AJPR
Avicenna Journal of Pharmaceutical Research
Avicenna J Pharm Res. 2023;4(1):1-7. doi:10.34172/ajpr.1097
http://ajpr.umsha.ac.ir

Original Article

Evaluating the Impact of Medication Reconciliation Performed by Pharmacists on Medication Errors in Hospitalized Patients With Decompensated Heart Failure: A Prospective Study

Maryam Mehrpooya[1], Soraya Khodaie[1], Salman Khazaei[2], Davoud Ahmadimoghaddam[3*]

[1]Department of Clinical Pharmacy, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran
[2]Department of Epidemiology, Research Center for Health Sciences, Hamadan University of Medical Sciences, Hamadan, Iran
[3]Department of Pharmacology and Toxicology, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran

Article history:
Received: March 16, 2023
Revised: April 21, 2023
Accepted: April 29, 2023
ePublished: June 30, 2023

***Corresponding author:**
Davoud Ahmadimoghaddam,
Email: davoud1980@yahoo.com

Abstract

Background: Medication reconciliation is the process of comparing a patient's medication orders in the hospital with the patient's history of medications used prior to admission. The main purpose of this study was to investigate the effect of drug reconciliation by clinical pharmacists on preventing or reducing medication errors in patients with heart failure during admission.

Methods: This prospective study was conducted at Farshchian Heart Hospital, Hamadan University of Medical Sciences, over 6 months. Demographic characteristics and treatment details of patients in the admission phase and data related to pharmaceutical activities were collected and analyzed by clinical pharmacists.

Results: Drug combination was performed in 290 patients. At least one medication discrepancy was observed in 169 patients. The most common types of reconciliation errors were "omission" (n=163, 48.9%) and "dose" (n=71, 21.3%), respectively. About 30% of the identified unintentional inconsistencies had the ability to cause moderate to severe harm to the patient. Organized clinical physician-pharmacist recommendations were reported to be nearly 85%, and about 80% of patients were satisfied with the services provided by pharmacists during their hospitalization.

Conclusion: Our findings demonstrated that pharmacist involvement in hospital care transitions had a positive effect on reducing medication errors in heart failure. Patients with relatively complex medication regimens benefited from continuity of care, including receiving services from a clinical pharmacist during the transition of care.

Keywords: Medication reconciliation, Medication discrepancy, Hospital admission, Clinical pharmacist, Heart failure

Please cite this article as follows: Mehrpooya M, Khodaie S, Khazaei S, Ahmadimoghaddam D, Evaluating the Impact of Medication Reconciliation Performed by Pharmacists on Medication Errors in Hospitalized Patients With Decompensated Heart Failure: A Prospective Study. Avicenna J Pharm Res. 2023;4(1):1-7. doi:10.34172/ajpr.1097

Introduction

Medication therapy, despite its lower cost and lower risk than other treatment methods (e.g., surgery), if used incorrectly, can cause adverse effects in patients and even increase mortality from treatment (1). Medication error is defined as any violation and error in the patient medication process that causes harm to the patient, and several factors cause unwanted medication accidents. It is noteworthy that a high percentage of medication errors are preventable. Therefore, different methods are used to prevent these errors (2). A body of evidence indicates that when the patient's care and treatment conditions change due to insufficient communication between the previous treatment team and the new treatment team about the medications that the patient has used so far, there is a possibility of medication inconsistencies. This issue, by causing a medication error, can cause mild to severe clinical damage to the patient (3). In fact, when the patient's care conditions change, which probably leads to a change in his/her medicines, medication reconciliation aims to determine the fate of the medicines that the patient has been using so far. It also investigates, according to the doctor's opinion, whether these medications remain unchanged or should be discontinued, or whether other

parameters (e.g., dose, dosage intervals, medication forms, or ways of administration) need a change (4). Medication inconsistencies can be intentional or unintentional. In fact, based on the doctor's opinion and the patient's new conditions, it is necessary to change the patient's previous medications in the list of new medications. On the other hand, medication inconsistencies can be unintentional. It implies that the patient's previous medications have been inadvertently changed in the patient's new medication list. In fact, the purpose of medication reconciliation is to identify these unintentional medication inconsistencies that cause medication errors and can put the patient at risk of potential harm caused by medication errors (5). Although different people in the treatment staff, including doctors and nurses, can perform medication reconciliation, studies show that pharmacists can provide this type of service with higher quality and more suitable for patients (6).

A group of patients who are at risk of medication errors are patients with cardiovascular diseases, especially patients diagnosed with heart failure (7). Heart failure is a common disease and a serious threat to health, especially in the elderly, which, while causing economic damage to society, causes a significant decrease in the quality of life and premature death of these patients. It occurs when heart dysfunction causes the heart to be unable to pump enough blood to meet the body's metabolic needs (8). Medication treatment is one of the main therapeutic interventions in these patients. Considering that many medications are used for these patients, these patients are at high risk of medication errors (9). Studies have shown that pharmacist interventions, such as patient education, medication reconciliation, and medication counseling in patients with acute and chronic heart failure, increase the patient's adherence to medication treatment, improve clinical outcomes resulting from treatment, reduce medication errors and the need for repeated hospitalizations, and finally decrease costs for the patient and the health system of society (10).

In Iran, few studies have been performed in the field of medication reconciliation. The results of these studies indicate that the input of pharmacists in the process of medication reconciliation can be helpful in preventing medication errors and optimally advancing the goals of medication therapy (11,12).

According to our investigations, no study has so far been conducted in Iran to investigate the results of medication reconciliation by a pharmacist in hospitalized patients diagnosed with uncompensated heart failure. Therefore, this prospective study seeks to examine the effect of medication reconciliation on preventing medication errors in hospitalized patients with uncompensated heart failure.

Materials and Methods

Study Design

This prospective cross-sectional trial study was conducted in a specialized heart hospital in Iran. Participation in this study was suggested by a clinical resident pharmacist to adult patients (over 18 years old) with a history of HF . All participants provided written informed consent before entering the study, and medication reconciliation was routinely performed in the hospitalization phase for patients by the retroactive method.

Participants

Adult patients who were admitted to the general and intensive care units of Farchian Heart Hospital in Hamadan from December 2022 to June 2023 and were taking at least 3 medications were included in this study. Both the patient's medical history and a written informed consent-form were obtained from the patients or their companions before participating in the study. Patients were excluded from the study if it was impossible to collect the necessary demographic, clinical, and medication information from them or their companions or if the information related to the study objectives could not be recorded for them.

Data Collection

A form was provided for each patient. It was designed based on the medication reconciliation form of the Ministry of Health and Medical Education of Iran for the pharmaceutical consolidation of hospitalized patients, which was modified by the research team based on study objectives. The first part of this questionnaire included characteristics and basic demographic information, such as age, gender, marital status, place of residence (village or city), level of education, income level, insurance status, and employment status, as well as required clinical information, including the number and type of concurrent diseases. In addition, in this part of the checklist, there was a section where the student researcher recorded the patient's medical history in summary form. The second part of this form included the part where the number and type of medications currently consumed by the patient (before the doctor's visit) were entered and recorded, which encompassed the name of the medication, the form of the medication, the dose of the medication, and the intervals of its use. After medication reconciliation, the required information was entered into the checklist based on the objectives of the study.

To classify diseases, the World Health Organization classification system was used, which is available at http://www.int.who.icd/browse10/2016/en#/i/. The ATC 2018 classification system of the World Health Organization, which is available at http://www.whocc.noatc-ddd-index/, was utilized to classify drugs.

Pharmaceutical Intervention

During the admission of patients, it was attempted to enter the study under the supervision of a pharmaceutical student in a proportional ratio in terms of age and gender. For this purpose, the research student appeared at the patient's bedside and performed the *medication reconciliation*

steps. In the history stage, the student researcher took relevant demographic and clinical information from the patient or the patient's companion and entered this information in the relevant checklist designed for this purpose for each patient. In cases where the information obtained from the patients or their companions regarding the patient's medical and clinical records was insufficient, the necessary information was obtained from the medical record or the attending physician. To describe the medical history of the patients, which was the main part of the *medication reconciliation* process, the research student interviewed the patients or their companions. Further, she attempted to prepare the most accurate history of the patient's medications from other information sources of the patient, such as the patient's previous prescription, if the patient was insured, the patient's insurance book, and if the patient had her own medications. This medication record included all the medications that the patient was taking, including medications prescribed by the doctor, non-prescription medications that the patient prepared and used, herbal medications, and nutritional supplements. The medications prescribed to the patients at the time of admission to the hospital were also extracted from the patients' medication cards. Then, the medications consumed by the patient before hospitalization and the medications prescribed in the hospital were compared, and the inconsistencies in the *medications* used by the patient were identified and entered in the standard *medication reconciliation* form designed by the Ministry of Health and Medical Education. In the process of *medication reconciliation*, the research student compared the patient's new drugs with her previous medications. Based on this comparison, the patient's medications were placed in seven groups, including medicines that remain unchanged in the patient's new medicine list, medicines that have been discontinued in the patient's new medicine list, and medicines whose dosage has been changed in the patient's new medicine list. The other groups were medicines whose usage intervals have been changed in the patient's new medicine list, medicines whose pharmaceutical form has been changed in the patient's new medicine list, medicines that have been changed in the patient's new medicine list, and medicines added to the patient's new medicine list.

Moreover, from a clinical point of view, unintentional medication inconsistencies have the ability to potentially harm the patient and endanger the patient's safety since they are medication errors. After the completion of the study, two other clinical pharmacists who were not part of the research team retrospectively classified these unintentional medication discrepancies into four groups (without harm, mild, moderate, and severe) according to the patient's medical and clinical records. This division was based on similar previous studies, including the study performed by Cornish et al (13). In this way, the inconsistencies were examined by two clinical pharmacists, and each of these unintentional inconsistencies was placed in the following four categories based on the possibility of damage:

- Class 1: Medication inconsistencies that are unlikely to cause problems for the patient or worsen his/her clinical conditions.
- Class 2: Medication inconsistencies that can cause problems or worsen the patient's clinical conditions to a mild extent.
- Class 3: Medication inconsistencies that can cause problems or worsen the patient's clinical conditions to a moderate extent.
- Class 4: Medication inconsistencies that can cause problems or worsen the patient's clinical conditions to an extreme extent.

Study Outcomes

The primary outcome of determining the effect of medication reconciliation by the pharmacist on preventing medication errors in hospitalized patients with heart failure was uncompensated.

The secondary outcomes were comparing the drug history taken by the doctor with the drug history taken by the pharmacist, determining the frequency of unintentional medication discrepancies in hospitalized patients with uncompensated heart failure, and estimating the frequency of patients with at least one unintentional medication discrepancy. Determining the frequency of unintentional medication inconsistency in the patients under study and measuring the frequency of drug incompatibility based on the category of drugs used were the other secondary outcomes. In addition, two other outcomes included investigating the relationship between the frequency of drug inconsistencies and the demographic and clinical factors of patients (e.g., age, gender, marital status, education level, place of residence, income level, duration of illness, number of co-morbidities, and number of medications) and determining the frequency of potential harm due to unintentional drug inconsistencies identified. Other secondary outcomes were measuring the frequency of accepting or not accepting the pharmacist's intervention to resolve inconsistencies during medication reconciliation by the doctor, determining the time required for medication reconciliation by the pharmacist, and estimating the cost of manpower for medication reconciliation by the pharmacist.

Statistical Analysis

According to the study of Mehrpouya et al, the prevalence of unintentional medication inconsistency in the patients under study was 0.57, and considering the confidence interval of 95% and the accuracy of estimation equal to 0.057, the sample size was determined as 290 people using the following formula:

$$\frac{z_{1-\frac{\alpha}{2}}^{2} \times p(1-p)}{d^2}$$

SPSS statistical software (version 20) was utilized

to analyze the data. The information obtained from the patients' checklist and related forms was coded and entered into SPSS software. To analyze the data, descriptive statistics (means and standard deviations, as well as frequencies and percentages) were employed for quantitative and qualitative data, respectively. An independent t-test and the Chi-square test were used to compare quantitative and qualitative variables, respectively. In this study, a *P*-value of less than 0.05 was considered statistically significant.

Results

Population Description

Among the 386 examined patients, 96 were excluded from the study at the beginning, 70 patients were excluded due to the lack of inclusion criteria (including not being over 18 years old and not taking at least 3 medicines daily), 10 cases of communication with patients failed, and 16 patients were not satisfied to participate in the study. Finally, medication reconciliation was performed at the time of admission for 290 patients who met the inclusion criteria and were satisfied to participate in the study. A total of 290 patients (out of 386 examined patients) who received medication reconciliation services during hospitalization were included in this study. The flowchart of the study is depicted in Figure 1. The characteristics of the patients are presented in Table 1. The proportion of men was 53.6% (n = 154), and the gender ratio was 1.13 (Table 1). The average age was 67 years, with a minimum age of 32 years and a maximum age of 95 years. The common underlying diseases in the patients included hypertension, lipid disorders, and diabetes, and on average, each patient suffered from an average of 3.43 ± 1.2 concurrent diseases. The median left ventricular ejection fraction was 32%, and most patients were in class 3 severities of left ventricular dysfunction.

General Results of Medication Reconciliation

A total of 904 cases of medication discrepancies were identified based on the results. The average time required by the pharmacist for medication reconciliation for each patient was 34 minutes (Table 2). After examining patients based on their clinical conditions at the time of admission, 571 (63.10%) and 333 (36.80%) cases were classified by the clinical pharmacist as intentional and unintentional medication discrepancies, respectively. Based on these results, 169 out of 290 patients (58.15%) had at least one medication discrepancy at the time of admission, with an average incidence of 1.26 unintentional medication discrepancies per patient (Figure 2).

The most common type of reconciliation error was "omission of a drug" (48.9%), followed by "change of medication dose" (21.3%). Figure 3 illustrates the types of identified reconciliation errors.

Moreover, unintentional medication inconsistencies were investigated in terms of the severity of causing potential harm to the patient by the student pharmacist. Out of a total of 337 unintentional medication inconsistencies detected at the time of admission, 234 (69.43%), 77 (22.8%), and 24 (7.12%) cases could cause mild, moderate, and severe clinical harm to the patient, respectively (Figure 4).

On the other hand, a high percentage of unintentional medication discrepancies were related to non-cardiovascular agents (250 out of 337 cases of unintended drug discrepancies identified). Considering that non-cardiovascular agents were not in the specialty of doctors

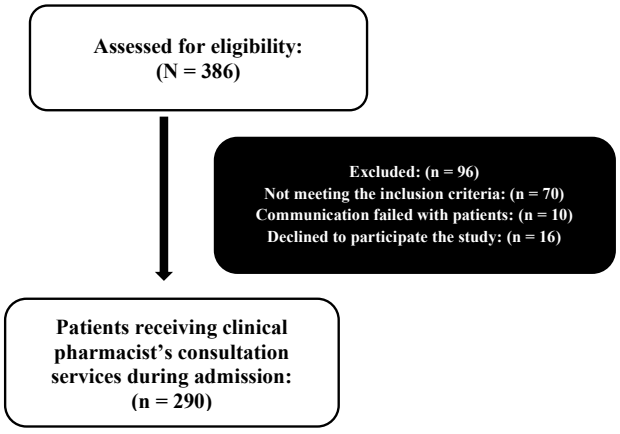

Figure 1. Diagram of Patients' Participation in the Study

Table 1. Demographic Characteristics and Concurrent Diseases of Patients Participating in the Study

Characteristics	No. (%)
Age groups	
Less than 50 years	33 (11.2)
Between 50 and 65 years	99 (33.6)
More than 65 years	158 (53.6)
Median age (years) ± SD (range)	66.68 ± 13.36 (32-95)
Sex	
Female	136 (46.9)
Male	154 (53.1)
Concomitant diseases	
Hypertension, n (%)	247 (85.1)
Lipid disorders, n (%)	199 (68.6)
Diabetes, n (%)	162 (55.8)
Respiratory diseases, n (%)	74 (25.5)
Gastrointestinal diseases, n (%)	63 (21.7)
Neurological diseases, n (%)	41 (14.1)
Mental disorder, n (%)	22 (7.5)
Rheumatology diseases, n (%)	19 (6.5)
Median diseases ± SD (range)	3.43 ± 0.7 (1-5)
LVEF (Median diseases ± SD)	31.57 ± 5.02
Severity of heart failure	
Class 1, n (%)	3 (0.68)
Class 2, n (%)	69 (24)
Class 3, n (%)	190 (67.5)
Class 4, n (%)	29 (9.6)

Note. SD: Standard deviation; LVEF: Left ventricular ejection fraction.

Table 2. Time Analysis of Medication Reconciliation at the Time of Admission

Characteristics	Frequency
The time between the patient's visit and medication reconciliation (hours)	13 ± 5
Median ± SD (range)	(7-23)
The time required to perform medication reconciliation at the time of admission (minutes: hours)	(00:34 ± 00:10)
Median ± SD (range)	(00:20 ± 01:10)

Note. SD: Standard deviation.

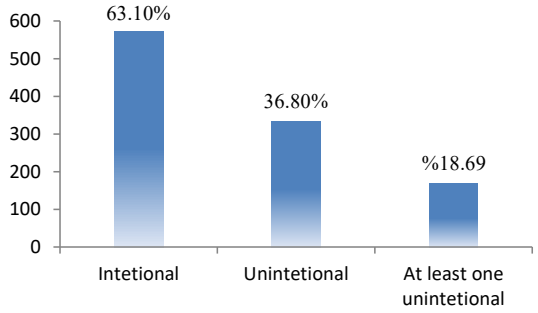

Figure 2. The Frequency of Intentional and Unintentional Medication Discrepancies Identified at the Time of Admission

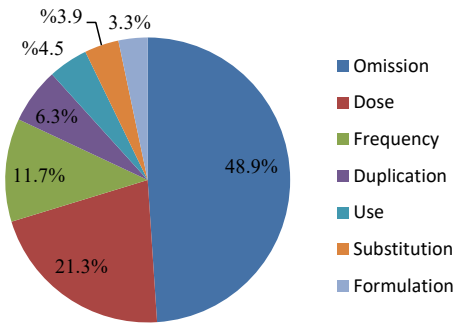

Figure 3. The Frequency of Types of Unintentional Medication Discrepancies

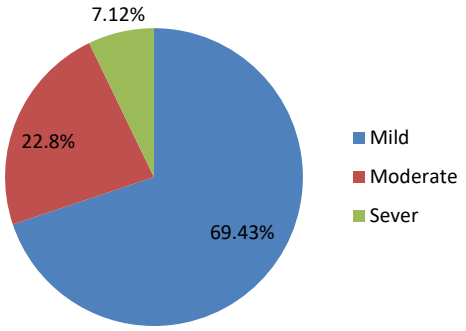

Figure 4. The Frequency of the Type of Unintentional Medication Inconsistencies Identified in Terms of the Severity of Potential Harm to the Patient

treating the patients, many of these medications were not included in the list of agents taken by the patient in the medication history taken from the patient, and no specific advice was given to the patient by the relevant doctor to continue or stop it (Table 2). Table 3 provides the frequency of unintentional medication discrepancies based on drug category.

Discussion

Studies have shown that interventions by clinical pharmacists can improve drug-related problems and influence positive clinical outcomes in inpatient and outpatient care settings (14). It has been found that the recognition of medication inconsistencies, which are dependent on various factors (e.g., older age and the number of medications before admission), is needed to solve drug-related problems (5,15-17). A comprehensive reconciliation process is necessary to more clearly review the results of pharmacist interventions (18). To evaluate outcomes based on drug-related measures, such as medication omissions and inappropriate prescribing, a prospective clinical study was conducted to investigate the effectiveness of pharmacist interventions for patients with heart failure during admission.

The service was useful for detecting unintentional discrepancies, and more than 85% of clinical pharmacist recommendations were accepted by physicians. About 19% of hospitalized patients had at least one medication discrepancy during admission. The rate of medication errors was reduced in this study. This result is consistent with previous findings, showing that an intervention involving pharmacist medication reconciliation reduced the rate of medication errors and adverse events during admission and helped improve medication safety (18,19).

In a study in Croatia, it was found that 35% of hospitalized patients had at least one unintentional discrepancy in internal services (20). Further, Cornish et al observed at least one unintentional discrepancy among their patients during inpatient admissions (21). In the present study, the increased rate of having at least one unintentional discrepancy was likely due to the study population, including patients with uncompensated heart failure. Consistent with the findings of this study, previous studies reported a high number of medications as a factor associated with unintentional discrepancy during admission (20,21).

According to Enver et al, the most common reason for unintentional discrepancy was medication omission (22), which is in line with our results. Antihypertensive drugs, antiplatelet agents, and beta-blockers were among the drugs in which unintentional discrepancies were found. On the other hand, short-term discontinuation of these drugs may lead to severe potential harm. For example, in a Canadian study, more than half of prescription-drug discrepancies (56.8%) were classified as potentially causing moderate/severe discomfort (23). In our study, 29.92% of unintentional discrepancies had the potential to cause moderate to severe harm, which cannot be ignored, demonstrating the importance of medication reconciliation in improving the health quality of people in the hospital.

Study Limitations

This study had some limitations. It was conducted in a single center, which limited the generalizability of the

Table 3. The Frequency of Unintentional Medication Discrepancies in Terms of Drug Category

Characteristics	No. (%)
Cardiovascular agents	Total N = 89
Antiplatelet agents	31 (34)
Antilipidemic agents	16 (17)
Beta blockers	8 (8.9)
Calcium channel blockers	6 (6.7)
Anticoagulants agents	10 (2.11)
Angiotensin enzyme inhibitors	6 (6.7)
Angiotensin receptor antagonists	7 (7.8)
Diuretics	2 (2.2)
Antiarrhythmic agents	3 (3.3)
Non-cardiovascular agents	Total N = 250
Gastrointestinal agents	104 (41.6)
Psychiatric medications	84 (33.6)
Musculoskeletal agents	37 (14.8)
Respiratory agents	18 (2.7)
Hematological agents	7 (2.8)

findings. The cost and effect of medication reconciliation at the discharge stage were not investigated in this study. Actual harms, including medication errors related to these discrepancies, could not be assessed with the protocol of this study. The implementation of this service (by phone) can reduce the number of unintentional discrepancies in hospitalized patients with heart failure and the high risk of medication errors. Further studies should evaluate the number of medication reconciliation services provided in the first 24 hours to hospitalized patients with heart failure.

Conclusion

Our findings revealed that medication reconciliation can identify and resolve inconsistencies. In addition, drug review appears to ensure that medication therapy better meets patient needs and can be used to help hospitals and health systems prioritize interventions to improve drug safety during care transitions. Future research should determine the clinical relevance of these interventions.

Competing Interests

The authors declare that they have no conflict of interests.

References

1. Ernst FR, Grizzle AJ. Drug-related morbidity and mortality: updating the cost-of-illness model. J Am Pharm Assoc (Wash). 2001;41(2):192-9. doi: 10.1016/s1086-5802(16)31229-3.
2. Karthikeyan M, Balasubramanian T, Khaleel MI, Sahl M, Rashifa P. A systematic review on medication errors. Int J Drug Dev Res. 2015;7(4):9-11.
3. Johnson A, Guirguis E, Grace Y. Preventing medication errors in transitions of care: a patient case approach. J Am Pharm Assoc (2003). 2015;55(2):e264-76. doi: 10.1331/JAPhA.2015.15509.
4. Almanasreh E, Moles R, Chen TF. The medication reconciliation process and classification of discrepancies: a systematic review. Br J Clin Pharmacol. 2016;82(3):645-58. doi: 10.1111/bcp.13017.
5. Al-Rashoud I, Al-Ammari M, Al-Jadhey H, Alkatheri A, Poff G, Aldebasi T, et al. Medication discrepancies identified during medication reconciliation among medical patients at a tertiary care hospital. Saudi Pharm J. 2017;25(7):1082-5. doi: 10.1016/j.jsps.2017.05.004.
6. Al-Hashar A, Al-Zakwani I, Eriksson T, Al Za'abi M. Whose responsibility is medication reconciliation: physicians, pharmacists or nurses? A survey in an academic tertiary care hospital. Saudi Pharm J. 2017;25(1):52-8. doi: 10.1016/j.jsps.2015.06.012.
7. Freedman JE, Becker RC, Adams JE, Borzak S, Jesse RL, Newby LK, et al. Medication errors in acute cardiac care: an American Heart Association scientific statement from the council on clinical cardiology subcommittee on acute cardiac care, council on cardiopulmonary and critical care, council on cardiovascular nursing, and council on stroke. Circulation. 2002;106(20):2623-9. doi: 10.1161/01.cir.0000037748.19282.7d.
8. Hoekstra T, Jaarsma T, van Veldhuisen DJ, Hillege HL, Sanderman R, Lesman-Leegte I. Quality of life and survival in patients with heart failure. Eur J Heart Fail. 2013;15(1):94-102. doi: 10.1093/eurjhf/hfs148.
9. Milfred-Laforest SK, Chow SL, Didomenico RJ, Dracup K, Ensor CR, Gattis-Stough W, et al. Clinical pharmacy services in heart failure: an opinion paper from the Heart Failure Society of America and American College of Clinical Pharmacy Cardiology Practice and Research Network. J Card Fail. 2013;19(5):354-69. doi: 10.1016/j.cardfail.2013.02.002.
10. Anderson SL, Marrs JC. A review of the role of the pharmacist in heart failure transition of care. Adv Ther. 2018;35(3):311-23. doi: 10.1007/s12325-018-0671-7.
11. Karimzadeh I, Mirjalili M, Mirzaei E, Mottaghi S, Vazin A. Medication reconciliation at admission by pharmacists in a teaching referral hospital in Iran. Trends Pharm Sci Technol. 2019;5(1):65-72.
12. Mehrpooya M, Khorami MR, Mohammadi M, Mohammadi Y, Ahmadimoghaddam D. Clinical pharmacists' contribution to medication reconciliation in outpatient specialty clinics in Iran. Curr Drug Saf. 2022;17(3):259-68. doi: 10.2174/1574886316666211123101002.
13. Cornish PL, Knowles SR, Marchesano R, Tam V, Shadowitz S, Juurlink DN, et al. Unintended medication discrepancies at the time of hospital admission. Arch Intern Med. 2005;165(4):424-9. doi: 10.1001/archinte.165.4.424 .
14. Phatak A, Prusi R, Ward B, Hansen LO, Williams MV, Vetter E, et al. Impact of pharmacist involvement in the transitional care of high-risk patients through medication reconciliation, medication education, and postdischarge call-backs (IPITCH study). J Hosp Med. 2016;11(1):39-44. doi: 10.1002/jhm.2493 .
15. Pippins JR, Gandhi TK, Hamann C, Ndumele CD, Labonville SA, Diedrichsen EK, et al. Classifying and predicting errors of inpatient medication reconciliation. J Gen Intern Med. 2008;23(9):1414-22. doi: 10.1007/s11606-008-0687-9.
16. Gleason KM, McDaniel MR, Feinglass J, Baker DW, Lindquist L, Liss D, et al. Results of the Medications at Transitions and Clinical Handoffs (MATCH) study: an analysis of medication reconciliation errors and risk factors at hospital admission. J Gen Intern Med. 2010;25(5):441-7. doi: 10.1007/s11606-010-1256-6.
17. Unroe KT, Pfeiffenberger T, Riegelhaupt S, Jastrzembski J, Lokhnygina Y, Colón-Emeric C. Inpatient medication reconciliation at admission and discharge: a retrospective cohort study of age and other risk factors for medication discrepancies. Am J Geriatr Pharmacother. 2010;8(2):115-26. doi: 10.1016/j.amjopharm.2010.04.002.
18. Hovey SW, Click KW, Jacobson JL. Effect of a pharmacist

admission medication reconciliation service at a children's hospital. J Pediatr Pharmacol Ther. 2023;28(1):36-40. doi: 10.5863/1551-6776-28.1.36.

19. Phatak A, Prusi R, Ward B, Hansen LO, Williams MV, Vetter E, et al. Impact of pharmacist involvement in the transitional care of high-risk patients through medication reconciliation, medication education, and postdischarge call-backs (IPITCH study). J Hosp Med. 2016;11(1):39-44. doi: 10.1002/jhm.2493.
20. Marinović I, Marušić S, Mucalo I, Mesarić J, Bačić Vrca V. Clinical pharmacist-led program on medication reconciliation implementation at hospital admission: experience of a single university hospital in Croatia. Croat Med J. 2016;57(6):572-81. doi: 10.3325/cmj.2016.57.572.
21. Cornish PL, Knowles SR, Marchesano R, Tam V, Shadowitz S, Juurlink DN, et al. Unintended medication discrepancies at the time of hospital admission. Arch Intern Med. 2005;165(4):424-9. doi: 10.1001/archinte.165.4.424.
22. Enver C, Ertürk Şengel B, Sancar M, Korten V, Okuyan B. Medication reconciliation service in hospitalized patients with infectious diseases during coronavirus disease-2019 pandemic: an observational study. Turk J Pharm Sci. 2023;20(4):210-7. doi: 10.4274/tjps.galenos.2022.08455.
23. Villanyi D, Fok M, Wong RY. Medication reconciliation: identifying medication discrepancies in acutely ill hospitalized older adults. Am J Geriatr Pharmacother. 2011;9(5):339-44. doi: 10.1016/j.amjopharm.2011.07.005.