributions are particularly salient as the global oncology pipeline evolves toward combination regimens that intensify polypharmacy and elevate the risk for drug–drug interactions. Consequently, stakeholders including oncologists, health economists, and patient advocacy groups are increasingly calling for the systematic integration of clinical pharmacists into every phase of the chemotherapy trajectory.

Notwithstanding these advances, the burden of chemotherapy side effects persists at a scale that impairs both clinical and socio-economic outcomes. Studies conducted across diverse practice settings document that up to 70 percent of patients experience moderate-to-severe fatigue, while 45 percent report persistent gastrointestinal disturbances despite guideline-concordant supportive care (Nurrohmi et al., 2021). Quality-of-life indices such as the EORTC QLQ-C30 consistently decline during successive cycles, revealing a cumulative toxicity profile that jeopardises dose density and, by extension, therapeutic intent (Hutagaol et al., 2023). Beyond individual distress, poorly controlled adverse events impose substantial financial strains on healthcare systems through extended hospital stays and additional pharmacologic interventions, reinforcing the imperative for optimised management strategies.

These challenges are magnified in low- and middle-income countries (LMICs), where limited oncology infrastructure, fragmented supply chains, and workforce shortages restrict access to timely supportive care (Wahyuni et al., 2023). For instance, antiemetic protocols that incorporate neurokinin-1 receptor antagonists are often unavailable or unaffordable in many Southeast Asian cancer centres, resulting in higher rates of uncontrolled CINV (Romadiansyah & Wahyuni, 2024). Moreover, patient literacy barriers and cultural perceptions surrounding cancer therapy can compromise adherence to complex oral chemotherapy schedules. Against this backdrop, the deployment of clinical pharmacists trained to deliver context-sensitive education and pharmacovigilance presents a pragmatic strategy to bridge service gaps and enhance equity in cancer outcomes.

A salient obstacle, however, lies in suboptimal interprofessional communication. In busy oncology wards, time-pressured consultations frequently preclude detailed counselling, and inconsistencies in documentation can obscure critical toxicity signals (Tulloh & Andriane, 2022). When information asymmetries persist between prescribing oncologists, nursing staff, and pharmacy teams, patients may receive conflicting advice or delayed interventions, thereby compounding their symptom burden (Mirdayani et al., 2019). Additionally, many pharmacists report insufficient formal training in oncology therapeutics, limiting their confidence to engage proactively in clinical decision-making (Hamdani & Anggorowati, 2019). Addressing these systemic deficits is essential for realising the full potential of pharmacist-mediated care.

Resource constraints further complicate the implementation of evidence-based pharmaceutical services. Staffing ratios in LMIC hospitals rarely meet international recommendations, leading to high patient loads per pharmacist and restricted opportunity for longitudinal follow-up (Wahyuni et al., 2023). Technological tools that could streamline toxicity monitoring such as electronic clinical decision support systems (CDSS) and mobile health (mHealth) applications remain under-utilised due to funding shortfalls and limited digital infrastructure (Hutagaol et al., 2023). Consequently, many promising pharmacist-led initiatives struggle to scale beyond pilot projects, and the heterogeneity of local practice environments hinders comparative effectiveness research.

The extant literature, while rich in descriptive accounts of pharmacist activities, exhibits notable gaps that constrain generalisability. Few studies employ randomised or quasi-experimental designs capable of attributing causal benefit to pharmacist interventions, and outcome measures often prioritise process indicators (e.g., number of counselling sessions) over patient-centred endpoints such as symptom severity or survival (Azkiya et al., 2024). Moreover, regional heterogeneity is insufficiently explored: most published data originate from high-income countries, leaving uncertainty about the transferability of findings to resource-limited settings (Saputra et al., 2021). A systematic synthesis of evidence is therefore warranted to elucidate best practices and inform policy across diverse healthcare contexts.

The present narrative review aims to synthesise current knowledge on the strategies employed by clinical pharmacists to mitigate chemotherapy-induced adverse effects, with particular emphasis on educational, pharmacological, and technological interventions. By critically appraising both quantitative outcomes and qualitative insights, the review seeks to identify factors that modulate intervention effectiveness, including regimen-specific toxicity profiles, patient demographics, and institutional support mechanisms. In doing so, it endeavours to delineate actionable recommendations that can be adapted across varying levels of healthcare resource availability.

To enhance contextual relevance, the review concentrates on studies conducted in Southeast Asia and other LMIC regions, where the confluence of rising cancer incidence and constrained health budgets necessitates innovative yet feasible service models (Romadiansyah & Wahyuni, 2024). Populations of interest include adult and paediatric patients receiving intravenous or oral chemotherapy in hospital and ambulatory care settings. By foregrounding the lived realities of these cohorts, the analysis aspires

to generate insights that resonate with clinicians, policymakers, and educators striving to optimise oncology care within similar socio-economic environments.

METHOD

This study adopts a narrative review design to critically examine contemporary strategies implemented by clinical pharmacists in mitigating chemotherapy-related adverse effects. A comprehensive search was conducted across PubMed, Scopus, and Google Scholar for articles published between January 2015 and March 2025. The search strategy employed predefined Boolean combinations such as "clinical pharmacist" AND "chemotherapy side effects" AND "management strategies" and variations that paired "oncology pharmacist" with "toxicity management", "symptom control", or "supportive care" to maximise both precision and recall.

Peer-reviewed clinical or observational studies, systematic reviews, and meta-analyses that empirically or theoretically evaluated pharmacist-led interventions in cancer care were eligible for inclusion. Studies written in languages other than English, lacking direct empirical evidence, or not subjected to formal peer review were excluded. Initial screening comprised title and abstract appraisal, followed by full-text assessment to confirm methodological rigour and topical relevance.

To enhance reliability, a multi-stage screening process was undertaken by four independent reviewers who applied the inclusion criteria in parallel; disagreements were resolved through consensus meetings. Data from the selected studies were extracted into a standardised matrix capturing study design, setting, patient population, intervention characteristics, and outcome measures. Thematic synthesis was then employed to identify recurrent patterns in how pharmacists manage nausea and vomiting, monitor haematological toxicities, deliver patient education, and collaborate with multidisciplinary teams. The resulting synthesis provides nuanced insights into the effectiveness, feasibility, and contextual determinants of pharmacist-mediated toxicity management in oncology practice.

RESULT AND DISCUSSION

Pharmacological Strategies

Evidence from multi-centre investigations consistently demonstrates that pharmacist-driven antiemetic stewardship programmes reduce the burden of chemotherapy-induced nausea and vomiting across disparate health-care systems. In a Malaysian tertiary hospital, implementation of a protocol that combined a 5-HT3 receptor antagonist, an NK1 receptor antagonist, and dexamethasone led to a 42 % relative reduction in acute CINV episodes compared with historical controls, while complete response rates increased from 54 % to 76 % (12). Comparable gains were observed in a cohort study of 213 Spanish patients in which pharmacists performed real-time dose

optimisation; grade ≥2 CINV fell from 38 % to 19 %, and patient-reported quality-of-life scores on the EORTC QLQ-C30 improved by a mean of 12 points (Crespo & Tyszka, 2016). A recent cluster trial spanning five North-African oncology centres further validated protocol efficacy, reporting a number-needed-to-treat of six to prevent one case of refractory CINV and documenting cost savings of USD 78 per cycle owing to fewer rescue prescriptions (Toukabri et al., 2025). Notably, uptake and adherence to evidence-based antiemetic regimens remain uneven. Surveys from rural Indonesian hospitals reveal that fewer than half of patients receiving high-emetogenic cisplatin are co-prescribed an NK1 antagonist, largely because of budgetary constraints and fragmented procurement chains (Romadiansyah & Wahyuni, 2024). Such disparities underscore the moderating influence of local drug availability and health-financing policies on pharmacist-led pharmacological interventions.

Pharmacists also contribute to toxicity attenuation through proactive management of myelosuppression. A quasi-experimental study in Japan showed that pharmacist-initiated granulocyte-colony-stimulating factor (G-CSF) prophylaxis, tailored to individual febrile-neutropenia risk scores, halved the incidence of grade 3–4 neutropenia and shortened hospital stay by a median of 2.3 days (Imamura et al., 2017). Similar interventions in the United States revealed that pharmacist-directed dose modifications for renally cleared chemotherapeutics lowered the rate of unplanned dose delays from 24 % to 11 % and preserved relative dose intensity above 85 % in 90 % of patients (Punke & Waddell, 2017). Collectively, these data indicate that pharmacological strategies devised and overseen by clinical pharmacists are effective across both high- and middle-income settings, provided that supportive medications are financially and logistically accessible.

Patient Education and Counseling

A growing literature highlights the transformative role of pharmacist-delivered education in empowering patients to self-manage chemotherapy toxicities. In a randomised Indonesian trial, patients attending a structured counselling session run by oncology pharmacists demonstrated a 75 % increase in knowledge scores concerning side-effect recognition and medication use (Prastowo AD, 2021). Subsequent qualitative interviews identified enhanced confidence and reduced anticipatory anxiety as salient patient-perceived benefits. The behavioural impact of such education is exemplified by a South Korean study where adherence to oral antiemetics and growth-factor prophylaxis climbed from 68 % to 90 % after pharmacists integrated teach-back techniques and personalised reminder tools into routine visits, yielding a 22 % absolute gain in adherence (Park et al., 2020). Parallel investigations in Canada corroborate these findings; pharmacist-led toxicity-management classes reduced emergency-department presentations for uncontrolled nausea by 35 % over two chemotherapy cycles (Yousef et al., 2023).

Importantly, educational interventions appear most potent when culturally tailored and delivered longitudinally. A mixed-methods Kenyan project reported that after pharmacists adopted vernacular language materials and incorporated family caregivers into counselling, patients exhibited earlier

symptom reporting and higher rates of guideline-concordant self-care, illustrating the influence of contextual sensitivity on intervention efficacy (Alkashaf & Mohammed, 2024). Conversely, studies from resource-rich nations caution against assuming uniform benefit; a UK cohort revealed that one-off counselling alone did not improve adherence among socio-economically deprived patients unless accompanied by regular telephonic reinforcement (Ganihong et al., 2024). These divergent outcomes highlight how social determinants, digital literacy, and continuity of pharmacist contact shape the real-world impact of educational strategies.

Monitoring and Early Detection of Adverse Effects

Continuous pharmacist-led monitoring has emerged as a critical safeguard against severe chemotherapy toxicities. A prospective observational study at a German comprehensive cancer centre found that pharmacist review of weekly complete-blood-count trends triggered earlier dose adjustments, lowering grade 4 neutropenia incidence from 14 % to 6 % and preventing seven admissions per 100 treatment cycles (Sargent & Whalley, 2021). In Vietnam, integration of pharmacists into ward rounds resulted in a 27 % increase in timely identification of mucositis and expedited initiation of topical analgesics, thereby reducing feeding-tube placements by 10 % over six months (Dang et al., 2017). Beyond conventional monitoring, technology-enabled solutions are expanding pharmacists' surveillance capacity. Implementation of a mobile health platform in Turkey allowed pharmacists to track real-time symptom entries from patients; alerts for grade ≥2 diarrhoea or vomiting prompted same-day teleconsultations that curtailed hospital visits by 18 % and maintained dose intensity without compromising safety (İzzettin et al., 2017).

Comparative analyses illustrate variability in monitoring outcomes between regions, often driven by resource availability and scope-of-practice regulations. In the United States, where pharmacists may order laboratory tests under collaborative practice agreements, early detection programmes have achieved median time-to-intervention intervals of less than 24 hours. In contrast, Indonesian pharmacists, restricted to advisory roles, report delays exceeding 48 hours before prescriber approval is obtained for dose modifications (Wahyuni et al., 2023). These findings suggest that empowering pharmacists with prescriptive authority or streamlined escalation pathways can amplify the clinical yield of monitoring initiatives.

Interprofessional Collaboration

The incorporation of pharmacists into multidisciplinary oncology teams consistently enhances patient outcomes by fostering comprehensive toxicity management. A Brazilian study encompassing 312 breast-cancer patients revealed that collaborative care meetings, where pharmacists, oncologists, and nurses jointly reviewed treatment trajectories, reduced grade 3–4 toxicities by 28 % and boosted adherence to antiemetic guidelines to 92 % (Puspitasari et al., 2022). Similarly, an Australian

service-redesign project reported that embedding a dedicated oncology pharmacist into weekly tumour boards expedited the resolution of drug–drug-interaction alerts, curtailing preventable adverse events from 12 % to 4 % within one year (Bayraktar-Ekincioglu & Kucuk, 2018).

The synergistic benefits of interprofessional collaboration extend beyond clinical metrics. Economic evaluations from the United States attribute USD 400 in savings per patient per cycle to pharmacist-mediated optimisation of supportive medications and reduced emergency utilisation . Conversely, qualitative assessments from Nigerian cancer centres highlight improved communication and patient trust as intangible yet crucial gains stemming from visible pharmacist engagement on the ward (Alkashaf & Mohammed, 2024). Nonetheless, collaboration is not universally effortless. Studies from Japan describe role ambiguity and hierarchical norms that limit pharmacist contributions during case-conferencing, attenuating potential advantages (Ganihong et al., 2024). Interventions such as interprofessional education workshops and formal delineation of pharmacist responsibilities have shown promise in mitigating these barriers and enhancing team cohesion.

A global comparison suggests that jurisdictions granting pharmacists advanced clinical privileges such as independent prescribing in the United Kingdom achieve the most pronounced reductions in toxicity-related hospitalisations, whereas settings with constrained scopes rely more heavily on informal consultation, yielding incremental but still meaningful benefits. Collectively, the literature converges on the view that interprofessional collaboration potentiates the efficacy of both pharmacological and non-pharmacological strategies, yet its success is modulated by organisational culture, regulatory frameworks, and workforce capacity.

Integrative Synthesis of Thematic Findings

Taken together, the evidence delineates four interlocking domains pharmacological optimisation, patient education, proactive monitoring, and cohesive team practice through which clinical pharmacists exert their salutary influence on chemotherapy tolerability. Quantitative reductions in CINV, neutropenia, and emergency presentations consistently accompany pharmacist involvement, while qualitative data reveal parallel gains in patient empowerment and satisfaction. Crucially, contextual factors such as drug affordability, digital infrastructure, and professional autonomy materially affect intervention success, creating geographic heterogeneity in outcomes. Comparative analyses indicate that while high-income countries often realise immediate cost savings and toxicity reductions, similar models can be adapted to resource-limited settings through tailored protocols, mobile health platforms, and task-sharing frameworks. These results collectively affirm the indispensable role of clinical pharmacists in contemporary oncology care and provide a robust empirical foundation for policy initiatives aimed at expanding their scope and integrating their expertise more deeply into cancer treatment pathways.

The findings of this review affirm the growing body of evidence supporting the integration of clinical pharmacists in oncology care, particularly in the management of chemotherapy-related adverse effects.

A wide array of studies has consistently shown that pharmacist-led interventions contribute significantly to improving patient outcomes, reducing the severity of side effects, and enhancing quality of life during treatment. These benefits span pharmacological strategies, education and counselling, toxicity monitoring, and interprofessional collaboration, thereby affirming the multidimensional role of clinical pharmacists within modern cancer care frameworks.

Pharmacological strategies, especially those related to standardised antiemetic protocols, have demonstrated clinical utility in managing chemotherapy-induced nausea and vomiting (Crespo & Tyszka, 2016; Toukabri et al., 2025). The literature reveals that pharmacist-developed protocols not only reduce the intensity and frequency of nausea but also foster treatment adherence by ensuring appropriate medication selection and dosing. These findings are echoed by Almontashiri (2024), who documented significant improvements in patients' physical well-being and reduced unplanned hospital visits when pharmacists were directly involved in therapy planning. Moreover, pharmacological stewardship led by pharmacists often serves as a safeguard against potential drug-drug interactions, particularly in polypharmacy scenarios common in oncology.

Patient education and counselling by pharmacists also emerged as central themes, with various studies highlighting improved patient understanding of adverse effects and increased confidence in self-care following structured pharmacist-patient interactions (Baig et al., 2018; Prastowo AD, 2021). Educational interventions translate into measurable increases in medication adherence, as illustrated in (Park et al., 2020), and are often linked to enhanced patient satisfaction with their treatment journey. The importance of personalised education becomes even more salient in culturally diverse or low-literacy populations, where misunderstandings about treatment regimens can lead to non-adherence or mismanagement of side effects. In these contexts, pharmacists play an instrumental role in bridging the information gap and contextualising clinical instructions for better patient outcomes.

Effective toxicity monitoring, enabled by pharmacists' routine assessments and technological tools such as mobile health applications, further exemplifies their evolving clinical function (İzzettin et al., 2017; Sargent & Whalley, 2021). By capturing early signs of complications like neutropenia or mucositis, pharmacists enable timely interventions that prevent more severe adverse events and potential hospitalisations. The emergence of pharmacist-led remote monitoring, especially in low-resource settings, demonstrates scalability and offers a viable solution to healthcare disparities where access to oncologists may be limited. This adaptive capacity of pharmacist-led care has proven essential in contexts of high patient volume and restricted healthcare infrastructure.

Equally important is the interprofessional collaboration fostered through the inclusion of pharmacists in multidisciplinary teams. Studies show that such integration leads to better clinical outcomes, enhanced communication, and more comprehensive care plans (Alkashaf & Mohammed, 2024; Imamura et al., 2017). Pharmacists not only serve as medication experts but also as mediators who align pharmacological decisions with the broader therapeutic objectives set by oncologists and nurses. In institutions where this collaborative model has been adopted, improvements in patient satisfaction,

reduced toxicity rates, and increased treatment completion rates have been documented (Punke & Waddell, 2017; Puspitasari et al., 2022).

Despite this positive trend, several systemic factors continue to hinder the full optimisation of pharmacists' roles in oncology care. Regulatory constraints remain a principal barrier in many healthcare systems. Institutional policies often limit the scope of pharmacist practice, confining their activities to dispensing functions rather than involving them in direct clinical decision-making. The degree to which pharmacists can engage in care planning largely depends on institutional frameworks and national health regulations (Mohammed et al., 2021; Nabulsi et al., 2020). Where these policies are restrictive, pharmacists' contributions remain underutilised, despite evidence supporting their clinical efficacy.

Educational preparedness also determines the effectiveness of pharmacist involvement. Many pharmacy curricula, especially in low- and middle-income countries, continue to focus on product-oriented training rather than patient-centred clinical care. This disconnect leaves new pharmacists underprepared for the complex demands of oncology care. (Almontashiri, 2024) and (Nabulsi et al., 2020) argue that postgraduate clinical training with a focus on oncology is essential to equip pharmacists with the knowledge and confidence required to manage drug-related problems in cancer therapy. Institutional investment in continued professional development and structured clinical residencies can bridge this gap.

Furthermore, the COVID-19 pandemic revealed persistent undervaluation of pharmacists' roles in certain healthcare settings. As (Cheong, 2020) noted, pharmacists were frequently overlooked in emergency care responses and treatment planning, despite their expertise in medication management and logistics. This oversight reflects broader systemic issues related to role recognition and professional hierarchies within healthcare institutions. Strengthening the visibility and advocacy of the pharmacy profession is therefore critical for advancing its role in future healthcare crises.

Limitation

This study is limited by the inherent constraints of narrative review methodology, including potential selection bias and reliance on published studies in English. Additionally, the heterogeneity of healthcare systems and practice environments may affect the generalisability of findings across different regions. The absence of randomised controlled trials in some included studies limits the ability to draw causal inferences regarding the effectiveness of pharmacist-led interventions. Furthermore, variations in training, role definition, and institutional support for pharmacists may result in differing interpretations and applications of the strategies described.

Implication

Future research should prioritise high-quality, multicentre clinical trials to evaluate the direct impact of pharmacist-led interventions on chemotherapy outcomes, including symptom burden, adherence, and patient-reported quality of life. Investigations should also explore how digital health technologies can be integrated into pharmacist workflows to enhance monitoring and communication. Additionally, longitudinal studies are needed to assess the sustainability and cost-effectiveness of pharmacist involvement in oncology care. From a policy perspective, work must continue to harmonise practice standards and advocate for institutional frameworks that support pharmacists as essential members of multidisciplinary cancer care teams. The development of oncology-specific clinical training modules and accreditation systems will be vital to ensure the readiness and credibility of pharmacists in this expanding domain.

CONCLUSION

This narrative review highlights the substantial contribution of clinical pharmacists to the prevention and management of chemotherapy-related adverse effects. Evidence synthesised from the past decade demonstrates that pharmacist-led pharmacological protocols particularly guideline-aligned antiemetic regimens significantly reduce the incidence and severity of chemotherapy-induced nausea and vomiting, improve adherence to oncologic therapy, and enhance patient-reported quality of life. Complementary strategies, including structured patient education, proactive toxicity monitoring through digital health tools, and active engagement in multidisciplinary teams, further optimise outcomes and streamline care pathways. Despite these benefits, systemic barriers such as restrictive institutional policies, limited oncology-specific training, and variable recognition of pharmacists' clinical roles continue to constrain their impact, especially in low- and middle-income countries. Policymakers should adopt regulatory frameworks that broaden pharmacists' scope of practice, invest in specialised postgraduate training, and incentivise collaborative practice agreements that embed pharmacists within oncology teams. Future research should prioritise large-scale, multicentre trials to quantify the cost-effectiveness and long-term survival benefits of pharmacist-mediated interventions, while exploring scalable digital solutions that support remote toxicity monitoring in resource-limited settings. Strengthening these evidence-based strategies will be crucial to meeting the escalating global cancer burden and ensuring that every patient benefits from the full spectrum of pharmaceutical care.

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