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Improving Clinical Pharmacist Performance in Oncology Care Through Education on Pharmaceutical Care Plans Documentation: A Pre-post Interventional Study

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Abstract

Clinical pharmacists are vital in oncology care as they are involved in optimizing pharmaceutical care plans (PCPs). Their involvement in medication management and accurate documentation assists in the care of cancer patients. This study aims to evaluate the impact of a targeted educational intervention for clinical pharmacists on both the quantity and quality of PCP documentation, providing insights into optimizing pharmaceutical care within an oncology setting. A descriptive pre-post study was done at Shaukat Khanum Memorial Cancer Hospital & Research Centre, Lahore. Data on admitted patients' PCPs from November 2023 to March 2024 were collected from the Hospital Information System. PCP documentation was evaluated following the educational intervention on clinical pharmacy staff, and the improvement in the documentation among the specialties section was analyzed using a one-tailed *t*-test. The study assessed a total of 120 patients during the pre-intervention phase and 382 patients post-intervention. In the pre-intervention phase, the mean ± SD age of patients was 36.1 ± 20.1 years, with males constituting 57.5% and females 42.5%. Post-intervention, the mean ± SD age slightly increased to 37.3 ± 20.7 years, with a similar gender distribution of 58.9% males and 41.1% females. The intervention significantly increased the number of PCPs from 130 in the pre-intervention phase to 516 in the post-intervention phase, particularly in Adult Oncology ($P = .0115$) and Palliative Care ($P = .0095$). Post-intervention, a substantial enhancement in the documentation and management of PCPs was observed. The study demonstrates that structured educational interventions significantly enhance the clinical pharmacists' documentation of PCPs. By integrating targeted training with continuous reinforcement strategies, healthcare institutions can optimize pharmaceutical care processes, improve interdisciplinary collaboration, and ultimately enhance patient safety in oncology settings.

Keywords

clinical pharmacist, patient safety, cancer care facilities, medication therapy management, pharmaceutical services, documentation, hospital information systems

Highlights

- This descriptive pre-post quality improvement study assessed the impact of an educational intervention on pharmaceutical care plan (PCP) documentation by clinical pharmacy staff.
- A total of 120 patients were reviewed during the pre-intervention phase and 382 during the post-intervention phase.
- The intervention significantly increased documented PCPs from 130 pre-intervention to 516 post-intervention, with significant gains observed in the Adult Oncology and Palliative Care settings.
- Structured educational interventions, combined with reinforcement strategies, significantly improve PCP documentation by clinical pharmacists, supporting optimized pharmaceutical care processes, strengthened interdisciplinary collaboration, and enhanced patient safety in oncology settings.

Introduction

Clinical pharmacists are critical in oncology care settings, contributing to a team-based approach to enhance patient outcomes.[1] Their specialized training enables them to design, implement, monitor, and modify pharmacotherapeutic plans for individuals with cancer.[2,3] These pharmacists have demonstrated their value in improving clinical care, optimizing medication therapy management (MTM), managing supportive care, reducing medication errors, overseeing laboratory monitoring, and increasing documentation in electronic medical records.[4-11] Effective MTM requires comprehensive documentation, particularly in recording medication reviews and pharmaceutical care plans (PCPs).[12] The Pharmacists' Patient Care Process is a structured approach that involves 5 key steps: collecting patient information, assessing drug-related issues, developing a care plan, implementing interventions, and conducting follow-ups.[13] At the core of this process is the identification and resolution of drug therapy problems (DTPs), followed by the continuous evaluation and refinement of the care plan. A well-structured care plan includes essential components such as the patient's current medication regimen, identified DTPs, therapeutic goals, monitoring parameters, and follow-up strategies.[14]

Accurate and systematic documentation is crucial in pharmaceutical care, as it justifies pharmacists' clinical interventions to both patients and healthcare stakeholders.[15] Various methods have been proposed for documenting pharmaceutical care, with one widely formatted method being the SOAP (Subjective, Objective, Assessment, and Plan) notes, commonly used by physicians.[2] Similarly, the Patient Medication Profile in Scotland provides a comprehensive overview of a patient's medical history, admission reasons, laboratory results and PCPs.[6] Another approach, the Pharmacist's Workup of Drug Therapy, guides pharmacists in addressing pharmacotherapy issues using structured progress notes such as CORE (Condition, Outcomes, Regimen, and Evaluation) and FARM (Findings, Assessment, Regimen, and Monitoring).[12]

Despite the well-established role of clinical pharmacists in various healthcare settings, limited research has explored the impact of pharmacist-developed care plans in resolving DTPs among oncology patients. This pre-post descriptive study assesses how the educational intervention of clinical pharmacists influences the documentation of PCPs for admitted patients. As part of a longitudinal learning experience within the International Pharmacy Practice Residency Program, this study was designed as a quality improvement initiative to enhance existing clinical pharmacy practices. While the primary focus is on increasing the number of PCPs documented, the study also considers quality improvement a key area for future advancements. Furthermore, this study evaluates the impact of a targeted educational intervention for clinical pharmacists on both the quantity and quality of PCP documentation, providing insights into optimizing pharmaceutical care within an oncology setting.

Methods

Study Design

This study employed a descriptive pre-post design as part of a performance improvement project to enhance patient care through improved documentation of pharmacist-developed care plans. The initiative was driven by the need to standardize PCP documentation, ensure more structured monitoring of DTP, enhance continuity of care, and improve interdisciplinary communication.

Before the intervention, there was inconsistent PCP documentation, with variations in quality, completeness, and adherence to documentation standards. This study aimed to increase the number of structured PCPs, ultimately facilitating better MTM, reducing medication errors, and improving patient outcomes.

Setting and Participants

The research was conducted at Shaukat Khanum Memorial Cancer Hospital & Research Centre, Lahore, Pakistan. The pre-intervention phase spanned November 2023 to February 2024, and the post-intervention phase took place from March to June 2024. The study included all oncology patients admitted to inpatient services who required drug therapy

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monitoring and follow-up plans. The analysis did not include patients receiving treatment in the emergency assessment room or outpatient clinics.

Intervention

In February 2024, the clinical pharmacy team expanded from 9 to 14 dedicated pharmacists. Before the intervention, PCPs were primarily documented by 8 to 9 pharmacists, with some staff members rotating through different pharmacy services, such as ambulatory care and aseptic areas. Following the intervention, additional pharmacists, including new hires and those reassigned from rotational roles, were trained to contribute to PCP documentation actively.

To enhance their effectiveness, the clinical pharmacy staff received training on key performance indicators and the specific requirements of PCPs. This training was based on guidelines from the American Society of Health-System Pharmacists (ASHP), in-hospital policies, and their impact on optimizing patient medication therapy.[16] Pharmacists were educated on the eligibility criteria for PCPs, which included monitoring critically ill patients, those with abnormal laboratory values, and individuals requiring continuity of care. Emphasis was placed on the importance of regularly reviewing and updating PCPs to align with patients' evolving healthcare needs.

The PCPs were structured following the SOAP note format. They began with the patient's primary diagnosis and current chemotherapy protocol, followed by details on the specific reason for hospital admission. For example, if a patient undergoing chemotherapy developed febrile neutropenia, sepsis, or an allergic reaction, pharmacists would focus on key monitoring aspects such as drug-drug interactions, hepatic or renal dose adjustments, drug-disease interactions, and therapeutic drug monitoring for medications with a narrow therapeutic index. Additionally, chemotherapy dose reductions based on blood counts or abnormal parameters were considered.

These pharmacist recommendations were tailored to each patient's condition and specialty requirements. They communicated with physicians either through system-based intervention documentation or direct verbal discussions to ensure optimal patient care.

PCPs were reviewed weekly to track their number, while daily reminders were sent via WhatsApp and communicated in-person to ensure their impact on patient medication optimization. Education sessions were conducted in a classroom setting every week, with each session lasting 15 minutes. Additionally, a clinical pharmacy resident sent daily WhatsApp messages to remind the team to document PCPs for patients within their specialty who required them.

Data Collection

Data was extracted from the Hospital Information System (HIS) to assess the impact of the intervention. The collected data included patient demographics, the number of PCPs documented relative to total inpatient admissions, as well as the distribution of PCPs across different specialties. Additionally, information on the pharmacists responsible for PCP documentation was recorded while ensuring patient confidentiality.

Statistical Analysis

Statistical analysis was performed using Microsoft Excel (Version, Office 365). A one-tailed *t*-test was used to compare the number of specialty-wise PCPs documented before and after the intervention. To assess the overall change in PCP coverage, a one-tailed *t*-test was applied to compare PCP-to-patient and PCP-to-admission ratios between the pre- and post-intervention phases. These tests evaluated whether the rate of care plans per patient and per admission improved significantly following the intervention, among specialty-wise comparisons and overall comparisons. A *P*-value of less than .05 was considered statistically significant.

Ethical Consideration

The study was submitted for review to the hospital's Institutional Review Board (IRB) and was classified as a quality improvement project. As a result, the project was conducted with the approval of the head of the department.

Results

In the pre-intervention phase, a total of 120 patients were included, with a mean (SD) age of patients of 36.12 (20.1), where the majority of participants were male (57.5%). In the post-intervention phase, the number of patients increased to 382, with a mean (SD) age of 37.32 (20.7), and male participants comprised 58.9% (Table 1).

The marital status distribution remained largely consistent pre- and post-intervention, with the majority of patients reported as married (62.5% vs 67.8%). A notable proportion of patients were minors in both periods (18.3% pre vs 18.0% post), and the proportion of unmarried/single individuals showed a slight decrease post-intervention (15.8% to 12.8%). Income data revealed that over half of the patients in both periods were financially dependent (55.8% pre vs 59.5% post), with only a small fraction classified as high or low income. Moderate income representation slightly increased post-intervention (10.8%-13.1%), while the proportion of unknown income entries remained substantial. Similarly, profession data showed high proportions of incomplete data entry, which was classified as unknown entries (84.2% pre vs 78.5% post), limiting interpretability. This was primarily due to a single-entry slot under "Profession/Income" within the patients' notes in HIS. Among the known entries, homemakers and employed individuals comprised the most frequently reported categories, with marginal increases across all professional groups post-intervention, as shown in Table 1.

Table 1. Patient Demographics & Socio-economic Background.

Demographic	Pre-intervention (N = 120)	Post-intervention (N = 382)
Age (years) – mean (SD)	36.1 (20.1)	37.3 (20.7)
Gender		
Sex (male) – n (%)	69 (57.5)	225 (58.9)
Sex (female) – n (%)	51 (42.5)	157 (41.1)
Marital status – n (%)		
Married	75 (62.5)	259 (67.8)
Minor	22 (18.3)	69 (18.0)
Unmarried/single	19 (15.8)	49 (12.8)
Widowed	2 (1.7)	1 (0.3)
Divorced	-	1 (0.3)
Unknown	2 (1.7)	3(0.8)
Income – n (%)		
High	1 (0.8)	4 (1.0)
Moderate	13 (10.8)	50 (13.1)
Low	5 (4.2)	2 (0.5)
Dependent	67 (55.8)	227 (59.5)
Unknown	34 (28.4)	99 (25.9)
Profession – n (%)		
Homemaker	8 (6.7)	24 (6.3)
Unemployed	2 (1.7)	16 (4.2)
Student	1 (0.8)	4 (1.0)
Retired	-	3 (0.8)
Self-employed	1 (0.8)	15 (4.0)
Employed	7 (5.8)	20 (5.2)
Unknown	101 (84.2)	300 (78.5)

Note. Marital status, income, and profession data were cleaned and standardized for consistency. Similar free-text responses (eg, "Single," "Unmarried") were grouped (eg, as "Single/Unmarried"), and unclear or missing entries were categorized as "Unknown." Age-related terms (eg, "Child," "Juvenile") were labeled "Minor." Profession entries were manually reviewed and standardized into categories: Homemaker, Unemployed, Student, Retired, Self-Employed, Employed, and Unknown, based on the functional nature of physician responses in patient notes within HIS.

Table 2. Total PCPs Pre- and Post-Intervention.

Phase	Total patients	Total PCPs	PCP/patient ratio
Pre-Intervention	120	130	1:1.08
Post-Intervention	382	516	1:1.35

Pharmaceutical Care Plans (PCPs) and Admissions

In the pre-intervention phase, 130 care plans were documented for 120 patients (PCP/patient ratio = 1.08), while in the post-intervention phase, this increased to 516 care plans for 382 patients (PCP/patient ratio = 1.35), $P = .06$ (Table 2).

Before the intervention, 6475 admissions resulted in 130 PCPs (1 PCP per 50 admissions), while after the intervention, 6681 admissions resulted in 516 PCPs (1 PCP per 13 admissions), $P = .09$ (Table 3).

Table 3. PCPs per Total Admissions.

Phase	Total admissions	Total PCPs	PCP/admissions ratio
Pre-Intervention	6475	130	1:50
Post-Intervention	6681	516	1:13

Monthly Trend in PCPs

A month-wise analysis showed a marked increase in PCP documentation (Figure 1). In the pre-intervention phase, the mean number of PCPs per month was 32.5 (SD: 14.3), while in the post-intervention phase, it rose to 129.3 (SD: 29.8), reflecting a fourfold increase (Table 4).

The trend of PCPs was analyzed across various specialties in the pre- and post-intervention phase, and the results have revealed an increase in the number of PCPs. Adult Oncology has demonstrated the most significant increase, with the number of care plans rising from 8 in the pre-intervention phase to 109 in the post-intervention phase. In contrast, Infectious disease care plans have shown a moderate rise during this period. Other specialties, such as Critical care, Internal medicine, and Palliative care, have also demonstrated a considerable increase in care plans from 16 to 86, 29 to 81, and 14 to 58, respectively, as shown in Table 5 and Figure 2.

Specialty-Wise PCPs

There are 7 specialties for clinical rounds that clinical pharmacists are part of. As mentioned in specialty -wise analysis, a pharmacist was assigned for individual clinical rounds based on their specialty, task list, shift distribution, and operational workload with clinical pharmacy. The statistical comparison of specialty-wise care plans before and after pharmacist education intervention shows significant improvement across various specialties (Table 5). The number of PCPs increased significantly across all specialties following the intervention. The most significant improvement was seen in Adult Oncology (Figure 2), with PCPs increasing from 8 to 109 ($P = .0115$). Palliative Care (PC) also saw a notable rise (14-58, $P = .0095$). While Infectious Diseases (ID) and Pediatric Oncology (PO) showed significant increases, the changes in Critical Care (CC) and Surgical Services (SS) were not statistically significant (Table 5).

Pharmacists were assigned to different specialties based on task lists, shift distributions, and operational workload, ensuring that clinical pharmacists were integrated into multidisciplinary teams. The intervention led to an overall improvement in PCP documentation across all specialties, particularly in Adult Oncology and Palliative Care.

Discussion

The primary objective of this study was to evaluate the impact of a structured educational intervention on clinical

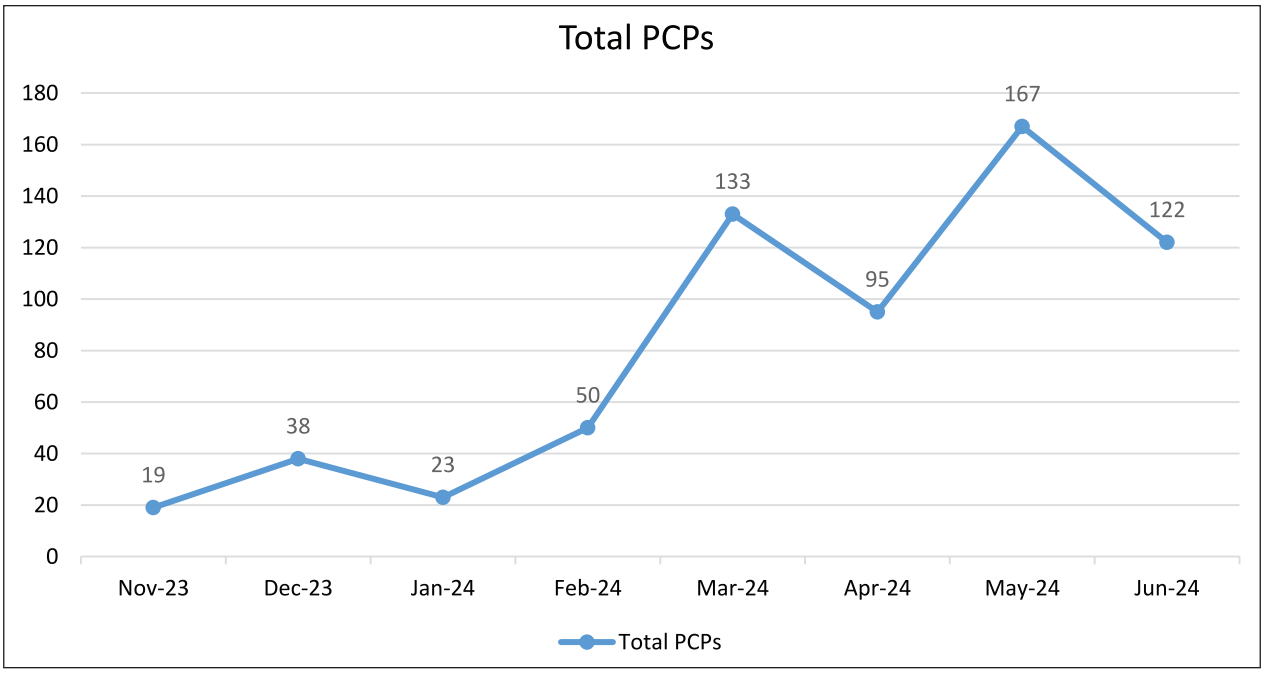

Figure 1. Graphical representation of PCPs trend.

Table 4. Month-Wise PCPs Pre- and Post-Intervention.

Pre-intervention	No. of PCPs	Post-intervention	No. of PCPs
November	19	March	133
December	38	April	95
January	23	May	167
February	50	June	122
Mean (SD)	32.5 (14.3)	Mean (SD)	129.3 (29.8)

pharmacists' documentation of PCPs within an oncology setting. The findings indicate a significant increase in the number of documented PCPs following the intervention, highlighting the effectiveness of targeted education in enhancing pharmacist engagement and adherence to standardized documentation practices. Prior research has emphasized the role of clinical pharmacists in optimizing MTM, reducing medication errors, and improving patient safety.[9,17] This study demonstrates that structured training and consistent reinforcement strategies, such as daily reminders, can significantly enhance PCP documentation. These improvements are crucial for standardizing patient care, ensuring continuity, and facilitating interdisciplinary communication.

The results further suggest that expanding the clinical pharmacy workforce contributed to increased PCPs. While the educational intervention was the primary driver, the addition of trained pharmacists to the team likely enhanced overall documentation capacity. However, even after accounting for the increase in personnel, the substantial rise in PCPs per pharmacist indicates that education played a central role in improving documentation efficiency and adherence to care planning protocols.

The study's findings are also consistent with existing literature on the importance of performance indicators in clinical pharmacy. Losier et al[18] found that pharmacists typically spend a significant portion of their time on routine tasks, including completing PCPs, indicating a potential area for efficiency improvement through targeted education. Moreover, the COLLABORATE (Capturing Outcomes of Clinical Activities Performed by a Rounding Pharmacist Practicing in a Team Environment) study on clinical pharmacy key performance indicators highlighted the role of structured monitoring and quality improvement initiatives in enhancing pharmacy care.[19] Our study builds on this by providing concrete evidence that educational interventions can effectively increase PCPs, improving overall care quality.

Specialty-wise analysis of PCP documentation revealed that the most pronounced improvements were observed in adult oncology and palliative care. For instance, the most significant rise in care plans was noted in Adult Oncology, with numbers increasing from 8 in the pre-intervention phase to 109 post-intervention. This specialty's improvement underscores the critical role of focused education in enhancing clinical pharmacy services. This aligns with the high complexity of

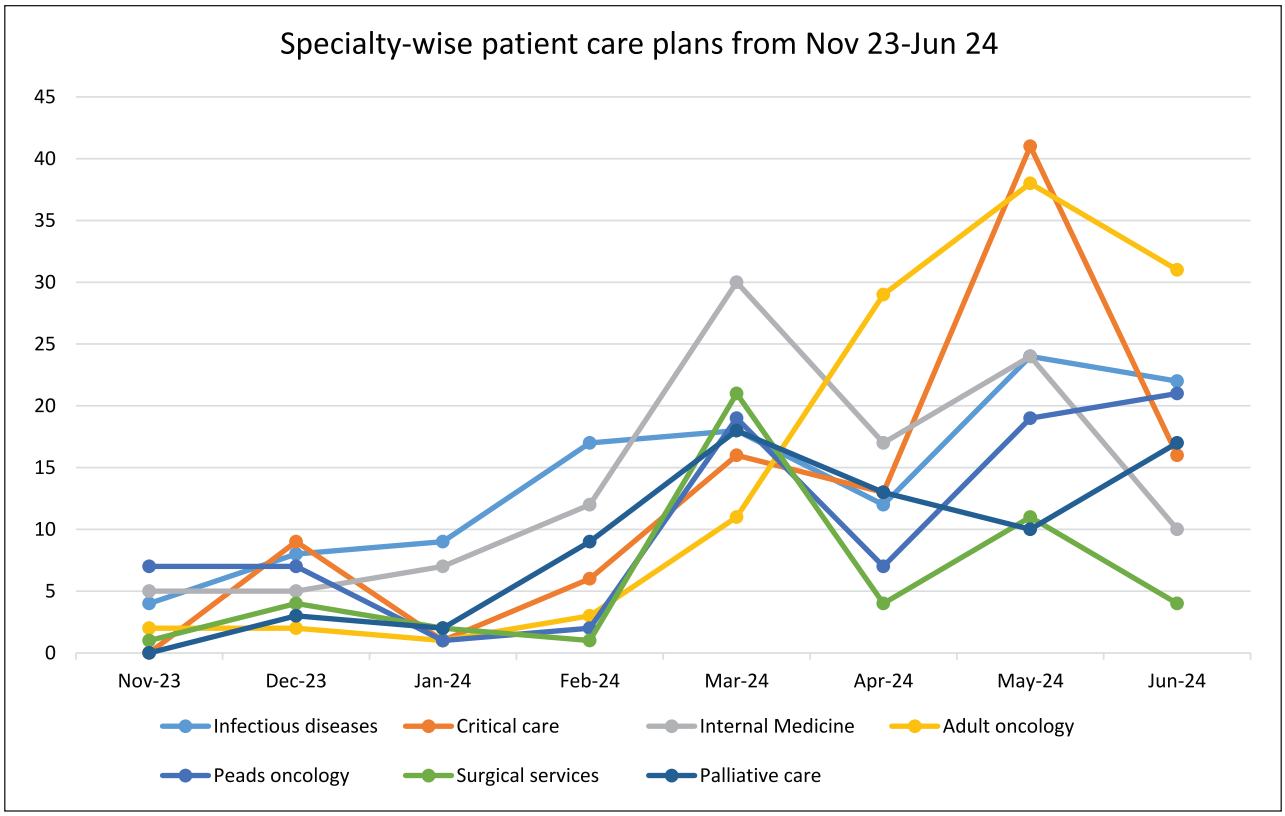

Figure 2. Graphical representation of specialty-wise PCPs trend.

Table 5. Statistical Comparison of Pre- and Post-Intervention of Specialty-wise PCPs.

Specialty	No. of PCPs (pre-intervention)	Mean	Standard deviation (SD)	No. of PCPs (post-intervention)	Mean	Standard deviation (SD)	*P*-value
ID	38	9.5	5.5	76	19	5.3	.0233*
CC	16	4	4.2	86	21.5	13.1	.0566
IM	29	7.3	3.3	81	20.3	8.7	.0529
AO	8	2	0.8	109	27.3	11.5	.0115*
PO	17	4.3	3.2	66	16.5	6.4	.0338*
SS	8	2	1.4	40	10	8.0	.0839
PC	14	3.5	3.9	58	14.5	3.7	.0095*

Note. ID = infectious diseases; CC = critical care; IM = internal medicine; AO = adult oncology; PO = pediatric oncology; SS = surgical services; PC = palliative care.
*Significant ($P < .05$).

pharmacotherapy in these specialties, where structured care planning is essential to managing adverse drug reactions, drug-drug interactions, and chemotherapy-related complications. The findings suggest that targeted pharmacist training should be further tailored to the specific challenges of each specialty to maximize the outcome. Similarly, while other specialties like Infectious Diseases and Critical Care also saw notable increases, the magnitude of change was less pronounced compared to Adult Oncology. This variation highlights the need for tailored educational strategies that address the specific needs and challenges of different specialties.

While the study focused primarily on increasing the number of PCPs, future research should explore the qualitative impact of these care plans on patient outcomes. Metrics such as reductions in medication errors, improved adherence, and enhanced patient safety could provide deeper insights into the broader benefits of pharmacist-led interventions. Additionally, further investigation is needed to evaluate the acceptance rate of pharmacist recommendations by physicians and other healthcare providers, which would help assess the real-world impact of improved PCP documentation on clinical decision-making.

Limitations

Despite its strengths, this study has some limitations. The single-center design may limit generalizability, and the

absence of direct patient outcome measures restricts the ability to draw definitive conclusions on the clinical impact of increased PCP documentation. Additionally, while the intervention successfully improved documentation rates, long-term sustainability requires ongoing reinforcement and periodic retraining to maintain consistency in PCP practices. The study also fails to establish how the characteristics (such as patient demographic information, including marital status, profession/employment, income information, etc., presented) influence the completion of PCPs. The quality of free-text data entry by physicians for patients' socioeconomic details in the HIS is poor, with high variability often leading to missing essential information.

Future Considerations

Given the limited existing literature, this study provides a valuable perspective on improving the quality of PCPs and adherence to established guidelines. Future research should focus on integrating PCPs into clinical pharmacy key performance indicators as standardized metrics and conducting more in-depth analyses of PCP quality. Tailored education for individual staff members could further enhance the effectiveness of pharmaceutical care. Further work can be done on the quantitative analysis of the effect of such quality improvement projects on decreasing the number of medication errors, adverse drug reactions, and DTPs.

Conclusion

This study demonstrates that structured educational interventions significantly enhance the clinical pharmacists' documentation of PCPs. By integrating targeted training with continuous reinforcement strategies, healthcare institutions can optimize pharmaceutical care processes, improve interdisciplinary collaboration, and ultimately enhance patient safety in oncology settings. Future research should build upon these findings by examining the direct impact of improved PCP documentation on clinical outcomes and exploring strategies for sustaining these improvements over time.

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Ethical Considerations

The hospital's Institutional Review Board (IRB) classified the project as a quality improvement initiative and did not require formal IRB review. As per institutional policy, the project was conducted with the approval of the designated departmental authority (Head of Department).

Consent to Participate

As the project did not involve direct patient interaction or the collection of identifiable data, informed consent was not required. All institutional data privacy and ethical standards were followed.

Author Contributions

TS: Conceptualization, Writing original draft, Principal investigator, Data curation, Literature review, Data analysis. AS: Conceptualization, Study Design, Writing original draft, Data curation, Supervision, Literature review, Data analysis, Manuscript Review & Editing. OAB: Conceptualization, Data analysis, Expertise in Oncology Care. SM: Conceptualization, Data analysis, Manuscript Review, Expertise in Pharmacotherapy. AU: Investigation, Data curation, Expertise in Pharmacotherapy. IR: Investigation, Data curation, Expertise in Quality Improvement Process. NP: Literature review, Literature Search, Manuscript Review & Editing, Clinical Pharmacy Expertise. SS: Literature review, Literature Search, Manuscript Review & Editing, Clinical Pharmacy Expertise. All authors reviewed and approved the final version of the manuscript.

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