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# Drug-Related Problems Leading to Hospitalization: A Literature Review

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**Abstract**

Background: Drug-related problems (DRPs) are described as problems associated with medications that can lead to treatment failure and may also cause hospital admissions. The novelty of this study is that it supplements previous research data with the latest data on DRPs leading to hospital stays, specifically articles published between 2021 and 2025. Objective: This study aims to identify the prevalence of hospitalization due to DRPs, the types of DRPs that lead to hospital admissions, the medications involved, and the risk factors for DRPs. Methods: A literature search was conducted across the PubMed, ScienceDirect, and Scopus databases, limiting publication years to 2021-2025. Results: In the 12 studies reviewed, the frequency of hospitalization due to DRP varied between 5,0% to 57,9%. Adverse drug reactions (ADRs), non-compliance, drug interactions, dosing errors, and incomplete therapy indication were the most common types of DRPs that lead to hospitalization. The drugs most commonly involved in DRPs were antidiabetic agents, cardiovascular agents, diuretics, and antineoplastic agents. Age, polypharmacy, and the number and severity of comorbidities were identified as primary risk factors for hospitalization caused by DRPs. Conclusion: The frequency of hospitalization due to DRP varied between 5,0% to 57,9%. Factors such as age, number of medications, and comorbidities influence the frequency of DRPs.

**Keywords:** Drug related problems, Adverse drug reaction, Hospitalization, Risk factor

## 1. INTRODUCTION

Drug-related problems (DRPs) are described as problems associated with medications that may result in the failure to fulfill therapeutic goals and lead to suboptimal clinical outcomes (Al-Worafi, 2020; Kemal et al., 2022; Tharanon et al., 2022). DRPs may have negative impacts on patients health (Garin et al., 2021). DRPs can lead to hospitalization, prolonged hospitalization, reduced quality of life, elevated healthcare costs, and higher morbidity and mortality rates (Al-Worafi, 2020).

DRPs significantly contribute to hospital admissions. A study finds that hospitalizations due to DRPs were high at 57.9% incidence (Demessie & Berha, 2022). The factors leading to hospitalization because of DRPs are varied. Drug interaction, adverse drug reactions (ADRs),

non-adherence, incomplete therapy indication, and dosage-related problems are DRPs that frequently lead to hospitalization (Boppana et al., 2023; Chan et al., 2014; Konuru et al., 2019). Multiple risk factors contribute to hospitalization, which include polypharmacy and old age (Angamo et al., 2017; Laatikainen et al., 2016).

Several studies have reported the risk factors and the prevalence associated with DRPs. Previous studies reviewed articles on DRPs as a cause of hospitalizations through 2017. This study aims to supplement previous research data with the latest data on DRPs leading to hospital stays, specifically articles published between 2021 and 2025, the prevalence of DRPs leading to hospitalization, type of DRPs, the medications associated with DRPs, and the risk factors contributing to hospitalization due to DRPs are findings from many articles. The data presented is used to predict the risk of hospitalization due to DRPs and as a preventive measure to avoid DRPs and improve service quality.

## 2. MATERIAL AND METHODS

Literature on drug-related problems leading to hospitalization was conducted on PubMed, ScienceDirect, and Scopus databases (Figure 1). The inclusion criteria for article selection were limited to publications from January 2021 to July 2025, articles written in English, and articles with full-text open access. The exclusion criteria included articles that did not discuss inpatient care or hospitalization and review articles. The word combinations use included "Drug Related Problems" OR "Drug related Problem" OR "Adverse Drug Reaction" AND "Hospitalization" OR "Hospital admission".

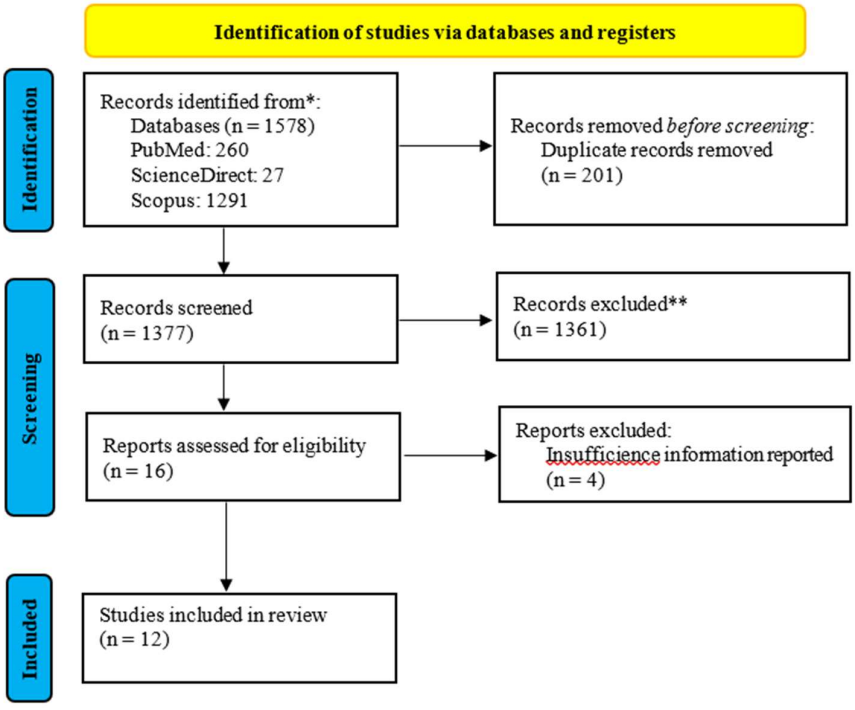


**Figure 1.** PRISMA flow diagram of the study selection process for the literature review on drug-related problems leading to hospitalization.

Total 1578 article were identified from the database. Identified articles were reviewed by three authors. The results found from each database include 260 articles from PubMed, 27 articles from ScienceDirect, and 1,291 articles from Scopus. Duplicate articles were removed resulting 1377 articles. The selection was determined by title, abstract, and content of the article. Total 12 article were use for study. Data were extracted from each article: study area, study design, study group, sample size, mean age, admission to hospital causes by drug, type of DRPs causes admission, drug causes DRPs, and factor associated with admission due to DRPs.

## 3. RESULTS AND DISCUSSION

### 3.1 Characteristic study

Among the 12 articles reviewed about medication-related to hospitalizations, 6 articles evaluated hospitalizations related to all drug related problems, 4 articles focused on hospitalizations owing to adverse drug reactions (ADRs), and 2 articles investigated hospitalizations resulting from drug-drug interactions. The characteristics study presented in Table 1. The studies occurred across several nations. Most study designs used were cross-sectional prospective and retrospective, and case-control studies. Several studies included samples of adult patients aged 18 and older, as well as geriatric patients aged 60 years and older. The average age of patients admitted to the hospital for medication-related complications was within the geriatric category (Table 1).

### 3.2 Drug related to hospitalization

DRP can lead to readmission shortly after patient is discharged. Study showed that 16% of readmission within 30 days of discharge were due to DRP (Uitvlugt et al., 2021). In this review, the incidence rate of hospitalization related to DRP varies among several studies. The frequency of hospitalization due to DRP varied between 5,0% to 57,9%. In some studies, the incidence rate of hospitalization related to DRP reaches 50%. A study showed an incidence rate of 57,9%, while another study reported an incidence rate of 54,6% (Brandariz-Núñez et al., 2023; Demessie & Berha, 2022). Other research reports that hospitalizations due to DRP are less than 50%. A study reported the lowest incidence rate is 5,0% (Komagamine, 2024). Previous studies from various sources between 2012 and 2017 showed that hospitalizations related to DRP had varying average prevalence rates of 15,4%, with a prevalence range between 1,5% and 41,3% (Ayalew et al., 2019).

### 3.3 Type of DRPs cause hospitalization

Based on the reviewed articles, several types of DRPs lead to hospitalization (Table 2). Among the twelve articles reviewed, six mentioned ADRs leading to hospitalization, four mentioned non-compliance and patient-related factors, three mentioned untreated indications, two mentioned drug interactions and dosing errors, and one mentioned medication selection. The results are similar to those of previous studies, which identified ADRs, non-compliance with therapy, therapy failure, overdose, and medication errors as the main causes of DRPs leading to hospitalization (Al-Arifi et al., 2014; Chan et al., 2014; Karuppannan et al., 2013).

**Table 1.** Characteristic study selected articles for the review DRPs leading hospitalization.

| Author, years of publication | Study Area | Study Design | Study Group | Mean age |
|---|---|---|---|---|
| Uitvlugt et al. (2021) | The OLVG teaching hospital includes seven departements, Amsterdam,Netherlands | Cross-sectional observational study | Adult patients ≥18 years | 69,5 years |
| Demessie & Berha (2022) | Tri hospitals Addis Ababa, Ethiopia. | Prospective observational study | Patients aged ≥14 years | 47,5 years |
| Kemal et al. (2022) | FHCSH's internal medicine department in Bahir Dar, Amhara regional state | Prospective cross-sectional study | Adult patients age ≥ 18 years | 45 years |
| Létinier et al. (2022) | Bordeaux University Hospital | Descriptive, cross-sectional study | Patients aged 75 years and over | 85 |
| Očovská et al. (2022) | University Hospital Hradec Králové | Observational cross-sectional study | No age-related exclusion criteria | 71 years |
| Park et al. (2022) | Hospitals in South Korea | Retrospective observational study | Patients aged ≥65 years | - |
| Zaidi et al. (2022) | Four major public hospitals of Tasmania, Australia | Retrospective observational study design | People aged ⩾18 years | 83 years |
| Brandariz-Núñez et al. (2023) | University hospital, Spain | Observational and retrospective study | Patients > 18 years | 70 ± 17,5 years |
| Hughes et al. (2024) | Hospital in Ireland | Cross-sectional study | Patients aged ≥65 years | - |
| Komagamine (2024) | NHO Tochigi Medical Center in Utsunomiya, Japan | Retrospective cross-sectional study | Patients aged > 18 years | 78 years |
| Phoemlap et al. (2024) | Non-trauma ED tertiary-care hospital | Cross-sectional study | Patients aged 60 years and older | 75,5 years |
| Zaidi et al. (2024) | Public hospitals in Tasmania, Australia | Retrospective Case-Control Study | Patients aged ≥ 65 years | - |

In this review, the frequency of ADRs leading to hospitalization range from 5% to 54,6%. In a previous systematic review of articles published before 2021, the prevalence of ADRs leading to hospitalization ranged from 4,2 to 30%. ADRs can lead to hospitalization due to serious clinical effects such as bleeding, gastrointestinal disorders, electrolyte imbalances, diarrhea, urinary tract disorders, and kidney disease (Brandariz-Núñez et al., 2023; Haerdtlein et al., 2023).

Dosing too high or too low is frequently associated with ADR and treatment failure, potentially resulting in hospitalization (Schönenberger & Meyer-Massetti, 2023). The frequency of dosing errors in this review ranged from 12,2% to 24%. A study suggests that drug interactions can increase the frequency of adverse events. Patients exposed to drug interactions have a lower quality of life and require longer treatment times than patients who are not exposed

to drug interactions. The prevalence of ADRs caused by drug interaction was 49,4%. Cardiovascular drugs and central nervous system drugs are the drug classes most frequently involved in drug interactions (Hughes et al., 2024).

**Table 2.** Frequency and Type DRPs causes hospital admission.

| Author, years of publication | Sample size | Admission to Hospital Related to Drug Problems | Type of DRPs causes Admission |
|---|---|---|---|
| Uitvlugt et al. (2021) | 1111 patients | 181 (16%) medication-related readmissions | Underprescribing (40%)<br>Prescription error (35%)<br>Non-adherence (35%)<br>Wrong dosage (24%)<br>Lack of monitoring (20%) |
| Demessie & Berha (2022) | 423 patients | 245 (57,9%) participants with drug related hospitalization | Indication without therapy (n = 94; 37,8%)<br>Failure to receive drugs (n=13; 0,53%)<br>Subtherapeutic dosage (n = 30; 12,2%)<br>Non-compliance (12,1%) |
| Kemal et al. (2022) | 423 patients | 31,9% patients were Drug Related Hospital Admission | Indication without therapy (10,2%)<br>Adverse Drug Reaction (5%) |
| Létinier et al. (2022) | 5860 patients | 375 (6,4%) concomitant usage was found to be contraindicated or warned against | Drug Interaction (6,4%) |
| Očovská et al. (2022) | 1202 patients | 195 drug related patient hospital admission | Safety of treatment (n=145; 74%)<br>Effectiveness of treatment (n=50; 26%) |
| Park et al. (2022) | 6000 patients | 864 (14,3% ) patients with medication-related emergency department | ADE (n = 583; 67,5%)<br>Underuse or noncompliance (n = 281; 32,5%) |
| Zaidi et al. (2022) | 7552 patients | 1775 (23,5%) ADR-related hospitalization | ADR (23,5%) |
| Brandariz-Núñez et al. (2023) | 216 patients | 118 (54,6%) patients required hospitalization with ADR | ADR (54,6%) |
| Hughes et al. (2024) | 782 patients | 353 (45,1%) patients with an ADR-related hospital admission | ADR causes by drug interaction (n= 156; 49,4%)<br>ADR cause by non-drug interaction (n= 197; 42,3%) |
| Komagamine (2024) | 5707 patients | 287 (5,0%) hospitalizations due to ADRs | ADR (n = 287; 5,0%) |
| Phoemlap et al. (2024) | 351 patients | 43 (12,3%) visited the emergency department because of preventable DRPs | Factor related to patient (31,5%)<br>Problem of drug selection (26,7%)<br>Other causes (24,9%) |
| Zaidi et al. (2024) | 7928 people | 1876 (23,7%) ADR-related hospitalization | ADR (n = 1876; 23,7%) |

**Table 3.** Drug causes DRPs and factor associated hospitalization due to DRPs.

| Author, years of publication | Drug that causes DRPs | Factor Associated with Hospitalization due to DRPs |
|---|---|---|
| Uitvlugt et al. (2021) | Antidiabetic drug (15%)<br>Diuretic drug (15%)<br>Laxatives (14%)<br>Antithrombotic drug (10%)<br>Asthma / COPD drug (8%) | The number of drug modification during the index hospitalization<br>Up to three admissions to hospital in the six months before index hospitalization |
| Demessie & Berha (2022) | Furosemide 59 (24,1%)<br>ACE inhibitors 48 (19,1%)<br>Anticoagulants and antiplatelets 44 (18%)<br>Oral hypoglycemic agents 37 (15,1%)<br>Antibiotics 25 (10%)<br>Insulin 24 (9,8%)<br>Anticancer drugs 23 (9%)<br>Combination of antiretroviral 15 (6,1%) | Age over 64 years<br>Higher educational level<br>Unemployed<br>Comorbidities |
| Kemal et al. (2022) | Cardiovascular drugs 69 (51,1%)<br>ART drugs 7 (8,9%)<br>Anti TB drugs 5 (3,7%)<br>Antidiabetics 4 (3,0%)<br>Anticoagulants 3 (2,2%)<br>Antineoplastic agent 2 (1,5%)<br>Antibiotics 1 (0,7%)<br>NSAIDs 1 (0,7%) | Patients with lower CCI scores<br>The duration of drug therapy |
| Létinier et al. (2022) | An antidepressant<br>Antiarrhythmic agents<br>Beta blockers<br>Antithrombotic agents<br>Non-steroidal anti-inflammatory drugs | No Result |
| Očovská et al. (2022) | Antirheumatic<br>Anti-inflammatory<br>Drugs used in diabetes<br>Psycholeptics<br>Antipsychotic | No Result |
| Park et al. (2022) | Anticoagulants<br>Anticholinergic drugs<br>Benzodiazepine<br>Diuretics<br>Insulin<br>NSAIDs without the use of PPI<br>P2Y12 inhibitors | No Result |
| Zaidi et al. (2022) | Antithrombotics 19,3%<br>Anti hypertensives 11,5%<br>Opioids 11,1%<br>Psychotropics (excluding antidepressants) 7,7%<br>Antidepressants 6,7% | No Result |
| Phoemlap et al. (2024) | Antithrombotics<br>Oral hypoglycemic agents<br>Antineoplastics | Patients with multimorbidity (≥ 6 comorbid diseases)<br>Visits involving potentially inappropriate medications |

**Table 4.** Drug causes DRPs and factor associated hospitalization due to DRPs (*Continued*).

| Author, years of publication | Drug that causes DRPs | Factor Associated with Hospitalization due to DRPs |
|---|---|---|
| Brandariz-Núñez et al. (2023) | Antagonists Vitamin K 23<br>Direct acting anticoagulants 14<br>Antiplatelet 12<br>Low molecular weight heparins 4<br>Monoclonal antibodies<br>Platinums 9<br>Taxanes 8<br>Anti- metabolites 7<br>Alkylating agents 5<br>Vinca alkaloids 3 | Charlson comorbidity index score 4-6 and ≥ 10 |
| Hughes et al. (2024) | Cardiovascular drugs<br>Gastrointestinal drugs<br>Central nervous system drugs<br>Infection drugs<br>Endocrine drugs | No Result |
| Komagamine (2024) | Cardiovascular drugs n = 83 (22,6%)<br>Musculoskeletal drugs n = 62 (16,8%)<br>Antithrombotic drugs n = 49 (13,3%)<br>Psychotropic drugs n = 39 (10,6%)<br>Antidiabetic drugs n = 37 (10,1%) | Polypharmacy<br>Age ≥ 65 years Ambulance use |
| Zaidi et al. (2024) | Diuretics<br>Renin- angiotensin system (RAS) inhibitors<br>Antithrombotics | CKD<br>Australian-born<br>Hypertension<br>Number of medicines |

Untreated indications or potential prescription omissions (PPO) can increase disease progression and increase the risk of readmission. Studies have demonstrated that the implementation of interventions to identify and improve PPO leads to a decrease in medication-related hospitalization (Blum et al., 2021). The frequency of untreated indication based on this review ranged from 10,2% to 40%.

Drug selection is a DRPs that causes hospitalization with a frequency of 49,4%. Inadequate medication selection, particularly the utilization of potentially inappropriate medication (PIM), also increases of the incidence of ADR and hospitalization. A meta-analysis of pharmaceutical intervention show decrease in the utilization of PIM, accompanied by a reduction in readmission rate within 30 days post-implementation of enhancements in medication selection (Zhou et al., 2023). In additional factor related to patient, non-adherence to therapy contributes to the rise in clinical complications that may result in readmission. Several studies report that non-adherence with therapy correlates with a rise in readmission, especially among patients ≥55 years and in patients with heart disease (Ruppar et al., 2016; Walsh et al., 2019).

### 3.4 Drug cause DRPs

Based on the articles reviewed, there are various types of medications that lead to hospitalizations. The medications that most frequently lead to hospitalizations include

antidiabetic drugs, diuretics, cardiovascular drugs, antineoplastic drugs, psychotropic drugs, and gastrointestinal drugs (Table 3). Another study showing the highest prevalence of medications resulting in hospitalization includes cardiovascular, nervous system, blood and blood-forming agents, anticoagulants, diuretics, immunosuppressants, and agents acting on the renin-angiotensin system (Haerdtlein et al., 2023).

Antidiabetic drugs lead to hospitalization in patients due to their hypoglycemic effect. The drugs that most commonly cause hypoglycemia are primarily by patients receiving insulin and sulfonylureas (Vonna et al., 2024). Diuretics are often the drug commonly associated with hospitalization due to DRPs. A cross-sectional study involving 1111 readmissions found that 35% of incidents were linked to diuretics, often resulting from dosing errors or electrolyte imbalance that caused heart failure decompensation (Uitvlugt et al., 2021). Cardiovascular medication, such as antihypertensives and medication for functional gastrointestinal disorders, has a significant association with 30-day readmission because of adverse effects, including hypotension, renal impairment, or drug interaction (Butzner et al., 2022; Pereira et al., 2021). Antineoplastic drugs are high-risk medications with a narrow therapeutic window. That frequently causes nephrotoxicity, myelosuppression, and interaction with others medication, making them a significant factor in adverse drug events (Menezes et al., 2024).

**3.5 Factor associated with hospitalization**

The factors most commonly associated with hospitalization in this review were age, the number of medications associated with polypharmacy, and the number and severity of comorbidities. Other factors included the length of the previous stay, educational level, and place of birth. The information is summarized in Table 3. Other studies have shown that polypharmacy and the number of comorbidities significantly influence the incidence of ADR (Osanlou et al., 2022).

Older age is often associated with risk factors for ADR, as aging is accompanied by functional changes in the body, such as reduced kidney function and impaired ability to metabolize drugs (Lee, 2022). Polypharmacy is also a strong predictor; each additional medication increases the risk of readmission by approximately 3%, and patients with polypharmacy have a 22% higher risk than patients without polypharmacy. Another study reports a probability of readmission of 1,66 in patients taking ≥10 medications (Glans et al., 2020; Turnbull et al., 2021). The burden of comorbidities, measures by the Charlson Comorbidity Index or the number ICD-10 disease, significantly increases the likelihood of readmission with OR 1.12 per CCI unit (Glans et al., 2020).

The strength of this review article is that it summarizes the most recent articles, especially those from 2021 to 2025, about the correlation between DRPs leading to hospitalization, and it point of the common types of DRPs, drug groups, and factors associated to hospitalization. The limitation of this article is dependence on the quality of data from the included studies and the variability of patient characteristics and care conditions across studies, which prevents direct comparisons among different types of DRPs.

## 4. CONCLUSION

DRPs is contributing factor to recurrent hospitalizations. Frequency of hospitalization due to DRP varied between 5% to 57,9%. The types of DRPs that most commonly lead to hospital admissions include adverse drug reactions, lack of adherence to therapy, and interactions with other medications. The drugs most commonly associated with DRPs include antidiabetic drugs, cardiovascular drugs, diuretics, and antineoplastic drugs. This is due to complex treatment, high risk for safety, and need for therapeutic monitoring. Reducing recurrent hospitalization resulting from DRPs needs the identification of DRPs and the enhancement of clinical pharmacy's participation, such as medication monitoring and patient education, as strategies to lower the readmission rate and improve healthcare quality.

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## CONFLICT OF INTEREST

Authors declare that there are no conflict of interest in this article.

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