Drug-Drug Interaction Risk in Polypharmacy: A Case Study-Based Approach in Elderly Care

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Abstract

Despite the implications for patient safety and the increased occurrence among older patients, prior research has not examined Drug-Drug Interactions (DDIs) concerning the medical treatment of senior mental patients. To detect possible DDI and polypharmacy (PP) in prescriptions for elderly inpatients with mental illnesses and to analyze relevant characteristics. The present retrospective cross-sectional research examined the medical records of 94 hospitalized individuals over 60 years old diagnosed with mental illnesses and given various drugs. Drug medications were verified at admission, at the midpoint, and during the final prescription review. Multivariable logistic regression (LR) assessment evaluated variables related to the incidence of DDIs. The theoretical prevalence of DDI was 68.1% at enrollment, 75.6% halfway through hospitalization, and 81.2% at the final prescription. Most of the prescription medications were medicines affecting the neurological system. A significant proportion of severe and potentially prohibited DDIs occurred. Individuals aged 60 to 70 years, those using cardiac and pulmonary treatments, and the total number of prescriptions substantially contributed to DDI. Understanding the aspects related to DDI among individuals with mental illnesses might enhance the efficacy and safety of nursing treatment.

Keywords: Drug-Drug Interaction, Polypharmacy, Elderly Care, Health.

1 INTRODUCTION

Polypharmacy (PP) Wang et al. (2024) among the elderly is prevalent, with current statistics from the Norwegian Prescription Database indicating that 24% of prescribed drug users aged 65 and older were given 10 or more medications in 2020. PP in older people presents a dual challenge. Numerous pharmaceuticals are essential for managing disorders and alleviating sensations in multimorbid elderly folks. PP is linked to a heightened risk of drug-drug interactions (DDIs) Niu et al. (2024) and adverse reactions, resulting in functional deterioration, hospitalization, and perhaps death. Adverse events associated with medication usage have been projected to account for around 12% of hospital stays among the elderly.

DDIs arise when the simultaneous administration of another medicine influences the efficacy of one medication. DDIs diminish the affected medicines' effectiveness or augment efficacy, elevating the risk of adverse consequences. The incidence of DDIs grows with the rising number of drugs. The documented prevalence of DDIs in surveys ranges from 15% to 72%, contingent upon the features of the research population (age, morbidity), the context, and the evaluation of suspected DDIs.

In recent decades, there has been a growing focus on enhancing medication prescribing practices for people over 65. This has led to doctors' heightened use of clinical decision support tools and an augmented application of structured drug reviews Armando, Miglio, de Cosmo, & Cena (2023). Every resident is allocated a designated physician. The physician is tasked with coordinating patients' pharmacotherapy and doing medication reviews as necessary for those using multiple medications. Decision-support systems for clinical decisions and thorough medication evaluations have shown efficacy in mitigating adverse health effects associated with PP by decreasing the incidence of potentially severe DDIs and adverse reactions to drugs Bettonte, Berton, & Marzolini (2022).

2 BACKGROUND

2.1 Research Design and Context

This research was a cross-sectional retrospective analysis done at a public hospital in an urban center. This institution served as a benchmark for the treatment of people with mental and neurological disorders.

2.2 Ethical Considerations

The research received approval from the Ethics Board in Nursing and the Hospital's Research and Ethics Council Oermann, Barton, Yoder-Wise, & Morton (2021). The need for written permission from participants was waived due to the retrospective approach of the research, which relied on the examination of de-identified information. The research did not include submitting the patients to any treatments. No effort has been made to get more information from the individuals or their families. The information has just been documented in the medical records. The data are aggregated findings that do not identify any patient.

2.3 Patient Demographics and Inclusion Criteria

The population being studied was non-probabilistic and encompassed all inpatients at hospitals who satisfied the following criteria: an identification of a mental health condition, age exceeding 60 years (as stipulated by the World Health Organization (WHO) Anderson & Doyle (2021) for nations that are developing), both genders, utilization of multiple prescribed medications, and verified access to medical records containing information on use of drugs. The data-gathering period spanned from 2010 to 2020. This timeframe was selected owing to the limited turnover of individuals meeting the specified inclusion criteria, attributable to the intricacy of the cases.

The objective was to incorporate as many patients as feasible to guarantee sample reliability and sufficient outcomes analysis. All patient medication prescriptions were evaluated at the time of hospitalization, at the midpoint of the hospitalization (median duration), and at the last documented prescription to analyze the trends in drug prescriptions and possible DDIs throughout hospitalization.

The "last medication" refers to the medication acquired at discharge, just before death, or when gathering information if the patient remained hospitalised.

2.4 Data Acquisition and Variables

The results were obtained by conducting a retrospective review of medical records Sjöberg, Edberg, Rasmussen, & Beck (2021). The gathered data were systematically arranged in a data register tool for this investigation. The outcome measure of the research was the incidence of a possible DDI in patient medication, defined as the discovery of at least a single possible medication interaction regardless of severity categorization. This investigation did not assess the clinical manifestations of DDIs; hence, the term "the potential DDI" was employed. The independent factors were age, gender, evaluation, Anatomical Therapeutic Chemistry (ATC) Das & Mazumder (2024) drug categorization, and PP, which is characterized as the simultaneous use of more than five drugs.

2.5 Statistical Evaluation

The results were analyzed using the Statistical Analysis Software (SAS). The statistical evaluation was conducted by calculating the total and percentage rates for categories, as well as the measures of the center of gravity (mean and average). Qualitative explanatory factors were analyzed for the response variables by using logistic regression. A 92% confidence interval (CI) and a statistically significant threshold of 0.05 were utilized. The explanatory parameters with a $p \leq 0.3$, determined through univariate analyses, were incorporated into the logistic regression framework alongside clinically pertinent variables (age, gender, evaluation, and the number of medications) due to their frequent citation in research as potential factors linked to DDIs. Every factor with $p < 0.25$ in the unadjusted models was incorporated into the modified versions.

3 RESULTS AND FINDINGS

Two hundred thirty-three residents were included, including 110 from metropolitan areas and 125 from towns and villages. The average age of the respondents was 780 years, with 45% identifying as male. Diabetes and hyperlipidemia were the predominant diagnoses, impacting 50% and 45% of patients, respectively.

3.1 PP

The average amount of medications was 4 (range 0-15), and PP was seen in 102 patients (44%). Eight people (3.5%) used ten or more substances, whilst ten individuals (4.5%) abstained from drug usage entirely. Diabetes diagnosis (P=0.023), heart disease (P<0.001), and the need for assistance with medications (P=0.03) had a strong correlation with PP. Gender, age, residence, and diagnoses of cancer, pulmonary illness, and musculoskeletal disorders were not substantially correlated with PP.

3.2 Possible Pharmacological Interactions

A total of 200 people utilized two or more substances. Three hundred potential DDIs were identified, impacting 107 people (54%). A total of 132 DDIs were categorized as significant DDIs, affecting 80 persons (41%), as seen in Fig. 1. Two individuals, using 10 and 15 distinct medications, respectively, encountered six significant potential DDIs apiece. The overall quantity of medications correlated with exposure to at least one potential DDI and at least one serious DDI ($P<0.002$). Cardiovascular disease had a favorable correlation with exposure to a DDI ($P=0.024$). Age, sex, residence, need for assistance with medications, and diagnoses of obesity, pulmonary illness, musculoskeletal disorders, and cancer exhibited no significant correlation with potential DDIs.

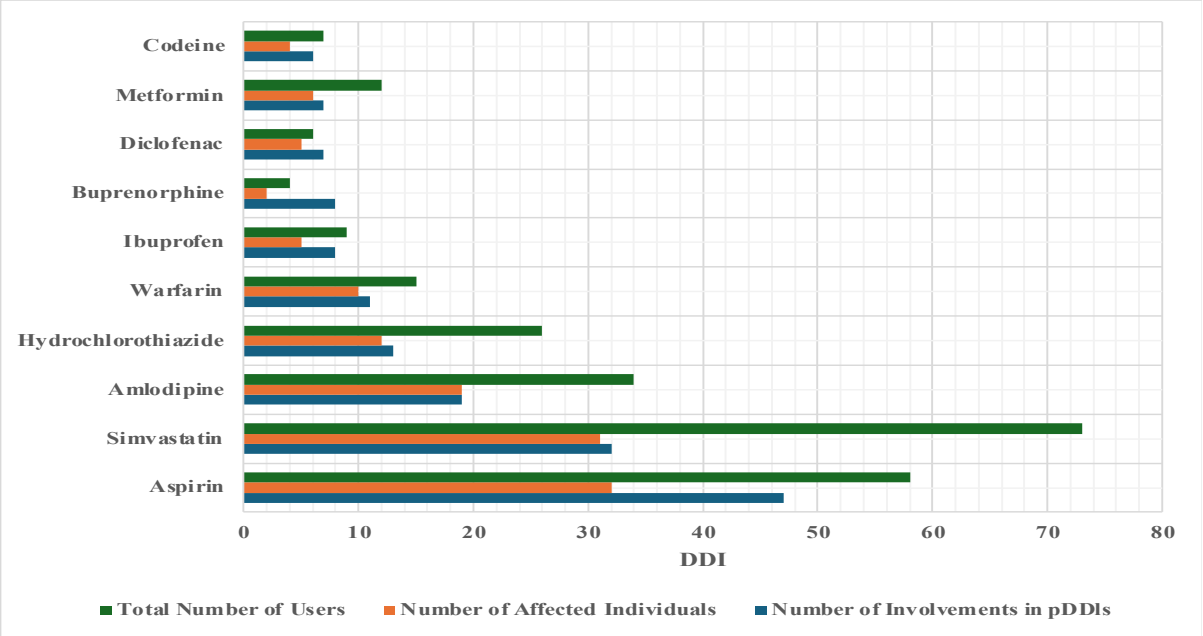

Figure 1: DDI analysis

A person used an inappropriate combination of isosorbide mononitrate and vardenafil. Of the 135 detected significant potential DDIs, low-dose aspirin was implicated 45 times, whereas simvastatin was linked 30 times. The most prevalent potential DDI was the cholesterol-lowering drug in conjunction with the calcium channel blockers Norvasc (15 people), verapamil (4 people), and diltiazem (2 people). The predominant potential DDI with ibuprofen was when used with a diuretic, either hydrochlorothiazide or a loop-like diuretic, occurring in 16 instances. Aspirin was commonly seen in conjunction with other medications that influence platelet function or blood coagulation, including NSAIDs (6 people), warfarin (1 person), and antiplatelet (1 individual). The drug was the most often implicated in potential DDIs, with nine DDIs occurring among only the people.

4 DISCUSSION

This research examined whether PP modulates the impact of Cost of Care (COC) on DDI in older adults. The study identified a notable partial mediated effect of multiple medications, which was more

pronounced when excessive multiple medications were designated as the mediator. The study demonstrates that optimizing the impact of COC on diminishing DDI is achieved by interventions targeting PP. Proper medicine prescriptions help prevent improper PP. The findings indicate that PP is prevalent among older people, with a more severe incidence compared to other nations and regions. The elevated incidence of PP is ascribed to the frequent consultations with physicians. The findings indicated that the mean number of doctor visits was 30, with around two-thirds of the study group exceeding 17 visits within one year. The absence of an adequate referral system results in patients self-referring to doctors, contributing to diminished COC. The research identified an inverse relationship between COC and multiple medications; specifically, elevated COC levels inhibited PP in individuals.

PP and DDI exhibited a positive correlation, affirming that PP constitutes a risk factor for DDI. The mediation study revealed that improving COC offers protective benefits against DDI occurrences. PP and severe PP demonstrated varying magnitudes of influence when analyzing the impact.

Research examining those with hypertension amongst Medicare recipients revealed that increased COC leads to a higher acquisition of antihypertensive medications by older individuals. This indicates the potential presence of a mediating impact of PP. In the investigation, with the removal of PP and extreme PP, the influence of COC on DDI occurrences mainly arose from the relationship between COC and the PP state. Despite the presence of PP or severe multiple medications, the protective impact is ascribed to the direct influence of COC.

In the analysis of subgroups, the research used age and gender as the criteria for categorization, since individuals of different sexes have been seen to exhibit distinct health care-seeking behaviors. The study demonstrated that the elements of COC's influence on DDI occurrences varied across men and women. Mediation refers to the process by which exposure influences the result via the mediator; interaction denotes how the mediator alters the impact of the exposure on the outcome. Women contact doctors more often than men, which indicates a possible alienation in the healthcare system that disproportionately affects women. Studies have suggested that variations in women contribute to a higher desire to consume drugs. The improvement of COC significantly influences the administration of medications in women, hence decreasing the incidence of DDI episodes among them. The investigation of the impact of COC on DDI occurrences across various age groups revealed that the effect elements exhibited a greater disparity in models using inadequate PP as a mediator. The elimination rate for the cohort aged > 80 years was inferior to that of other demographics. The therapy might be assumed to be more cautious and consistent for this age bracket. Therefore, consulting a regular doctor acquainted with the individual and the medication history is beneficial.

5 CONCLUSION

This research has considerable ramifications for practical use. The study established the significant occurrence of probable DDIs in the medications of elderly individuals with mental problems admitted

to the examined institution. A substantial proportion of elderly individuals with cognitive issues were subjected to PP. Positive correlations were noted between the incidence of a probable DDI and PP, in addition to cardiovascular, pulmonary, and central nervous system medications, and those aged 60 to 69 years. Incorporating nurses, pharmacists, and doctors into multidisciplinary teams, particularly for assessing medication prescriptions, decreases the incidence of DDIs and enhances pharmacotherapy's safety in mental institutions. To enhance patient safety, the research advocates adopting measures that enable health practitioners to identify and avoid possible DDIs, improving medication efficacy and safety.

This research emphasizes PP and other aspects related to DDI in hospitalized elderly individuals with cognitive impairments. This problem has not been well examined; hence, this research enhances the understanding of solutions for the care of hospitalized older adults with mental disorders. The study demonstrates the significant incidence of feasible drug reactions, critical issues regarding interactions between drugs in older adults with cognitive problems, and the variety of prescription medications that impact their standard of living throughout pharmacology. The data has significant potential to transform practices inside behavioral health facilities, especially concerning safety, quality of treatment, and individuals' constitutional rights.

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