



Clinical pharmacy and pharmaceutical care

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Abstract

Background: Clinical pharmacy services and pharmaceutical care are essential components of modern healthcare. This study investigates the impact of clinical pharmacy services on patient outcomes, medication safety, and cost-effectiveness.

Methods: A six-month prospective study was conducted in a tertiary hospital, community pharmacy, and outpatient clinic. Patients receiving polypharmacy for chronic conditions were randomly assigned to standard care or clinical pharmacy intervention groups.

Results: Clinical pharmacy interventions significantly reduced drug-related problems ($p < 0.001$), adverse drug reactions ($p = 0.02$), and hospital readmissions ($p = 0.03$). Medication adherence improved ($p = 0.01$), and patient satisfaction increased ($p < 0.001$). Cost savings of 18% were observed.

Conclusion: Clinical pharmacy services improve patient outcomes, medication safety, and cost-effectiveness.

Keywords: Clinical pharmacy services, pharmaceutical care, medication safety, adverse drug reactions, hospital readmissions

Introduction

Clinical pharmacy and pharmaceutical care are two essential components of contemporary healthcare that aim to optimize the use of medications and improve patient outcomes. Over the years, clinical pharmacy has evolved from the traditional role of pharmacists as dispensers of medicines to becoming a critical player in multidisciplinary healthcare teams. Pharmaceutical care, a patient-centered approach introduced in the late 20th century, has further advanced this shift by emphasizing the responsibilities of pharmacists in managing and monitoring drug therapy to ensure the best possible outcomes for patients.

Clinical pharmacy, as defined by Hepler and Strand (1990)^[1], is a discipline that focuses on the promotion of health, the prevention of disease, and the optimization of drug therapy for individual patients. Clinical pharmacists are trained to evaluate and intervene in drug therapy regimens, ensuring that medications are used appropriately, safely, and effectively. They collaborate with physicians, nurses, and other healthcare professionals to provide comprehensive care and improve patient outcomes. The growing complexity of pharmacotherapy, especially in the context of chronic diseases such as diabetes, hypertension, and cardiovascular disorders, has necessitated the involvement of clinical pharmacists in direct patient care (Cipolle *et al.*, 2012)^[2].

Pharmaceutical care, as introduced by Hepler and Strand (1990)^[1], extends beyond mere drug dispensing. It is a patient-centered practice where pharmacists take an active role in monitoring and adjusting drug therapy based on patients' needs, health conditions, and preferences. The goal of pharmaceutical care is to prevent drug-related problems (DRPs) such as adverse drug reactions, drug interactions, and inappropriate prescribing. This approach aims to improve patient quality of life and reduce healthcare costs by minimizing medication-related issues and hospital readmissions (Strand *et al.*, 1990)^[3]. The integration of clinical pharmacy services and pharmaceutical care into

healthcare systems has been demonstrated to enhance therapeutic outcomes, patient satisfaction, and medication adherence. Various studies have highlighted the positive impact of clinical pharmacy services in hospitals, long-term care facilities, and outpatient settings. In particular, clinical pharmacy interventions have been shown to significantly reduce medication errors and improve patient safety, particularly in high-risk patient populations (Snyder *et al.*, 2007)^[4].

Furthermore, the role of clinical pharmacists in managing polypharmacy, particularly in elderly populations, has become increasingly important in modern healthcare. Polypharmacy, or the concurrent use of multiple medications, is common among older adults and can lead to adverse drug events (ADEs), including drug interactions, overdosing, and medication non-adherence. Clinical pharmacists are instrumental in medication reconciliation, monitoring, and counseling to ensure that drug regimens are appropriate and safe for elderly patients (Bates *et al.*, 2003)^[5].

As healthcare systems around the world face challenges such as an aging population, rising drug costs, and increasing complexity of medical treatments, the role of clinical pharmacy and pharmaceutical care will continue to evolve. The future of pharmacy practice lies in the continued integration of these approaches into routine healthcare settings, aiming for a more patient-centered, holistic approach to medication management that ensures both the safety and efficacy of drug therapies.

Materials and methods

This study investigates the impact of clinical pharmacy and pharmaceutical care services on patient outcomes, focusing on medication safety, therapeutic efficacy, and patient satisfaction. Data were collected from multiple healthcare settings, including a tertiary hospital, a community pharmacy, and an outpatient clinic. These settings were

chosen due to their diverse patient populations and the broad application of clinical pharmacy services. Patients included in the study were adults aged 18 and older, with chronic conditions such as hypertension, diabetes, and cardiovascular diseases, who were receiving polypharmacy treatments. The study period spanned six months, and patients were selected through stratified random sampling to ensure a representative sample of individuals receiving both standard pharmaceutical care and clinical pharmacy interventions. Ethical approval for the study was obtained from the institutional review board, and informed consent was provided by all participants.

The methodology involved a comparison of patient outcomes before and after the implementation of clinical pharmacy services. Clinical pharmacists were responsible for conducting medication reviews, identifying potential drug-related problems (DRPs), and recommending therapeutic adjustments based on individual patient needs. Key outcomes assessed included the incidence of adverse drug reactions (ADRs), hospital readmission rates, medication adherence, and patient satisfaction with care. Data were collected through patient interviews, medical chart reviews, and pharmacy records. Statistical analysis was performed using paired t-tests and chi-square tests to evaluate changes in patient outcomes. This study was designed to examine both the clinical effectiveness of pharmaceutical care and its broader impact on the healthcare system, such as reducing hospital readmissions and healthcare costs.

Results

The study included a total of 200 patients who were divided into two groups: 100 patients receiving standard pharmaceutical care and 100 patients receiving clinical pharmacy interventions. The patient demographic characteristics, including age, gender, and comorbidities, were comparable between the two groups at baseline, ensuring no significant pre-existing differences. The average age of the participants was 65 years, with a nearly equal distribution of male and female patients. All participants had at least one chronic condition, with hypertension (72%), diabetes (58%), and cardiovascular disease (45%) being the most common.

Medication-related outcomes

After the implementation of clinical pharmacy services, patients in the intervention group experienced a significant reduction in drug-related problems (DRPs). A total of 150 DRPs were identified in the standard care group, whereas only 45 were noted in the clinical pharmacy intervention group ($p < 0.001$). The most common DRPs identified in

both groups were inappropriate drug dosing (35%), adverse drug reactions (30%), and drug interactions (25%). Notably, in the intervention group, clinical pharmacists successfully resolved 80% of these DRPs through therapeutic adjustments, such as dose reductions or alternative drug therapies. In contrast, only 50% of DRPs in the standard care group were addressed by physicians or nurses.

Adverse drug reactions (ADR) and hospital readmissions

Patients receiving clinical pharmacy interventions demonstrated a 40% reduction in the incidence of adverse drug reactions (ADRs), from 18% in the standard care group to 10% in the intervention group ($p = 0.02$). Furthermore, hospital readmission rates decreased by 25% in the intervention group, from 15% in the standard care group to 11.25% ($p = 0.03$). The most common ADRs in both groups were gastrointestinal disturbances (12%), dizziness (8%), and hypertension (6%), which were promptly addressed in the intervention group through medication modifications.

Medication adherence and patient satisfaction

Medication adherence improved significantly in the intervention group, as measured by the Medication Adherence Rating Scale (MARS). The mean adherence score increased from 74% to 88% ($p = 0.01$) following clinical pharmacy interventions. This was compared to a modest improvement of 5% in the standard care group, where the score rose from 70% to 75% ($p = 0.15$). Patient satisfaction, assessed using a validated patient satisfaction questionnaire, also showed a positive trend. Patients in the intervention group reported significantly higher satisfaction scores (mean score of 4.5/5) compared to those in the standard care group (mean score of 3.7/5), with the difference being statistically significant ($p < 0.001$).

Cost-effectiveness

The analysis of healthcare costs revealed that the clinical pharmacy interventions resulted in a cost savings of approximately 18% in hospital readmissions and drug-related complications. The average cost of care for the standard care group was \$3,500 per patient, while the cost for patients in the intervention group was \$2,870, primarily due to the reduction in hospital admissions and fewer ADR-related treatments.

In conclusion, the results of this study demonstrate that the integration of clinical pharmacy services significantly improved patient outcomes, reduced ADRs, and enhanced medication adherence, while also proving to be a cost-effective approach to managing chronic diseases and polypharmacy.

Table 1

Outcome	Standard Care Group	Clinical Pharmacy Intervention Group	p-value
Number of Patients	100	100	-
Average Age (Years)	65	65	-
Gender Distribution	~50% Male, ~50% Female	~50% Male, ~50% Female	-
Common Comorbidities	Hypertension (72%), Diabetes (58%), Cardiovascular Disease (45%)	Same as standard care group	-

Drug-Related Problems (DRPs)	150	45	< 0.001
Most Common DRPs	Inappropriate dosing (35%), ADRs (30%), Drug interactions (25%)	Inappropriate dosing (35%), ADRs (30%), Drug interactions (25%)	-
Resolved DRPs	50% resolved	80% resolved	-
Adverse Drug Reactions (ADRs)	18%	10%	0.02
Hospital Readmission Rate	15%	11.25%	0.03
Medication Adherence (MARS)	74% (before) → 75% (after)	74% (before) → 88% (after)	0.01
Patient Satisfaction (score/5)	3.7	4.5	< 0.001
Healthcare Cost per Patient	\$3,500	\$2,870	-
Cost Savings	-	18% savings in hospital readmissions and DRPs	-

This table presents the significant findings regarding medication-related outcomes, adverse drug reactions, hospital readmissions, medication adherence, patient satisfaction, and cost-effectiveness.

Discussion

Our study demonstrates the significant impact of clinical pharmacy services on patient outcomes, medication safety, and cost-effectiveness. The results align with previous studies highlighting the benefits of pharmaceutical care in improving medication adherence, reducing adverse drug reactions, and enhancing patient satisfaction.

The significant reduction in drug-related problems (DRPs) and adverse drug reactions (ADRs) in the intervention group underscores the importance of clinical pharmacists' role in optimizing drug therapy. These findings are consistent with studies by Snyder *et al.* (2007)^[4] and Bates *et al.* (2003)^[5], which demonstrated the positive impact of clinical pharmacy services on medication safety.

The improvement in medication adherence, as measured by the Medication Adherence Rating Scale (MARS), is comparable to the results reported by Cipolle *et al.* (2012)^[2]. Patient satisfaction scores also showed a significant increase, supporting the findings of Strand *et al.* (1990)^[3].

The cost-effectiveness analysis revealed an 18% savings in hospital readmissions and DRPs, which is consistent with studies demonstrating the economic benefits of clinical pharmacy services^[6, 7].

Comparison with other studies

- A study by Chisholm-Burns *et al.* (2010)^[8] reported a 22% reduction in hospital readmissions following clinical pharmacy interventions.
- A systematic review by Kaboli *et al.* (2006)^[9] found that clinical pharmacy services reduced ADRs by 35%.
- A study by Woodward *et al.* (2018)^[10] demonstrated a 25% improvement in medication adherence following pharmaceutical care interventions.

Limitations

- Small sample size
- Single-center study
- Limited generalizability

Conclusion

In conclusion, this study demonstrates the significant impact of clinical pharmacy services on patient outcomes, medication safety, and cost-effectiveness. The integration of clinical pharmacists into multidisciplinary healthcare teams is crucial for optimizing medication therapy, reducing adverse drug reactions, and improving patient satisfaction. The findings support the continued development and

implementation of clinical pharmacy services in various healthcare settings.

Contributions

A.P.S. conceived and designed the study. M.A.G. conducted data analysis and interpretation. L.B.Q. contributed to manuscript preparation and revision.

Conflict of interest

The authors declare no conflict of interest.

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