

Clinical Pharmacist Interventions in Neurology: A Systematic Review on Drug-Related Problems and Outcomes

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www.jrasb.com || Vol. 4 No. 4 (2025): August Issue

Received: 09-08-2025

Revised: 13-08-2025

Accepted: 18-08-2025

ABSTRACT

Patients with neurological disorders often require complex treatment regimens and frequently present with multiple comorbidities, which increases the likelihood of drug-related problems (DRPs). This systematic review compiles evidence from quantitative interventional and observational studies conducted across different healthcare settings to evaluate the effect of clinical pharmacist interventions on detecting and resolving DRPs in neurology wards. Findings consistently indicate that pharmacist-led interventions can substantially improve clinical outcomes, reduce medication-related complications, and optimize overall pharmacotherapy. The primary aim of this review is to provide a structured and comprehensive overview of the contribution of clinical pharmacists in the identification and management of DRPs among neurological patients. A thorough electronic literature search was carried out with a high-sensitivity strategy to retrieve relevant publications. Major databases consulted included Web of Science, Scopus, the Cochrane Library, and MEDLINE (via PubMed). Evidence from these studies shows that clinical pharmacist involvement was associated with a 43–78% reduction in DRPs, a 20–35% improvement in medication adherence, and measurable enhancements in clinical outcomes, including better seizure control, improved motor function, and higher medication safety standards. Importantly, the majority of pharmacist recommendations were accepted by prescribers (82–96%). Overall, the findings support the integration of clinical pharmacists into neurology services, demonstrating their value in reducing drug-related complications, enhancing therapeutic effectiveness, and strengthening patient safety.

Keywords- Drug-related problems, Clinical pharmacist, Neurology, interventions and medication safety.

I. INTRODUCTION

Neurological conditions such as epilepsy, stroke, Parkinson's disease, multiple sclerosis and dementia are the global burdens of diseases which requires pharmacotherapy for extended period of time. However, drug-related problems (DRPs) are frequently linked to these therapies, which may affect the therapeutic results, patient safety, and general quality of life [1,3]. Neurology patients are particularly vulnerable to these due to the

complexity of their pharmacological regimens, frequent comorbidities, and the narrow therapeutic indices of many neurological drugs.

Rationale for why neurology patients are at higher risk of showing drug-related problems:

1. Polypharmacy - patients with chronic neurological diseases often have multiple medications for the treatment of their primary disease as well multiple medications to address comorbid conditions [2,6].

2. Complexity of Dosing Regimens - many of the drugs used to treat neurological disorders require root titration as well as ongoing therapeutic monitoring (e.g. antiepileptics).
3. Drug-drug and drug-disease interaction - common occurrence in elderly patients, particularly patients with additional comorbidities, such as hypertension, diabetes, and possible impairment of renal function [4,9].

Role of clinical pharmacists: Clinical pharmacists who are highly skilled in medication use and improving patient-related outcomes plays a vital role in:

1. Identification and resolution of drug-related problems.
2. Optimizing dose/medications [5].
3. Monitoring for adverse drug reactions (ADRs).
4. Patient/caregiver education.
5. Medication reconciliation while transitioning to/from the hospital [7,9].

Thus, their role is important in neurology wards and ICUs as patients are often more susceptible to drug-related complications.

Table 1: Types of Drug-Related Problems Common in Neurology

Type of drug-related problems	Examples
Dose-related	High-dose levodopa causing dyskinesia
Drug interactions	Phenytoin + warfarin increasing INR
Inappropriate drug choice	Anticholinergics in dementia
Non-adherence	Missed antiepileptic doses → seizures
Duplications	Two benzodiazepines prescribed together

Global burden and the need for pharmacist involvement: According to the World Health Organization, neurological disorders affect over 1 billion people around the globe. Studies from multiple countries found an average of 0.29–1.45 [1,6] drug-related problems per patient admitted to the neurology unit. Studies estimate that 5.0 to 10.0% of hospital admissions are due to drug-related problems and as high as 30–50% of hospitalizations are related to preventable medication errors. This systematic review selected information from multiple studies to evaluate the impact of pharmacist interventions on drug-related problems in neurology settings. The most frequent pharmacist interventions included starting one or more new medications, changing the improper drug selected, and maximizing drug dosing. This integrated therapeutic approach is the key to reduce the frequency and pattern of drug-related problems in patients with neurological disorders [3,7].

II. METHODS

An extensive and systematic literature search was conducted using electronic databases including PubMed, Scopus, ScienceDirect, Web of Science, and Cochrane Library. The search was restricted to papers published in the previous 15 years (January 2010–June 2025) in English. Search terms included: "Clinical Pharmacist," "Drug-Related Problems," "Pharmacist Interventions," "Neurology," [10] "Neurological Disorders," "Pharmacist Outcomes," and "Pharmacist in Neurology" for maximum sensitivity in the search. Eleven peer-reviewed articles related to clinical pharmacist interventions in neurology patients were included and assessed the drug-related problems and patient outcomes of those cases. Eligible studies were grouped in a meaningful way, based on intervention types, reported outcomes, and clinical settings [4,7,10].

III. RESULTS

Study selection and characteristics:

The search through the databases resulted in a total of 57 articles that has full-text assessment based on the inclusion criteria and 11 studies were eligible for review. The articles were published between 2010 and 2025 and were based on clinical pharmacist interventions in both inpatient, outpatient, and rehabilitation settings focusing on neurology settings.

The Included Studies Represented Studies from A Variety of Regions, including from India, United States, United Kingdom, Iran, Malaysia, And Saudi Arabia, Representing Both Clinical Pharmacist Interventions in Neurology: A Systematic Review on Drug-Related Problems and Outcomes. and developed health care systems. The study designs included: prospective observational studies (5 studies) [1,3,4,6], randomized controlled trials (3 studies) [5], retrospective cohort studies (2 studies), and a quasi-experimental study.

Types and frequency of drug-related problems:

Across the 11 studies, 2,476 neurology patients were examined. While there were variations in the frequency and type of drug-related problems in patient populations and practice settings, several changes were observed:

- Incorrect or inappropriate dosages were reported in 9 of the 11 studies, often involving antiepileptics, levodopa, and antipsychotics. [1,3,6].
- Drug-drug interactions (DDIs) were found predominantly in polypharmacy studies, especially involving antiepileptics, antidepressants, and antihypertensives.
- Therapeutic duplications were a theme in studies involving elderly patients with dangerous overlaps in prescriptions, especially benzodiazepines and anticholinergics. [3,6,9].

- Adverse drug reactions (ADRs) were most commonly related to antiepileptics and dopaminergic agents.
- Non-adherence or improper administration was often found in outpatient studies, which cited poor health literacy, cognitive impairment, and complicated drug dosing regimens as contributing factors [3,7].

Overall, across all studies, the average number of drug-related problems per patient ranged from 1.2 to 3.7.

**Table 2: Distribution of drug-related problems
Among the Included Studies:**

Type of Drug-related problem	% of Total Drug-related problems Identified
Incorrect dose	34%
Drug-drug interactions	22%
Therapeutic duplication	18%
Non-adherence	15%
Inappropriate drug choice	11%

Nature of clinical pharmacist interventions:

Clinical pharmacist interventions were classified in a number of contexts; both proactive and reactive, such as systemic recommendations, prescriber consultation, and direct patient care. The broad categories consisted of:

- Medication reconciliation and review on admission and discharge [2,6].
- Optimizing and adjusting doses, particularly in renal/hepatic insufficiency.
- Identifying and resolving Drug-drug interactions [2,8].
- Counselling patients and caregivers on matters related with adherence and adverse effects of medications [3,7].
- Monitoring therapeutic drug levels specifically on phenytoin, valproate, and carbamazepine [4,5].
- Developing individual care plans for patients specifically for epilepsy and Parkinson's disease [1,5,6].

Most studies mentioned that pharmacist recommendations made to the clinical team were accepted in 82–96% of cases.

Impact on outcomes:

The outcome measures varied between studies, but showed consistently positive outcomes from pharmacist interventions:

1. Reduction in drug-related problems:

- All studies reported that after the implementation of clinical pharmacist interventions there was a significant decrease in the frequency of drug-related problems.

- Within the interventional arms, reductions in drug-related problems were from 43%-78% in both inpatient and outpatient settings. [1,3,6,9].

2. Improved medication adherence:

- Six studies measured the medication adherence. Adherence was assessed through validated scales (e.g. Morisky scale) or at the follow-up interviews.
- Adherence improved in those that received pharmacist counselling. Adherence scores improved by 20-35% over the 3-6-month follow-up period [3,7].

3. Clinical outcomes:

- Four studies indicated measurable improvements in disease specific clinical outcomes:
 - Seizure frequency decreased in patients suffering from epilepsy after the pharmacists conducted dose titration and whenever drug interactions were rectified.
 - Motor function improved in Parkinson's patients after dopaminergic drug adjustments [5].
 - Blood pressure and lipids were stabilized in stroke patients after a program of coordinated care [9].

4. Safety outcomes:

- Incidence of adverse drug reactions decreased in 5 studies [4,6,8] selected to independently report on these outcomes relative to the 5 domains of high-risk drug monitoring protocols enacted between studies.
- Pharmacists also detected potentially fatal Drug-Drug Interactions (e.g. enzymes inducers with oral anticoagulants) [2,10].

The following observations were made among the sub-groups of studies in this review:

- Studies including older patients demonstrated a higher baseline incidence of drug-related problems, but also showed a greater improvement associated with pharmacist led interventions. [6,8].
- Outpatient pharmacist led interventions had a lower number of studies but demonstrated sustained impact on adherence and education of patients [3,7].
- Pharmacists involved on interdisciplinary teams (i.e. pharmacists working as members of the neurology rounds) had a higher acceptance of recommendations and better outcomes.

IV. CONCLUSION

Clinical pharmacist interventions play a pivotal role in reducing drug-related problems, enhancing therapeutic outcomes, and strengthening patient safety within neurology care settings. The accumulated evidence strongly supports the integration of clinical pharmacists into routine neurological services, highlighting their contribution not only to improved clinical results but also to better medication management and adherence. Expanding clinical pharmacy services should therefore be

a priority for policymakers and healthcare administrators, as such initiatives have the potential to improve patient health outcomes while delivering significant economic and healthcare system benefits.

ACKNOWLEDGEMENT

We sincerely thank the Almighty, our HOD Dr. T. Tamil Selvan, our guide Mrs. Rajasree S., and our family and friends for their invaluable support in completing this work.

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