DOI: 10.36566/ijhsrd/Vol8.Iss1/384
https://ijhsrd.com/index.php/ijhsrd

Indonesian Journal Of Health Sciences Research and Development

e- ISSN: 2715-4718

Research Article

THE EVALUATION OF DRUG INTERACTIONS IN PRESCRIPTIONS FOR HEART DISEASE PATIENTS AT THE XYZ PHARMACY IN 2024

Miftahul Hidayati [1 *], Rahmadevi[2]

[1,2] Faculty of Pharmacy, Universitas Adiwangsa Jambi

Corresponding Author :
Rahmadevi, E-mail: zuldev1807@gmail.com*

ABSTRACT

Background: Cardiovascular disease is a major cause of morbidity and mortality, with treatment commonly involving polypharmacy, which increases the risk of drug interactions.
Methods: This study aimed to evaluate potential pharmacokinetic drug interactions in prescriptions of heart disease patients at XYZ Pharmacy in 2024. This study used a descriptive observational design with a retrospective approach through prescription review. A total of 45 prescriptions that met the inclusion criteria were selected using total sampling. Data were analyzed descriptively using frequency and percentage.
Results: The results showed that most prescriptions contained 3–4 drugs (62.2%), indicating polypharmacy. A total of 92 potential drug interaction cases were identified, consisting of 79.30% pharmacodynamic interactions and 20.70% pharmacokinetic interactions. Pharmacokinetic interactions occurred during the absorption, distribution, metabolism, and excretion phases, with examples including digoxin–spironolactone, clopidogrel–lansoprazole, and metformin–furosemide. The most common interaction combinations occurred between cardiovascular drugs (54.35%).
Conclusion: In conclusion, there are potential pharmacokinetic drug interactions in prescriptions of heart disease patients at XYZ Pharmacy in 2024. These findings highlight the importance of drug interaction screening in pharmaceutical services to improve the safety and effectiveness of therapy.

Keywords: Pharmacokinetics, Drug interaction, Polypharmacy, Heart Disease, patient

INTRODUCTION

Cardiovascular disease remains one of the leading causes of morbidity and mortality worldwide, including in Indonesia. According to the World Health Organization, cardiovascular diseases cause more than 17 million deaths annually [1]. In Indonesia, the prevalence of heart disease continues to increase due to population aging and lifestyle changes [2]. The management of heart disease generally requires long-term combination therapy, including antiplatelets, anticoagulants, beta-blockers, ACE inhibitors, diuretics, and statins, which may lead to polypharmacy [3–5].

Polypharmacy in heart disease patients can increase the risk of drug interactions, especially pharmacokinetic interactions involving drug absorption, distribution, metabolism, and excretion [6]. These interactions may alter plasma drug concentrations, potentially reducing therapeutic effectiveness or increasing toxicity risk. Elderly patients are more vulnerable due to physiological changes such as decreased renal and hepatic function [7–10]. Therefore, monitoring drug use in cardiovascular patients is essential to ensure safe and effective therapy.

Several studies have reported potential drug interactions in prescriptions for heart disease patients. Islamiyah found potential drug interactions in polypharmacy prescriptions among heart clinic patients [11]. Similar findings were reported by Ayuningsih, Wulandari et al., and Fajariyani et al., showing that cardiovascular patients receiving multiple medications remain at risk for clinically significant drug interactions [3,7,12]. Some commonly reported interactions include digoxin–furosemide and clopidogrel–proton pump inhibitor combinations [13–15].

Pharmacies have an important role in detecting and preventing potential drug interactions through prescription screening before medications are dispensed to patients. However, studies evaluating drug interactions at the pharmacy level are still limited. Therefore, this study aimed to evaluate potential pharmacokinetic drug interactions in prescriptions for heart disease patients at XYZ Pharmacy in 2024. The study focused on identifying drug combinations that potentially cause interactions based on absorption, distribution, metabolism, and excretion mechanisms using scientific literature and drug interaction databases as analytical references.

METHODS

This study used a quantitative approach with a descriptive observational design and a retrospective method through the review of prescriptions for heart disease patients at XYZ Pharmacy. The study was conducted from August to October 2025 using prescription data from January to December 2024. A retrospective approach was chosen because the study analyzed existing prescription data to identify potential drug interactions in heart disease patients receiving pharmaceutical services at the pharmacy.

The population consisted of all prescriptions for heart disease patients at XYZ Pharmacy in 2024, totaling 45 prescriptions. The sample was selected using a total sampling technique, in which all eligible prescriptions were included in the study. Inclusion criteria were prescriptions for patients diagnosed with heart disease, polypharmacy prescriptions containing ≥3 drugs, patients aged ≥30 years, prescriptions dispensed during January–December 2024,

and prescriptions with complete and clearly readable drug information. Exclusion criteria included prescriptions without a heart disease diagnosis, prescriptions containing fewer than 3 drugs, patients aged <30 years, incomplete prescription data, and prescriptions outside the study period.

The study used secondary data obtained through prescription review. The observed variables included the number of drugs per prescription, types of cardiovascular drugs, combinations of cardiovascular and non-cardiovascular drugs, and the potential for pharmacokinetic drug interactions based on absorption, distribution, metabolism, and excretion (ADME) mechanisms. Potential drug interactions were identified using drug interaction databases and references, including Drugs.com, Medscape, and relevant scientific literature. The research instrument consisted of a data collection sheet designed according to the study objectives and reviewed through consultation with academic supervisors.

Data were analyzed descriptively using frequency and percentage calculations to determine the distribution of potential drug interactions in prescriptions for heart disease patients. Drug interactions were further classified based on the type of drug combination and the pharmacokinetic mechanisms involved. The results were presented in tables to facilitate interpretation and provide an overview of potential pharmacokinetic drug interaction patterns in pharmaceutical services at XYZ Pharmacy.

RESULTS

This study was conducted using a retrospective descriptive observational method through the review of prescriptions for heart disease patients at Apotek XYZ during the period of August–October 2025. The analyzed variables included patient characteristics, the number of drugs prescribed, the types of prescribed drugs, and the potential for drug interactions based on pharmacokinetic and pharmacodynamic mechanisms. The analysis was carried out using drug interaction theory and the concept of polypharmacy in heart disease patients to describe the potential therapeutic risks that may occur in pharmaceutical services at the pharmacy.

Characteristics of Patients Based on Age

The results showed that the 46–55 years age group constituted the largest group of patients, as presented in the following table.

Table 1. Characteristics of Patients Based on Age

Age Group (Years)	Number of Patients (n)	Percentage (%)
36–45	6	13,3%
46–55	18	40,0%
56–65	12	26,7%
>65	9	20,0%
Total	45	100%

Based on Table 1, the 46–55 years age group was the largest patient group, consisting of 18 patients (40.0%), while the 36–45 years age group had the smallest number of patients, consisting of 6 patients (13.3%).

Distribution of the Number of Drugs in Prescriptions for Heart Disease

The research results showed that the most frequently prescribed drug groups are presented below.

Table 2. Distribution of the Number of Drugs in Prescriptions for Heart Disease Patients

Number of Drugs per Prescription	Number of Prescriptions (n)	Percentage (%)
3–4 obat	28	62,2%
5–6 obat	16	35,6%
≥7 obat	1	2,2%
Total	45	100%

Based on Table 2, the majority of prescriptions for heart disease patients contained 3–4 drugs, totaling 28 prescriptions (62.2%), while prescriptions containing ≥7 drugs were found in only 1 prescription (2.2%).

Types of Heart Medications Most Frequently Prescribed

The research results showed that the most frequently prescribed types of medications are presented below.

Table 3. Types of Heart Medications Most Frequently Prescribed

Class of Heart Medication	Example of Drug	Frequency (n)	Percentage (%)
Diuretik	Furosemide, Spironolakton	32	27,8
Antiplatelet	Aspilet, Clopidogrel	30	26,1
ACE Inhibitor / ARB	Captopril, Candesartan	15	13,0
Beta-blocker	Bisoprolol, Propranolol	13	11,3
Glikosida jantung	Digoksin	11	9,6
Statin	Atorvastatin	9	7,8
CCB	Amlodipine	5	4,3
Total		115	100

Based on Table 3, the most frequently prescribed drug class was diuretics with 32 prescriptions (27.8%), while the least prescribed drug class was calcium channel blockers (CCBs) with 5 prescriptions (4.3%).

Distribution of Drug Interaction Types between Heart Medications and Other Heart Medications as well as Heart Medications and Non-Heart Medications

The study identified 92 cases of potential drug interactions. Pharmacodynamic interactions were the most commonly found type of interaction, as shown in the following table.

Table 4. Distribution of Drug Interaction Types between Heart Medications and Other Heart Medications as well as Heart Medications and Non-Heart Medications

Interaction Category	Number of Cases (n)	Percentage (%)	Example of Interaction
Heart Medication + Heart Medication	50	54,35	Digoksin + Furosemid; ACEI/ARB + Spironolakton; Beta-blocker + CCB
Heart Medication + Non-Heart Medication	42	45,65	Clopidogrel + Lansoprazole; Furosemid + Cefixime; Bisoprolol + Alprazolam
Total	92	100	–

Based on Table 3.5, the highest number of interactions occurred in combinations of heart medications with other heart medications, totaling 50 cases (54.35%), while combinations of heart medications with non-heart medications were found in 42 cases (45.65%).

DISCUSSION

The age distribution of patients showed that heart disease was more dominant in late adulthood and elderly age groups. This condition is consistent with the epidemiological theory of cardiovascular disease, which states that the risk of heart disease increases with age due to changes in the structure and function of the cardiovascular system. Increased arterial stiffness, endothelial dysfunction, and decreased organ function cause elderly patients to require long-term pharmacological therapy more frequently [8,9]. This condition also contributes to the increasing practice of polypharmacy among heart disease patients [4,5].

The study results showed that most prescriptions contained ≥3 drugs. This condition indicates a high prevalence of polypharmacy among heart disease patients in outpatient healthcare services. Polypharmacy is commonly found in patients with chronic diseases because therapy is intended not only for the primary disease but also for comorbidities such as hypertension, Diabetes Mellitus, and dyslipidemia [10]. The simultaneous use of multiple drugs increases the risk of both pharmacodynamic and pharmacokinetic drug interactions, thus requiring special attention during prescription screening in pharmacies [16,17].

Diuretics were the most frequently prescribed drug class in this study. The use of diuretics in heart disease patients aims to reduce fluid retention and improve symptoms of heart failure [24]. In addition to diuretics, the use of antiplatelets, ACE inhibitors/ARBs, beta-blockers, and statins indicates that patient therapy was dominated by standard treatments for coronary heart disease and heart failure. However, the combination of several cardiovascular drugs may increase therapeutic complexity and the risk of drug interactions that can affect patient safety [26].

Pharmacokinetic Interactions

The pharmacokinetic interactions identified in this study involved changes in the processes of drug absorption, distribution, metabolism, and excretion. One of the most frequently identified interactions was the combination of Digoxin with Spironolactone. This interaction occurs during the renal elimination phase, where spironolactone may reduce digoxin clearance, thereby increasing plasma concentrations and the risk of toxicity. Digoxin is known to have a narrow therapeutic index, so even a slight increase in drug concentration may cause toxic effects such as arrhythmias and gastrointestinal disorders [17].

Another interaction was found in the combination of Digoxin with Cefixime. This interaction occurs during the absorption phase due to changes in normal intestinal flora caused by antibiotics. Reduced presystemic metabolism of digoxin by intestinal bacteria increases the bioavailability of digoxin, thereby increasing plasma drug concentrations [21,23]. In addition, the combination of Clopidogrel with Lansoprazole showed an interaction during hepatic metabolism through inhibition of the CYP2C19 enzyme, which may reduce the activation and antiplatelet effect of clopidogrel [14,15,22].

In the combination of Metformin with Furosemide, the interaction occurs during renal excretion. Furosemide may affect metformin clearance through changes in renal hemodynamics, thereby increasing systemic exposure to metformin. This condition may increase the risk of side effects such as lactic acidosis in patients with impaired kidney function [19,27]. These findings indicate that pharmacokinetic interactions still have important clinical implications, even though the number of cases was lower than pharmacodynamic interactions.

Interactions between heart medications and other heart medications dominated the study findings. Most interactions occurred during drug distribution and elimination, particularly in drugs metabolized through P-glycoprotein transporters and excreted through the kidneys [6]. Meanwhile, combinations of heart medications with non-heart medications mostly occurred during hepatic metabolism and renal elimination. This finding indicates that changes in plasma drug concentrations due to impaired metabolism or excretion are major factors contributing to pharmacokinetic interactions in heart disease patients.

Pharmacodynamic Interactions

Pharmacodynamic interactions were the most commonly identified interactions in this study. These interactions occur due to the effects of drugs acting on the same physiological system, resulting in either synergistic or antagonistic effects [17]. For example, the combination of Furosemide and Spironolactone may cause changes in potassium levels because furosemide increases potassium excretion, whereas spironolactone retains potassium in the body [25].

The combination of ACE inhibitors/ARBs with Spironolactone also increases the risk of hyperkalemia due to additive inhibition of the renin–angiotensin–aldosterone system [28]. In addition, the interaction between Digoxin and Furosemide may increase the risk of digoxin toxicity through hypokalemia, which increases myocardial sensitivity to digoxin [13]. The

combination of digoxin with beta-blockers such as Bisoprolol or Propranolol may also cause additive negative chronotropic effects in the form of bradycardia [17].

Other pharmacodynamic interactions were found in the combination of Aspirin (Aspilet) with Clopidogrel, which act synergistically in inhibiting platelet aggregation. This combination is commonly used in patients with coronary heart disease but may increase the risk of bleeding if not properly monitored [20]. The high incidence of pharmacodynamic interactions in this study highlights the importance of the role of pharmaceutical personnel in prescription screening and providing drug information services to minimize the risk of side effects and improve therapeutic safety in heart disease patients [16].

CONCLUSION

Based on the evaluation of drug interactions in prescriptions for heart disease patients at XYZ Pharmacy during the January–December 2024 period, it can be concluded that potential drug interactions were still frequently found in patients receiving polypharmacy therapy. The identified interactions included both pharmacodynamic and pharmacokinetic interactions, with pharmacodynamic interactions being more dominant.

The most common drug combinations were between cardiovascular drugs and other cardiovascular drugs, accounting for 54.35%, while combinations between cardiovascular and non-cardiovascular drugs accounted for 45.65%. A total of 92 potential drug interaction cases were identified, consisting of 79.30% pharmacodynamic interactions and 20.70% pharmacokinetic interactions. These findings indicate that the use of multiple drugs in heart disease patients may increase the risk of drug interactions that can affect both the safety and effectiveness of therapy.

The identified pharmacokinetic interactions occurred during the absorption, distribution, metabolism, and excretion (ADME) phases, particularly in hepatic metabolism and renal elimination processes. These interactions may alter plasma drug concentrations, potentially increasing the risk of toxicity or reducing therapeutic effectiveness. Therefore, prescription screening and drug therapy monitoring by pharmaceutical personnel are essential to minimize the risk of drug interactions in heart disease patients. The results of this study are expected to provide useful information for improving pharmaceutical services, especially in prescription screening, drug information services, and medication therapy monitoring at XYZ Pharmacy and other healthcare facilities.

ACKNOWLEDGMENT

The author would like to express sincere gratitude to all parties who have provided support, guidance, and assistance throughout the completion of this research entitled “Evaluation of Drug Interactions in Prescriptions for Heart Disease Patients at XYZ Pharmacy in 2024.” Special appreciation is extended to the supervisors for their valuable guidance and constructive suggestions during the research process. The author also expresses gratitude to the staff of XYZ Pharmacy for their cooperation and assistance in providing the necessary data for this study. In addition, the author would like to thank all parties who contributed directly or indirectly to the successful completion of this research. It is hoped that this study will provide useful contributions to improving pharmaceutical services and enhancing

patient safety, particularly for heart disease patients.

REFERENCES

1. Aljadhey, H., et al. (2016). *Incidence of adverse drug events in an academic hospital: a prospective cohort study*. Int J Qual Health Care, 28(4), 450–455.
2. Aronson, J. K. (2016). *Meyler's side effects of drugs: The international encyclopedia of adverse drug reactions and interactions* (16th ed.). Elsevier.
3. Ayuningsih, I. (2022). *Potensi kejadian interaksi obat pada pasien penyakit jantung koroner rawat jalan di RSKD Duren Sawit*. Repository Poltekkes Kemenkes Jakarta II.
4. Badan Penelitian dan Pengembangan Kesehatan. (2018). *Laporan Nasional Riskesdas 2018*.
5. Benjamin, E. J., Muntner, P., Alonso, A., Bittencourt, M. S., Callaway, C. W., Carson, A. P., Chamberlain, A. M., Chang, A. R., Cheng, S., Das, S. R., et al. (2019). Heart disease and stroke statistics—2019 update: A report from the American Heart Association. *Circulation, 139*(10), e56–e528.
6. Crawford, C., Patel, J., & Hockings, L. (2019). Role of P-glycoprotein in cardiovascular drug interactions. *Journal of Clinical Pharmacology, 59*(9), 1175–1187.
7. Fajariyani, A., Mariyana, T., & Rachmawati, P. (2024). Kajian retrospektif potensi interaksi obat resep polifarmasi pada pasien poli jantung di Rumah Sakit X di Karawang. *The Journal General Health and Pharmaceutical Sciences Research, 2*(2), 08–16.
8. Graham, G. G., Punt, J., Arora, M., Day, R. O., Doogue, M. P., Duong, J. K., Furlong, T. J., Greenfield, J. R., Greenup, L. C., Kirkpatrick, C. M., Ray, J. E., Timmins, P., & Williams, K. M. (2016). Clinical pharmacokinetics of metformin. *Clinical Pharmacokinetics, 55*(1), 81–98.
9. Gurbel, P. A., & Tantry, U. S. (2014). Antiplatelet therapy and bleeding risk. *Circulation, 129*(25), 2686–2698.
10. Haiser, H. J., Gootenberg, D. B., Chatman, K., Sirasani, G., Balskus, E. P., & Turnbaugh, P. J. (2014). Predicting and manipulating cardiac drug inactivation by *Eggerthella lenta*. *Science, 341*(6143), 295–298.
11. Hilmer, S.N. & Gnjidic, D. (2018). *The effects of polypharmacy in older adults*. Clin Pharmacol Ther, 103(2), 186–188.
12. Islamiyah, A.N. (2021). *Telaah Potensi Interaksi Obat Resep Polifarmasi Klinik Jantung pada Salah Satu Rumah Sakit di Bandung*. Kartika: Jurnal Ilmiah Farmasi, 8(1), 25-35.
13. Kim, J., Lee, H., & Park, S. (2024). Impact of proton pump inhibitors on clopidogrel responsiveness and clinical outcomes: A systematic review. *Biomedicines, 12*(1), 115–128.
14. Li, X., Andersson, T. B., Ahlström, M., & Weidolf, L. (2021). Comparison of inhibitory effects of proton pump-inhibiting drugs on human cytochrome P450 activities. *Frontiers in Pharmacology, 12*, 694371.
15. Mangoni, A.A. & Jackson, S.H.D. (2017). *Age-related pharmacokinetic and pharmacodynamic changes: basic principles and clinical relevance*. Br J Clin Pharmacol, 83(6), 1036–1046.
16. Mengistie, Y. G., Bitew, H. B., Tuha, A., & Hailu, H. G. (2021). Assessment of Potential Drug–Drug Interactions and Their Predictors in

Chronic Outpatient Department of Dessie Referral Hospital, Northeast Ethiopia. *Drug, Healthcare and Patient Safety*, 13, 29–35.

17. Midão, L., Giardini, A., Menditto, E., Kardas, P., & Costa, E. (2018). Polypharmacy prevalence among older adults based on the survey of health, ageing and retirement in Europe. *Archives of Gerontology and Geriatrics, 78*, 213–220.
18. Mullish, B. H., Williams, H. R. T., & Marchesi, J. R. (2018). The gut microbiome and pharmacology. *Clinical Medicine, 18*(3), 224–227.
19. Page, R. L., O'Bryant, C. L., Cheng, D., Dow, T. J., Ky, B., Stein, C. M., Spencer, A. P., Trupp, R. J., & Lindenfeld, J. (2016). Drugs that may cause or exacerbate heart failure. *Circulation, 134*(6), e32–e69.
20. Palmer, B. F., & Clegg, D. J. (2019). Diuretics and potassium balance. *The New England Journal of Medicine, 381*(1), 60–72.
21. Radu, A.-F., Radu, A., Bungau, G. S., Tit, D. M., Vesa, C. M., Jurca, T., Uivarosan, D., Gitea, D., Brata, R., & Bustea, C. (2026). Polypharmacy and drug–drug interaction architecture in hospitalized cardiovascular patients: Insights from real-world analysis. *Biomedicines, 14*(1), 218.
22. Shi, S., Morike, K., & Klotz, U. (2020). *The clinical implications of ageing for rational drug therapy*. European Journal of Clinical Pharmacology, 76, 107–115.
23. Spanakis, M., Alexakis, K., & Ioannou, P. (2025). Antiretroviral therapy and associated drug interactions with cardiovascular drugs: a critical review. *Frontiers in Pharmacology*, 16, 1685710.
24. Stopfer, P., Giessmann, T., Hohl, K., Sharma, A., Ishiguro, N., Taub, M. E., Zimdahl-Gelling, H., Gansser, D., Wein, M., Ebner, T., & Mueller, F. (2016). Pharmacokinetic interaction between the MATE1 transporter inhibitor and metformin. *Clinical Pharmacology & Therapeutics, 100*(5), 482–492.
25. Suharyani, S. (2015). *Evaluasi penggunaan kombinasi obat digoksin dan furosemid pada pasien gagal jantung*. Jurnal Kesehatan, 6(2), 701–708.
26. Wedemeyer, R. S., & Blume, H. (2014). Pharmacokinetic drug interaction profiles of proton pump inhibitors. *Drug Safety, 37*(4), 201–211.
27. Weir, M. R., & Rolfe, M. (2010). Potassium homeostasis and renin–angiotensin–aldosterone system inhibitors. *Clinical Journal of the American Society of Nephrology, 5*(3), 531–548.
28. World Health Organization. (2023). Cardiovascular diseases (CVDs).