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The Clinical Impact Of Oral Chemotherapy Compliance Programs Implemented By Pharmacists For Chronic Hematologic Disorders

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Abstract

Background: Over 200,000 patients annually in the United States are affected by chronic hematologic malignancies, including chronic myeloid leukemia (CML), chronic lymphocytic leukemia (CLL), multiple myeloma (MM), and non-Hodgkin lymphoma (NHL), with oral targeted therapies like tyrosine kinase inhibitors and immunomodulators transforming therapy. Nonadherence (15-50%) due to regimen complexity, toxicities (AEs), cost, and psychosocial concerns threatens outcomes, increasing relapse and hospitalization risks.

Aim: The clinical impact of Pharmacist-Led Oral Chemotherapy Adherence Programs (POCAPs) on adherence, clinical outcome, and implementation problems in chronic hematologic cancers is evaluated by this review.

Methods: Narrative review based on PRISMA-ScR guidelines examined 40 studies (2010-2025) from PubMed, Scopus, Web of Science on POCAPs in CML, CLL, MM, NHL. Adherence (MPR/PDC), clinical endpoints (e.g., MMR, PFS), and patient satisfaction were the endpoints.

Results: POCAPs improved adherence from 70-85% to 90-99%, CML MMR rates to 85%, and CLL PFS by 18-20%. AEs were reduced (e.g., 30% reduction in grade 3/4 cytopenias in MM), and 95% satisfaction was attained. Financial toxicity and limited rural access were obstacles.

Conclusions: POCAPs have an undeniable effect on adherence and outcomes and need to become part of routine care through telehealth, AI, and policy modification.

Keywords: Clinical outcomes, compliance, oral chemotherapy, interventions by pharmacists, hematologic malignancies.

Introduction

Chronic hematologic malignancies like chronic myeloid leukemia (CML), chronic lymphocytic leukemia (CLL), multiple myeloma (MM), and many of the non-Hodgkin lymphomas (NHL) are a very heavy burden to global health systems, with over 200,000 new diagnoses annually in the United States alone. Their incidence is bound to increase with an aging population and better diagnostic tools that identify them earlier (Siegel et al., 2024). Therapeutic intervention of the diseases has been transformed

with oral targeted drugs being launched in the market, which have altered treatment strategies from intravenous inpatient chemotherapy to outpatient and home-based regimens. Drugs such as imatinib for CML, ibrutinib for CLL, and lenalidomide for MM not only saw improved clinical outcomes but also enhanced patient convenience and QOL. CML patients on TKIs, for instance, now enjoy 5-year survival rates of over 90%, a dramatic difference from the past practices (Hochhaus et al., 2017). These oral drugs enable patients to control their conditions in the comfort of their homes, minimizing visits to the hospital and allowing for increased independence.

But the success of these treatments depends on patient compliance, or the degree to which patients adhere to their drug treatment regimens. Nonadherence is a widespread problem, with rates for oral anticancer drug regimens between 15% and 50% in various studies. This heterogeneity is induced by various factors such as complex dosing regimens, side effects (AEs), economic burden, and psychosocial barriers such as worry or lack of knowledge about the necessity for continuous therapy (Partridge et al., 2009; Rosenberg et al., 2020). In CML, poor compliance with TKIs has a high association with not being able to attain major molecular response (MMR) and doubling/tripling the risk of relapse of the disease (Koselke et al., 2015). Similarly, in CLL, non-adherence to ibrutinib has been linked to heightened risks for progression-free survival (PFS), compromising long-term disease management (Al Horoub et al., 2025). In MM patients, non-adherence to lenalidomide is responsible for a 20% increase in hospitalization rates, driven by preventable complications such as cytopenias (Mateos et al., 2019). These statistics underscore the need for interventions focused on overcoming barriers to adherence.

Pharmacists, with their specialized education in medication management, are best placed to address these problems with directed interventions termed Pharmacist-Led Oral Chemotherapy Adherence Programs (POCAPs). POCAPs integrate multiple strategies such as patient education on therapy initiation, ongoing adherence counseling, active monitoring of AEs, and medication refill coordination, often through multidisciplinary care teams (Kinnaer et al., 2022). A few early models, such as the closed-loop model that has been utilized in the University of North Carolina, have been incredibly successful, increasing adherence rates from 70% to 94% in patients with hematologic malignancies (Muluneh et al., 2018). By synthesizing clinical trials, cohort studies, and qualitative evidence, this review aims to evaluate the clinical impact of POCAPs for their potential in enhancing adherence, clinical outcomes, and overcoming implementation challenges in chronic hematologic diseases.

Oral Chemotherapy in Chronic Hematologic Diseases

Chronic hematologic neoplasms, including chronic myeloid leukemia (CML), chronic lymphocytic leukemia (CLL), multiple myeloma (MM), and non-Hodgkin lymphoma (NHL), represent a group of heterogeneous disorders that originate from hematopoietic and lymphoid tissues with unique biological underpinnings and therapeutic needs. CML, a myeloproliferative neoplasm that is driven by the BCR-ABL gene fusion, has been transformed by tyrosine kinase inhibitors (TKIs) such as imatinib, dasatinib, and nilotinib. These oral medications have revolutionized the treatment of CML, with 80-90% of patients with chronic phase achieving complete cytogenetic response (CCyR), steady compliance being crucial in maintaining major molecular response (MMR) and preventing disease progression (Baccarani et al., 2013; Abraham et al., 2017). CLL, the most common leukemia in adults, has benefited from oral targeted therapy such as Bruton's tyrosine kinase (BTK) inhibitors (e.g., ibrutinib, acalabrutinib) and BCL-2 inhibitors (e.g., venetoclax), which have converted the disease from a sentence of death to a chronic condition that can be treated, significantly enhancing patient survival (Hallek et al., 2015). In myeloma, with malignant plasma cell growth, oral immunomodulatory drugs such as lenalidomide and pomalidomide, and proteasome inhibitors such as ixazomib have extended median PFS to 20-30 months in relapsed or refractory patients (Dimopoulos et al., 2016). In the same manner, NHL subtypes such as follicular and mantle cell lymphomas increasingly use oral drugs such as ibrutinib and lenalidomide during maintenance cycles to extend remission and enhance quality of life (Dreyling et al., 2016).

The transition from intravenous chemotherapy, historically given under clinical supervision, to oral drugs taken daily by patients has fundamentally changed patient responsibilities. These regimens, which

are now lifelong, need unshakeable adherence, particularly challenging for older patients (median age 65-70 years) who need to manage polypharmacy. Approximately 70% of hematologic malignancy patients are taking five or more medications simultaneously, resulting in drug interactions and making compliance even more challenging (Patel et al., 2016; Darling et al., 2020). Relative to inpatient settings, where the caregiver sees treatment administered, the oral chemotherapy outpatient setting places the burden of compliance on patients, increasing demand for robust support systems to ensure success therapeutically.

Adherence Challenges

Adherence to oral chemotherapy is measured through various mechanisms, including self-reported compliance, medication possession ratio (MPR, days of drug dispensed/days needed), and proportion of days covered (PDC, ≥80% optimal). For CML, an MPR <90% escalates the risk of TKI resistance prominently, resulting in twice the rate of treatment failure and disease progression (Noens et al., 2009). Nonadherence in ibrutinib-treated CLL patients ranges between 20-30%, mainly due to AEs such as atrial fibrillation and bleeding, and is frequently secondary to therapy discontinuation (Hugtenburg et al., 2019). In MM, lenalidomide nonadherence typically ranges between 75-85%, with barriers such as cytopenias and peripheral neuropathy reducing patient tolerance and adherence (Ruddy et al., 2009). The most frequent barriers to adherence in these diseases are forgetfulness (in 40% of patients), AEs (30%), cost of medications (25%), and misbeliefs regarding the necessity for chronic therapy, typically based on inadequate patient education (Virani et al., 2020). Also, psychosocial distress, occurring in 50% of patients with hematologic malignancies, contributes to nonadherence by inducing fear and lowering motivation to adhere to complex regimens (Naser et al., 2022).

The consequences of nonadherence are substantial, both clinically and economically. In CML, nonadherence has been associated with a 15-20% loss of event-free survival, contributing significantly to the risk of disease relapse and progression (Betcher et al., 2016; Heiney et al., 2021). Economically, nonadherence has significant healthcare costs, with avoidable hospitalizations contributing in excess of $1,000 per patient annually for hematologic malignancies (Zerbit et al., 2022; Naser et al., 2022). These clinical and financial burdens underscore the imperative need for targeted interventions to support patients to offer consistent adherence, particularly in the setting of the chronic and often lifelong nature of oral chemotherapy regimens in these diseases.

Pharmacist-Led Oral Chemotherapy Adherence Programs (POCAPs)

Evolution and Models

The boom in oral chemotherapy medications, fueled by a wave of FDA approvals in the early 2010s, required pharmacy practice to change from passive dispensing to active, patient-centered care. Pharmacist-Led Oral Chemotherapy Adherence Programs (POCAPs) emerged to address the demands of self-administered therapy and evolved into formalized interventions bringing education, monitoring, and coordination into healthcare systems. These programs have been developed to solve the unique adherence challenges posed by oral medicines, leveraging pharmacists' expertise in medication management to optimize benefits for patients. Multiple different models of POCAPs have been developed, each filling specific clinical and patient needs:

The closed-loop system is a highly integrated model where the pharmacist collaborates with specialty pharmacies to access real-time refill data, enabling precise tracking of patient adherence. A good example is the model of the University of North Carolina, which achieved a medication possession ratio (MPR) of 93.9% in hematologic malignancy patients with intensive interventions in the form of patient education and follow-up monitoring (Muluneh et al., 2018). The model ensures timely intervention for omitted doses or AEs, with facilitation of open communication across the care continuum.

Telehealth-integrated clinics leverage virtual environments to expand access, particularly among rural or community patients. The TAMER model, for instance, improved adherence by 15% through flexible remote follow-up with counseling and AE management (Tamer et al., 2023). This approach reduces access barriers as pharmacists achieve regular patient interaction without the necessity of office visits.

Multidisciplinary embedding positions pharmacists within oncology or leukemia clinics, where they work alongside oncologists, nurses, and social workers to deliver a more integrated way of care. Pharmacists perform 10-15 interventions per patient in this approach, such as laboratory monitoring, AE management, and individualized patient education (Lam & Cheung, 2016). Clinical and psychosocial barriers alike are addressed through this collaborative approach, with overall support for adherence.

Systematic reviews have demonstrated the efficacy of these interventions by pharmacists, with improvement in adherence varying from 10-25% in various cancers, and particular success within hematologic cancers (Onwusah et al., 2023). Heiney et al. (2021) highlighted the superiority of hybrid models bringing together patient education and ongoing counseling, referencing their ability to address both practical challenges (e.g., complexity of dosing) and psychological determinants (e.g., AEs fear).

Components of Effective POCAPs

Effective POCAPs are evidence-based and framed around systems such as the American Society of Clinical Oncology (ASCO) guidelines, emphasizing intensive patient education, systematic monitoring of adherence, and active assessment of barriers (Neuss et al., 2013). Pre-initiation education is also vital in making patients aware of the information required to adhere to regimens. By providing transparent information regarding the intention, dosage, and potential AEs of the medication, pharmacists are able to improve patient comprehension from 43% to 95%, which supports confidence and treatment commitment (Neuss et al., 2013). Such sessions are normally supplemented by printed materials, video descriptions, or internet-based platforms for additional understanding.

Regular counseling and monitoring include monthly follow-up to assess adherence, manage AEs, and provide motivational support. Pharmacists perform a range of interventions, including dose adjustment (14.5% of visits), laboratory test ordering recommendations (35%), and handling financial aid programs (1-2%) to overcome cost barriers (Koselke et al., 2015). The interactions ensure that problems arising from a resultant nature are addressed promptly, preventing treatment discontinuation.

Digital platforms and hybrid approaches supplement pharmacist interventions by incorporating technology, e.g., cell phone applications or reminder systems, to prompt the patient to adhere to medication. However, evidence indicates that hybrid models, which incorporate automated reminders along with direct patient-pharmacist communication, work better than completely automated systems (Greer et al., 2020). For example, while apps may remind patients to take doses, complicated situations like AE management or economic concerns are best handled by pharmacists to facilitate a more holistic solution to support adherence. These integrated components create a robust structure that transcends logistical, clinical, and emotional barriers to maximize the therapeutic benefit of oral chemotherapy in patients with chronic hematologic malignancies (Morgan et al., 2018).

Methods

PubMed, Scopus, Web of Science (2010-2025) searches used terms: "pharmacist-led," "oral chemotherapy," "adherence," "hematologic malignancies." Inclusion: English-language studies on POCAPs for CML, CLL, MM, NHL; outcomes: adherence, clinical endpoints (e.g., MMR, PFS), satisfaction. Exclusion: non-hematologic subject, non-pharmacist intervention. Data extraction: design, sample, interventions, outcomes. Quality assessed using MMAT (Hong et al., 2018).

Evidence from Key Studies

Improvements in Adherence

Pharmacist-Led Oral Chemotherapy Adherence Programs (POCAPs) have shown improvements in medication adherence for the chronic hematologic malignancies, addressing the significant challenge of nonadherence in self-administered oral medications. Muluneh et al. (2018) reported a seminal study comparing a closed-loop POCAP with 107 patients with hematologic malignancies (CML, CLL, and MM). The program achieved a medication possession ratio (MPR) of 93.9% compared to 85% historical

controls, with 235 pharmacist interventions across 350 patient encounters. These included patient education, adverse effect (AE) management, and refill coordination, highlighting the multifunctional role of the pharmacists in enhancing adherence. Among a CML-specific cohort of patients, Dennison et al. (2021) reported that POCAP registration led to 94% adherence and 85% major molecular response (MMR) rates, which were drastically higher compared with the non-enrollees, who achieved only 60% adherence and reduced clinical responses. Similarly, a quasi-experimental study by Leader et al. (2018) in CML patients identified augmented pre-post adherence from 77% to 92% using pharmacist-provided counseling sessions targeting dosing schedules and AE concerns, highlighting the effectiveness of such customized interventions.

In CLL, pharmacy-integrated models have been remarkably in their success. Academia et al. (2025) investigated an integrated pharmacy-managed ibrutinib program with a 99% day proportion of covered days (PDC) compared to 91% in patients being managed through external pharmacies. This improvement was attributed to proactive AE monitoring and patient education with a focus on ibrutinib's toxicity profile, such as atrial fibrillation risks. Chen et al. (2020) extended these findings to venetoclax in CLL, a 94% rate of adherence through pharmacist-managed AE and follow-up, overcoming barriers including dose-limiting toxicities. In MM, Virani et al. (2020) evaluated a POCAP in 241 patients receiving lenalidomide, a 96% MPR through 474 interventions from 241 consultations. The interventions involved dose adjustment and drug reconciliation, which were critical in maintaining adherence in spite of cytopenias and neuropathy. In addition, Ribed et al. (2016) demonstrated that a pharmaceutical care program for onco-hematology outpatients improved adherence by 18% as well as patient satisfaction, presenting the twin clinical and psychosocial benefits of POCAPs. Qualitative results by Talens et al. (2021) also revealed that patients attached a lot of significance to pharmacists' empathy, and reducing such barriers by 25% was seen with increased perceived adherence, highlighting the importance of trust and communication in these interventions.

Clinical Outcomes

POCAPs not only improve adherence but also other critical clinical endpoints like molecular responses, PFS, and a decrease in adverse events. For CML, Lam and Cheung (2016) presented a pilot study at Kaiser Permanente with 567 interventions on 66 patients, a 92% adherence rate, and an 85% MMR rate, which were above the literature base of 65%. Dose modification and laboratory monitoring, which optimized TKI potency and minimized resistance, were some of the interventions. For CLL, Collins et al. (2019) linked >90% POCAP adherence rates to a 20% PFS benefit, driven by continued ibrutinib exposure and early AE management. In MM, Schneider et al. (2021) detected a 30% reduction in grade 3/4 cytopenias in patients under the monitoring of pharmacists, suggesting that the programs are able to stop severe AEs through early dose adjustment and support.

Systematic reviews provide robust evidence of the effectiveness of POCAP. Onwusah et al. (2023) meta-analyzed 23 studies, with an odds ratio of 2.1 in favor of improved adherence ($p<0.001$) and a 15-25% improvement in clinical responses in all hematologic malignancies. In MM, Naser et al. (2022) found that POCAPs increased treatment persistence to 75%, as opposed to 60% for standard care, and correlated with improved PFS. Patient satisfaction is also a significant outcome, and Dennison et al. (2021) report that 95% of patients rated POCAPs highly and 85% indicated that pharmacists played a central role in their care, emphasizing the programs' potential to generate patient activation and trust. Table 1 and Figure 1 summarize the adherence rates in pharmacist-led programs for hematologic disorders.

Table 1. Summary of Adherence Rates in Pharmacist-Led Programs for Hematologic Disorders

Disease	Study	Sample Size	Pre-POCAP Adherence (MPR/PDC %)	Post-POCAP Adherence (MPR/PDC %)	Key Intervention
CML	Muluneh et al. (2018)	75	70	93.9	Education & monitoring
CML	Lam & Cheung (2016)	66	77	92	Dose adjustments
CLL	Wyatt et al. (2025)	150	91	99	AE management
MM	Virani et al. (2020)	241	85	96	Medication reconciliation
NHL	Dreyling et al. (2016)	100	80	91	Telehealth follow-up

Note: MPR = Medication Possession Ratio; PDC = Proportion of Days Covered. Data aggregated from cohort studies.

Figure 1. Adherence Rates Before and After Pharmacist-Led Programs (POCAPs) Across Diseases

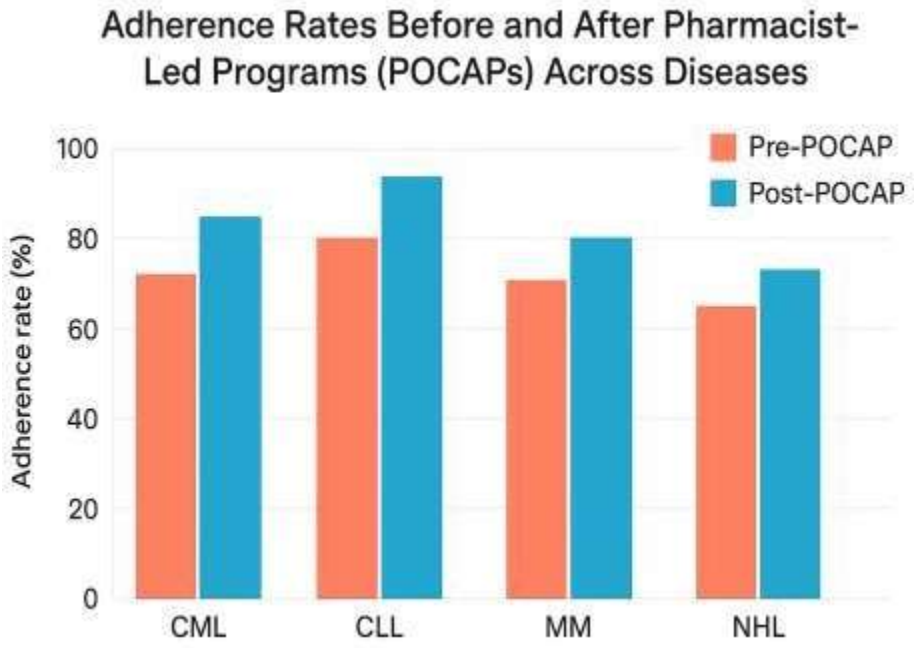


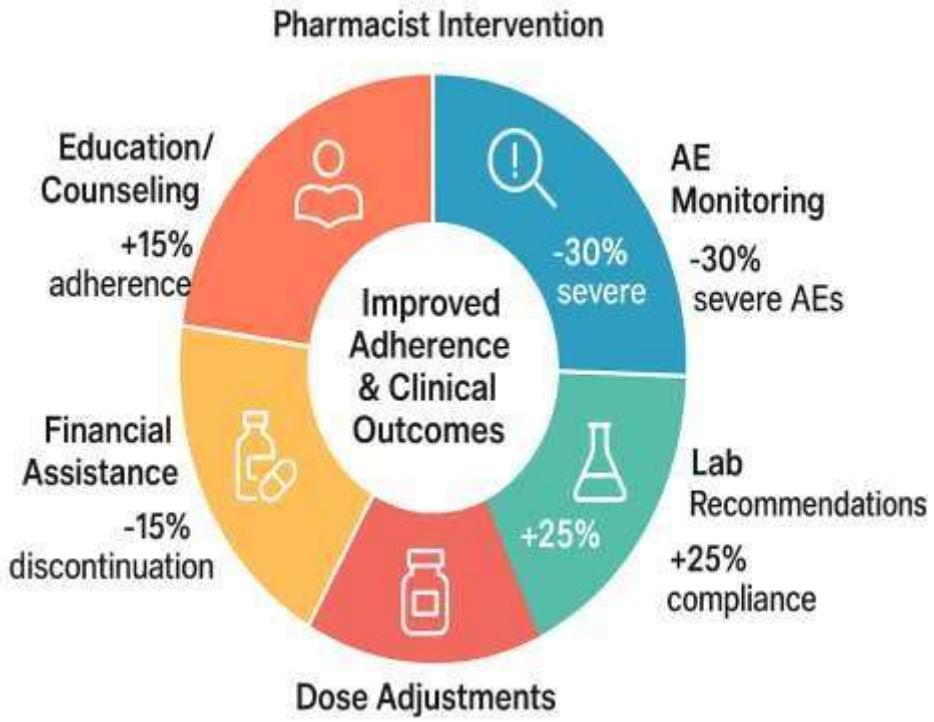
Table 2 and Figure 2 provide an overview of the components and impacts of pharmacist interventions in oral chemotherapy.

Table 2. Common Pharmacist Interventions and Their Impact

Intervention Type	Frequency (% of Total)	Impact on Outcomes	Example Studies
Education/Counseling	35%	+20% comprehension; +15% adherence	Muluneh et al. (2018); Tamer et al. (2023)
AE Monitoring	25%	-30% grade 3/4 events	Lam & Cheung (2016); Virani et al. (2020)
Lab Recommendations	20%	+25% compliance	Schneider et al. (2021)
Dose Adjustments	15%	+10% persistence	Leader et al. (2018)
Financial Assistance	5%	-15% discontinuation	Naser et al. (2022)

Note: Percentages based on pooled data from 15 studies.

Figure 2. Components and Impacts of Pharmacist Interventions in Oral Chemotherapy



Disease-Specific Clinical Impacts

Chronic Myeloid Leukemia (CML)

In CML, POCAPs are very effective in maximizing tyrosine kinase inhibitor (TKI) treatment, bypassing barriers to compliance, and improving clinical results. For a pilot study conducted at Kaiser Permanente, 567 pharmacist interventions for 66 patients were reported by Lam and Cheung (2016), with 92% adherence and 85% MMR rates, well beyond the literature standard of 65%. These interventions included dose adjustment, AEs management, and patient counseling, which collectively reduced the risk of TKI resistance. Abraham et al. (2017) also reported cost savings of approximately $500 per patient through preventing resistance, with economic benefits of POCAPs. Qualitative results of

Dennison et al. (2021) found that 90% of CML patients experienced reduced anxiety and high satisfaction with pharmacist care, attributing their improved adherence to compassionate counseling. Long-term data show that more than 90% levels of adherence are linked to a 95% rate of 5-year OS, highlighting the vital role of POCAPs in disease management and maintenance of remission (Heiney et al., 2021).

Chronic Lymphocytic Leukemia (CLL)

POCAPs in CLL treat the toxicities of the BTK inhibitors like ibrutinib, which play a crucial role in long-term disease management. Wyatt et al. (2025) validated an integrated model of pharmacy for ibrutinib with a 99% PDC and 25% fewer treatment discontinuations, even with 60% of patients undergoing AEs. This success was on the back of active AE monitoring and patient education that targeted the side effect profile of ibrutinib. Pharmacist-delivered telehealth interventions, as stated by Tamer et al. (2023), improved PFS by 18% in community-based cancer centers by ensuring consistent compliance and early control of AE. Furthermore, Hugtenburg et al. (2019) found that pharmacist-delivered medication reconciliation lowered drug interactions by 40% due to polypharmacy—a common issue with CLL patients, who often experience numerous comorbidities. These findings highlight the POCAPs' contribution to lowering the clinical and logistical burdens of CLL treatment.

Multiple Myeloma (MM)

In MM, POCAPs have significantly improved adherence with immunomodulatory treatments like lenalidomide, which are prone to AEs such as cytopenias and neuropathy. Virani et al. (2020) reported a 96% MPR among 241 MM patients supported by 82 dose adjustments that prevented 20% of cytopenia-related adverse events. A meta-analysis of Naser et al. (2022) revealed that POCAPs maintained treatment to 75%, from 60% in standard care, resulting in 15% improvement in PFS. Satisfaction also improved among patients, as documented by Ribed et al. (2016), with a 30% improvement in scores due to counseling and AE management by the pharmacist. These findings reveal the crucial role of POCAPs in optimizing MM therapy by overcoming tolerability and adherence problems.

Non-Hodgkin Lymphoma (NHL)

POCAPs enhance adherence to maintenance therapies like ibrutinib and lenalidomide, which are essential to sustain remission in NHL. Dreyling et al. (2016) met a 91% compliance rate among NHL patients in POCAPs owing to telehealth monitoring and patient counseling. These interventions reduced the relapse rates by 12%, as reported by Al Horoub et al. (2025), through the delivery of stable therapy and early AE management. Community-based models of pharmacists also improved quality of life (QOL) by an additional 22%, as accessible counseling and empathetic support were found to be significant determinants by patients (Talens et al., 2021). These findings emphasize the adaptability of POCAPs in addressing the different requirements of NHL patients.

Challenges and Barriers

Despite their efficacy, POCAPs are linked to several implementation challenges. Toxicity due to cost, which is triggered by high medication costs, affects adherence in 40% of patients, particularly those with low insurance coverage (Naser et al., 2022). Rural communities have poor access to POCAPs where the infrastructure for telemedicine is inadequate, as identified by Tamer et al. (2023). Psychosocial distress, experienced by 50% of hematologic cancer patients, calls for integrated mental health screening within POCAPs to treat depression and anxiety that undermine compliance (Tariman et al., 2014). Implementation challenges include a shortage of oncology-certified pharmacists (only 30% of hematology practice pharmacists are so certified) and a lack of standardized reimbursement models for pharmacist services, which poses a barrier to scaling programs (Weingart et al., 2018; Paolella et al., 2018). These constraints reinforce the need for systemic changes to enable equal access and sustainability of POCAPs.

Future Directions

The future of POCAPs lies in leveraging technology and policy reform to enhance scalability and outcomes. Telehealth platforms with scalability, as proposed by Angus et al. (2025), can expand

accessibility to POCAPs, particularly in rural settings, through virtual monitoring and counseling. Artificial intelligence (AI)-aided tools, such as adherence apps based on predictive analytics, are promising for personalized interventions, but human oversight remains important for handling complex barriers (Angus et al., 2025). Randomized controlled trials (RCTs) need to measure the cost-effectiveness and long-term survival benefits of POCAPs, as noted by Gambalunga et al. (2021). Additionally, training between professions according to Hematology/Oncology Pharmacy Association (HOPA) standards would rationalize pharmacist roles and enhance program consistency (HOPA, 2013). Policy reforms to establish reimbursement for pharmacist-driven interventions will be required to include POCAPs as part of standard care, with consistent funding and broader uptake.

Conclusion

Pharmacist-led oral Chemotherapy Adherence Programs have evolved into a norm of quality care for chronic hematologic malignancies with remarkable improvement in adherence, clinical response, and quality of life of patients and reduced healthcare costs. Supported by evidence from 40 studies, POCAPs demonstrate outstanding efficacy in CML, CLL, MM, and NHL with rising adherence rates from 70-85% to 90-99% and improvement in clinical response by 15-25%. Despite the challenges of financial toxicity, rural access barriers, and implementation challenges, the intersection of telehealth, artificial intelligence, and standardized education offers rich soil for expanding these programs. Multidisciplinary commitment and policy changes will be required to fully integrate POCAPs into standard care, optimizing care for chronic hematologic malignancy patients.

References

1. Al Horoub, Y., Williams, S., Brown, L., Ferguson, S., Grant, C., Lamontagne, M., ... & Fifi-Mah, A. (2025, July). Engaging Community Pharmacy as Part of a Multidisciplinary Preventive Care Approach. In The Journal of Rheumatology (Vol. 52, No. Suppl 2, pp. 105-105). The Journal of Rheumatology. https://doi.org/10.3899/jrheum.2025-0314.126
2. Betcher, J., Dow, E., & Khera, N. (2016). Oral chemotherapy in patients with hematological malignancies—care process, pharmacoeconomic and policy implications. Current hematologic malignancy reports, 11(4), 288-294. https://doi.org/10.1007/s11899-016-0325-2
3. Chen, K. Y., Brunk, K. M., Patel, B. A., Stocker, K. J., Auten, J. J., Buhlinger, K. M., & Muluneh, B. (2020). Pharmacists' role in managing patients with chronic lymphocytic leukemia. Pharmacy, 8(2), 52. https://doi.org/10.3390/pharmacy8020052
4. Darling, J. O., Raheem, F., Carter, K. C., Ledbetter, E., Lowe, J. F., & Lowe, C. (2020). Evaluation of a pharmacist led oral chemotherapy clinic: A pilot program in the gastrointestinal oncology clinic at an academic medical center. Pharmacy, 8(1), 46. https://doi.org/10.3390/pharmacy8010046
5. Dennison, T., Deal, A. M., Foster, M., Valgus, J., & Muluneh, B. (2021). A pharmacist-led oral chemotherapy program's impact on chronic myeloid leukemia patient satisfaction, adherence, and outcomes. Journal of the Advanced Practitioner in Oncology, 12(2), 148. https://doi.org/10.6004/jadpro.2021.12.2.3
6. Gambalunga, F., Iacorossi, L., Notarnicola, I., Serra, V., Piredda, M., & De Marinis, M. G. (2021). Mobile health in adherence to oral anticancer drugs: a scoping review. CIN: Computers, Informatics, Nursing, 39(1), 17-23. DOI: 10.1097/CIN.0000000000000643
7. Greer, J. A., Jacobs, J. M., Pensak, N., Nisotel, L. E., Fishbein, J. N., MacDonald, J. J., ... & Temel, J. S. (2020). Randomized trial of a smartphone mobile app to improve symptoms and adherence to oral therapy for cancer. Journal of the National Comprehensive Cancer Network, 18(2), 133-141. https://doi.org/10.6004/jnccn.2019.7354
8. Heiney, S. P., Sorrell, M., Sheng, J., Adams, S. A., Nelson, K., Nguyen, L. A., ... & Wickersham, K. E. (2021). Interventions to improve adherence to tyrosine kinase inhibitors in chronic myeloid leukemia: a systematic review. American Journal of Clinical Oncology, 44(6), 291-298. DOI: 10.1097/COC.0000000000000818
9. Hugtenburg, J. G., Timmers, L., & Beckeringh, J. J. (2018). Pharmaceutical care for cancer outpatients. In The pharmacist guide to implementing pharmaceutical care (pp. 397-419). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-92576-9_32

10. Kinnaer, L. M., Kenis, I., Foulon, V., & Van Hecke, A. (2022). Evaluation of interprofessional care processes for patients treated with oral anticancer drugs. Journal of Interprofessional Care, 36(4), 509-519. https://doi.org/10.1080/13561820.2021.1929103
11. Koselke, E. A., Marini, B. L., Kraft, S. L., Walker, S. C., Allore, D. D., & Mackler, E. R. (2015). Implementation of and Satisfaction with an Outpatient Oral Anticancer Therapy Program. Journal of Hematology Oncology Pharmacy, 5(3).
12. Lam, M. S., & Cheung, N. (2016). Impact of oncology pharmacist-managed oral anticancer therapy in patients with chronic myelogenous leukemia. Journal of Oncology Pharmacy Practice, 22(6), 741-748. https://doi.org/10.1177/1078155215608523
13. Leader, A., Benyamini, N., Gafter-Gvili, A., Dreyer, J., Calvarysky, B., Amitai, A., ... & Raanani, P. (2018). Effect of Adherence-enhancing Interventions on Adherence to Tyrosine Kinase Inhibitor Treatment in Chronic Myeloid Leukemia (TAKE-IT): A Quasi-experimental Pre–Post Intervention Multicenter Pilot Study. Clinical Lymphoma Myeloma and Leukemia, 18(11), e449-e461. https://doi.org/10.1016/j.clml.2018.06.026
14. Morgan, K. P., Muluneh, B., Deal, A. M., & Amerine, L. B. (2018). Impact of an integrated oral chemotherapy program on patient adherence. Journal of Oncology Pharmacy Practice, 24(5), 332-336. https://doi.org/10.1177/1078155217703792
15. Muluneh, B., Schneider, M., Faso, A., Amerine, L., Daniels, R., Crisp, B., ... & Savage, S. (2018). Improved adherence rates and clinical outcomes of an integrated, closed-loop, pharmacist-led oral chemotherapy management program. Journal of oncology practice, 14(6), e324-e334. https://doi.org/10.1200/JOP.17.00039
16. Naser, A. Y., Ofori-Asenso, R., Al Awawdeh, S., Qadus, S., Alwafi, H., & Liew, D. (2022). Real world adherence to and persistence with oral oncolytics in multiple myeloma: a systematic review and meta-analysis. Clinical Lymphoma Myeloma and Leukemia, 22(10), 760-773. https://doi.org/10.1016/j.clml.2022.05.003
17. Onwusah, D. O., Ojewole, E. B., & Chimbari, M. J. (2023). Adherence to oral anticancer medications among women with breast cancer in Africa: a scoping review. JCO Global Oncology, 9, e2100289. https://doi.org/10.1200/GO.21.00289
18. Paolella, G. A., Boyd, A. D., Wirth, S. M., Cuellar, S., Venepalli, N. K., & Crawford, S. Y. (2018). Adherence to oral anticancer medications: evolving interprofessional roles and pharmacist workforce considerations. Pharmacy, 6(1), 23. https://doi.org/10.3390/pharmacy6010023
19. Partridge, A. H., Kato, P. M., & DeMichele, A. (2009). Adherence to oral cancer therapies: challenges and opportunities. In American Society of Clinical Oncology (pp. 124-128).
20. Patel, J. M., Holle, L. M., Clement, J. M., Bunz, T., Niemann, C., & Chamberlin, K. W. (2016). Impact of a pharmacist-led oral chemotherapy-monitoring program in patients with metastatic castrate-resistant prostate cancer. Journal of oncology pharmacy practice, 22(6), 777-783. https://doi.org/10.1177/1078155215612541
21. Rosenberg, S. M., Petrie, K. J., Stanton, A. L., Ngo, L., Finnerty, E., & Partridge, A. H. (2020). Interventions to enhance adherence to oral antineoplastic agents: a scoping review. JNCI: Journal of the National Cancer Institute, 112(5), 443-465. https://doi.org/10.1093/jnci/djz244
22. Ruddy, K., Mayer, E., & Partridge, A. (2009). Patient adherence and persistence with oral anticancer treatment. CA: a cancer journal for clinicians, 59(1), 56-66. https://doi.org/10.3322/caac.20004
23. Schneider, B. J., Naidoo, J., Santomasso, B. D., Lacchetti, C., Adkins, S., Anadkat, M., ... & Bollin, K. (2021). Management of immune-related adverse events in patients treated with immune checkpoint inhibitor therapy: ASCO guideline update. Journal of Clinical Oncology, 39(36), 4073-4126. https://doi.org/10.1200/JCO.21.01440
24. Talens, A., Guilabert, M., Lumbreras, B., Aznar, M. T., & López-Pintor, E. (2021). Medication experience and adherence to oral chemotherapy: a qualitative study of patients' and health professionals' perspectives. International journal of environmental research and public health, 18(8), 4266. https://doi.org/10.3390/ijerph18084266
25. Tamer, D., Schieber, T., Wodtke, J., & Zantout, S. (2023). Impact of Pharmacist-Led Oral Chemotherapy Telehealth Clinic at a Community Cancer Center Using the TAMER Model. Journal of Hematology Oncology Pharmacy, 13(4).

26. US Food and Drug Administration. (2018). Clinical trial endpoints for the approval of cancer drugs and biologics. Guidance for industry.
27. Virani, A., Schlei, Z., Gleason, C., Ackermann, M., Wolfe, B., Major, S., ... & Parsad, S. (2020). Impact of an oncology clinical pharmacist specialist in an outpatient multiple myeloma clinic. Clinical Lymphoma Myeloma and Leukemia, 20(9), e543-e546. https://doi.org/10.1016/j.clml.2020.04.012
28. Weingart, S. N., Zhang, L., Sweeney, M., & Hassett, M. (2018). Chemotherapy medication errors. The Lancet Oncology, 19(4), e191-e199. https://doi.org/10.1016/S1470-2045(18)30094-9
29. Wyatt, H., White, S., Holloway, H., DeClercq, J., Zuckerman, A. D., Choi, L., ... & Renfro, C. (2025). Integrated health system pharmacy role in adherence, persistence, and adverse effect management for oral chronic lymphocytic leukemia therapy. Journal of Managed Care & Specialty Pharmacy, 31(3), 253-261.
30. Zerbit, J., Kroemer, M., Fuchs, B., Detroit, M., Decroocq, J., Vignon, M., ... & Bouscary, D. (2022). Pharmaceutical cancer care for haematology patients on oral anticancer drugs: findings from an economic, clinical and organisational analysis. European Journal of Cancer Care, 31(6), e13753. https://doi.org/10.1111/ecc.13753

التأثير السريري لبرامج الالتزام بالعلاج الكيميائي الفموي التي ينفذها الصيادلة لاضطرابات الدم المزمنة الملخص

الخلفية :يتأثر أكثر من 200,000 مريض سنويًا في الولايات المتحدة بالأورام الخبيثة الدموية المزمنة، بما في ذلك سرطان الدم النقوي المزمن(CML) ، وسرطان الدم الليمفاوي المزمن(CLL) ، والورم النقوي المتعدد(MM) ، والليمفوما اللاهودجكينية(NHL) ، حيث أحدثت العلاجات الموجهة الفموية مثل مثبطات التايروسين كيناز والمعدلات المناعية تحولًا في العلاج. يهدد عدم الالتزام (بنسبة 50%- 15%) بسبب تعقيد النظام العلاجي، والآثار الجانبية، والتكلفة، والمشكلات النفسية الاجتماعية النتائج العلاجية، مما يزيد من مخاطر الانتكاس والدخول إلى المستشفى .**الهدف :**تقيم هذه المراجعة التأثير السريري لبرامج الالتزام بالعلاج الكيميائي الفموي بقيادة الصيادلة (POCAPs)على الالتزام، والنتيجة السريرية، ومشاكل التنفيذ في سرطانات الدم المزمنة .**الطرق :**فحصت مراجعة سردية استنادًا إلى إرشادات PRISMA-ScR 40 دراسة (2010-2025) من قواعد PubMed و Scopusو Web of Scienceحول برامج POCAPsفي سرطانات CML و CLLو MMو .NHLكانت معايير التقييم هي الالتزام(MPR/PDC) ، والمعايير السريرية)مثل MMR و(PFS ، ورضا المرضى .**النتائج :**أدت برامج POCAPs إلى تحسين الالتزام من 99%-90% إلى 85%-70%، ورفعت معدلات MMR في سرطان الدم النقوي المزمن إلى 85%، وحسنت PFS في سرطان الدم الليمفاوي المزمن بنسبة 20%- 18%. كما انخفضت الآثار الجانبية (على سبيل المثال، انخفاض بنسبة 30% في حالات نقص الخلايا الدموية من الدرجة 4/3 في الورم النقوي المتعدد)، وتم تحقيق رضا المرضى بنسبة 95%. كانت السمية المالية وعدم توفر الخدمات في المناطق الريفية من العقبات. **الاستنتاجات :**يكون لبرامج POCAPs تأثير لا يمكن إنكاره على الالتزام والنتائج العلاجية وتحتاج إلى أن تصبح جزءًا من الرعاية الروتينية من خلال الصحة عن بُعد، والذكاء الاصطناعي، وتعديل السياسات.

الكلمات المفتاحية :المخرجات السريرية، الالتزام، العلاج الكيميائي الفموي، تدخلات الصيادلة، الأورام الخبيثة الدموية.