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Medication Reconciliation Service in Hospitalized Patients with Infectious Diseases During Coronavirus Disease-2019 Pandemic: An Observational Study

Short Title: Medication Reconciliation Service During COVID-19

Cüneyd Enver[1], Buket Ertürk Sengel[2], Mesut Sancar[1], Volkan Korten[2], Betül Okuyan[1]
[1]Marmara University, Faculty of Pharmacy, Department of Clinical Pharmacy, Istanbul, Turkey
[2]Marmara University, School of Medicine, Department of Infectious Diseases and Clinical Microbiology, Istanbul, Turkey

Corresponding Author Information
Betül Okuyan
betulokuyan@yahoo.com
+90 533 330 03 53
https://orcid.org/0000-0002-4023-2565
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07.10.2022

ABSTRACT
Objectives: To determine the prevalence and type of medication discrepancies and factors associated with unintentional discrepancies and identify the rate of hospital readmission and emergency service visit within 30 days after discharge among hospitalized patients with infectious diseases and receiving clinical pharmacist-led medication reconciliation during the Coronavirus Disease 2019 pandemic.
Materials and Methods: This observational study was conducted in the internal medicine and infectious diseases wards of a tertiary university hospital between July 2020 and February 2021 among hospitalized adult patients with any infectious diseases. Medication reconciliation service [including patient counseling]) was provided in-person or by telephone. The number and type of medication discrepancies detected during the medication reconciliation services, the acceptance rate of pharmacist's recommendation, and factors associated with having at least one unintentional medication discrepancy at admission were evaluated. At follow-up, hospital readmission and emergency service visit within 30 days after discharge was assessed by telephone.
Results: Among 146 patients, 84 patients (57.5%) had at least one unintentional discrepancy at admission. Only three unintentional discrepancies were determined in three patients at hospital discharge. All the pharmacist's recommendations for medication discrepancies were accepted by the physicians. Having COVID-19 (OR=2.25, 95% CI:1.15-4.40; $p<0.05$), being high risk for medication error (OR=2.01, 95% CI:1.03-3.92; $p<0.05$), and higher number of medications used at home (OR=1.41, 95% CI:1.23-1.61; $p<0.001$) were associated with having at least one unintentional discrepancy at admission. The rates of 30-day hospital readmission and admission to emergency medical service were 12.3% and 15.8%, respectively.
Conclusion: Medication reconciliation service provided by in-person or by telephone was useful to detect and solve unintentional medication discrepancies during the COVID-19 pandemic.

***Key words**:* Medication reconciliation, clinical pharmacist, infectious disease medicine, COVID-19, unintentional discrepancy

INTRODUCTION

Medication reconciliation is "a formal process for creating the most complete and accurate list possible of a patient's current medications and comparing the list to those in the patient record or medication orders" to avoid medication errors such as duplications, and omissions [1]. Medication reconciliation could be reduced medication errors and related harms. Providing, recording, and passing along the current and correct medications list of the patient is essential for patient safety, especially during the transition of care (including hospital admission and/or discharge) [2].

Medication reconciliation can be provided by various healthcare professionals. However, studies have shown that services such as medication reconciliation and discharge patient consultation led by pharmacists increased patients' knowledge of medication and reduced adverse drug events and medication errors in the transition of care [3-4]. Pharmacists, who have diverse knowledge, and skills, can establish and maintain an effective medication reconciliation process in hospitals and healthcare systems [5]. Medication reconciliation led by an inpatient pharmacist is an effective method for maintaining the patient's post-discharge care [6]. A review published in Cochrane Library concluded that the impact of pharmacist-involved medication reconciliation services was unclear on medication discrepancies, adverse drug effects, and health values [7]. Medication discrepancy is defined as the differences between medication regimens given in different care settings and often results from lack of documentation and time to create complete and accurate list of the patients' medication history. Therefore, medication reconciliation is an essential component in ensuring safe patient care by preventing medication discrepancy in any setting [1,7].

Clinical pharmacists (CPs) provided medication reconciliation services in patient with various infectious diseases [8-9]. In the infectious disease ward, medication reconciliation reduced the number of undocumented unintentional discrepancies [10] and hospital readmission within a month after discharge [11]. Amid the coronavirus disease 2019 (COVID-19) pandemic, CPs continued to provide services (including medication reconciliation) with different working models [12-13]. Medication reconciliation service is not provided routinely at hospitals in Turkey. There are few studies in Turkey about medication reconciliation services provided in hospitalized older patients at admission [14] and in patients admitted to oncology and internal medicine service [15].

The aim of the study was to determine the prevalence and type of medication discrepancies and factors associated with unintentional discrepancies and identify the rate of hospital readmission and emergency service visit within 30 days after discharge among hospitalized patients with infectious diseases and receiving clinical pharmacist-led medication reconciliation during the Coronavirus Disease 2019 (COVID-19) pandemic. STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology statement) was followed to report this observational study [16].

METHODS

Study Design and Setting

This observational study was conducted in the internal medicine and infectious diseases wards of a tertiary university hospital between July 2020 and February 2021 among hospitalized adult patients with any infectious diseases (including COVID-19).

Study Population and Recruitment

All hospitalized adult patients with infectious diseases who had chronically utilized at least one medication before hospital admission were eligible for this study. All the eligible patients were included in this study without using any specific sampling method. The medication reconciliation services (including gathering the best possible medication history) were provided by the CP within 48 hours after hospital admission in person or by telephone. The patients were excluded from the study if they were transferred to an intensive care unit or another hospital, who stayed in the hospital for less than 24 hours, who died, who refused the therapy, who were unwilling to continue after participating, and who did not receive medication reconciliation service provided by CP within 48 hours after hospital admission.

Medication Reconciliation

Neither hospital pharmacists nor clinical pharmacy residents have been involved in medication history taking and medication reconciliation services in this hospital. There was no discharge patient counseling service provided routinely by pharmacists. During this study, medication reconciliation service (both at

admission and discharge [including patient counseling service]) was provided in person or by telephone. These services were provided by the clinical pharmacy resident who had theoretical and clinical courses during his education and training for clinical pharmacy services.

Medication reconciliation service flow charts were adapted from previous projects [17-18]. The best possible medication history (including prescribed medications, OTC drugs, herbal, and dietary supplements) was taken within 48 hours after hospital admission in person and by telephone. At least two resources (such as self-reports of patients and/or caregivers, electronic medication records, and home medicine list) were used for obtaining the best possible medication history [18].

During medication reconciliation service at hospital admission, a current and accurate medication list was provided by comparing the physicians' orders at admission with their best possible medication history for home medicines. At hospital discharge, medications used in the last 24 hours before hospital discharge, the discharge prescription, and the best possible medication history for home medicines were assessed by a clinical pharmacy resident. The medication discrepancies were discussed with the physicians at hospital admission and discharge to provide a current and accurate medication list. At hospital discharge, according to the current and accurate medication list, pill cards (including pictograms) [19], and brochures (including low molecular weight heparin prescribed for patients with COVID-19) were provided to the patients by the CP. Patient counseling was provided by using the teach-back method [20].

Data Collection and Variables

Data including age, sex, education level, having COVID-19, duration of hospital stay, the number of medications used at home and the Charlson Comorbidity Index [21] was collected at baseline. For evaluating the risk of medication error, SCOREM Index [22]. was calculated. If the total score of SCOREM Index was three or greater, the patients were considered as high risk for medication error. Patients' all medications (including prescribed and OTC medications) were recorded. The risk of mortality and unplanned hospital readmission at hospital discharge was calculated by using LACE Index [23]. If the score of LACE Index was 10 points or higher (out of 19), the patients were considered as with high risk for mortality, and unplanned hospital readmission.

Primary outcomes were prevalence and type of medication discrepancies, and factors associated with unintentional medication discrepancies. The number of discrepancies detected during the medication reconciliation service was evaluated and classified according to MedTax (Medication Discrepancy Taxonomy) [24]. Resources for obtaining the best possible medication history were recorded. At follow-up, the history of readmission to the hospital or emergency service within 30 days after discharge was assessed by telephone calls.

Ethics approval

The study protocol was approved by Marmara University, School of Medicine Clinical Trials Ethical Committee (date: June 12, 2020, and number: 09.2020.508). The required permission to conduct this study was taken from The Republic of Turkey, Ministry of Health. Informed consent was taken from patients and/or caregivers.

Sample Size Calculation

As in the study conducted by Cornish et al [25], all eligible patients were consecutively included to this study. In a previous study, the rate of patients with at least one unintended medication discrepancy was 47% in internal medicine wards [26]. It was assumed that the rate would be 60% in the study population during the COVID-19 pandemic. The sample size was calculated as 96 with alpha at 0.05 and power of 0.80 to detect the prevalence of unintentional discrepancies [27].

Data Analysis

Descriptive statistics were presented as number (n) with percentage, and median (interquartile range [IQR]). $p<0.05$ was considered statistically significant. According to the findings of the Kolmogorov-Smirnov test, nonparametric statistics were conducted in this study. Fischer's exact test was used to compare two groups (w/wo COVID-19, and with high risk or low risk according to LACE Index). Univariate logistic regression analysis was performed to determine factors associated with unintentional discrepancies. The odds ratio (confidence interval 95%) was presented. Statistical analysis was done using IBM SPSS (Statistical Package for Social Sciences) 11.0 Statistics.

RESULTS

A total of 146 patients who received medication reconciliation service during hospital admission were included in the study. Among them, 90 patients (61.6%) received clinical pharmacist-led medication reconciliation both at admission and discharge. The flow diagram of the study is displayed in Figure 1. The characteristics of the patients are shown in Table 1.

The most common sources for providing the best possible drug history on admission were the patient's medical record (93.8%), the patient's medication boxes (76.0%), and the patient's self-report (66.4%).

At hospital admission, the median of total discrepancies was 7.0 [5.0-10.0], the median of intentional discrepancies was 6.0 [4.0-9.0], and the median of unintentional discrepancies was 1.0 [0.0-2.0]. Among them, 99.3% (n=145) had at least one intentional discrepancy and 57.5% (n=84) had at least one unintentional discrepancy at hospital admission. At hospital discharge (n=90), the median of total discrepancies was 3.0 [2.0-5.0] and the median of intentional discrepancies was 3.0 [2.0-4.25]. Among them (n=90), 94.4% (n=85) had at least one intentional discrepancy and only three unintentional discrepancies were determined in three patients at hospital discharge. The most common unintentional discrepancy was drug omission (n=142; 74.7%) at admission. All the pharmacist's recommendations for medication discrepancies were accepted by the physicians. The frequency and type of medication discrepancies according to Medication Discrepancy Taxonomy (MedTax) were presented in Table 2.

Having COVID-19 (OR=2.25, 95% CI: 1.15-4.40; $p<0.05$), being high risk for medication error according to SCOREM Index (OR=2.01, 95% CI: 1.03-3.92; $p<0.05$), and higher number of medications used at home (OR=1.41, 95% CI: 1.23-1.61; $p<0.001$) were associated with having at least one unintentional discrepancy. Factors associated with having at least one unintentional discrepancy were presented in Table 3.

Of 146 patients who received medication reconciliation at admission, 78.8% had a high risk of mortality and unplanned hospital readmission (Table 1). Among these patients (n=146), the rates of 30-day hospital readmission, and emergency medical service visits were 12.3% and 15.8%, respectively. In 90 patients who received medication reconciliation both at hospital admission and discharge, 80.0% had high a risk of mortality and unplanned hospital readmission (Table 1). Among these patients (n=90), the rates were 10.0% for 30-day hospital readmission and 14.4% for emergency medical service visit. According to LACE Index, patients with high risk had a significantly higher rate of emergency medical service visits within 30 days when compared with patients with low risk ($p<0.05$). Patients with infectious diseases other than COVID-19 had a significantly higher rate of hospital readmission within 30 days compared with patients with COVID-19 ($p<0.05$). Secondary outcomes during follow-up in patients who received medication reconciliation service were presented in Table 4.

DISCUSSION

To the best of our knowledge, this is the first study to determine the prevalence and type of medication discrepancies and factors associated with unintentional discrepancies and identify the rate of hospital readmission and emergency service visit within 30 days after discharge among hospitalized patients with infectious diseases and receiving clinical pharmacist-led medication reconciliation during the Coronavirus Disease 2019 pandemic in Turkey. This service was found useful to detect unintentional discrepancies and all recommendations of CPs were accepted by the physicians. More than half of hospitalized patients with infectious diseases had at least one unintentional medication discrepancy at admission. However, the number of patients with at least one unintentional medication discrepancy at discharge was only three in patients receiving medication reconciliation both at admission and discharge. Patients with COVID-19, with a high risk for medication errors, and higher medications were more likely to have at least one unintentional medication discrepancy at admission during the COVID-19 pandemic.

In Croatia, it was found that 35% of the patients admitted to internal medicine service had at least one unintentional discrepancy [28]. In Italy, one-fourth of patients had at least one unintentional discrepancy at hospital admission and discharge [29]. Cornish et al [25] determined half of the patients used four or more medications and had at least one unintentional discrepancy during admission to the internal medicine ward. In China, more than one-fifth of patients had at least one unintentional discrepancy [30]. In the present study, an increased rate of having at least one unintentional discrepancy is likely due to the study population including patients with COVID-19. In line with the finding of the present study, previous studies [28, 30-31] showed a high number of medications as a factor related to unintentional discrepancy at admission. Like the present study, the most common reason for the unintentional discrepancy was the omission of medication in these studies [25, 28-31].

In the present study, the number of unintentional discrepancies was more than half at hospital admission. On the other hand, only three unintentional discrepancies were detected by CP. Cadman et al. demonstrated a reduction in the number of unintentional discrepancies at discharge after providing medication reconciliation at admission [32].

This study had some limitations. This study was conducted in a single center, which limited the generalizability of the findings. Actual or potential harms including medication errors related to these discrepancies could not be evaluated with this study protocol. The average time to spend providing medication reconciliation was not recorded and assessed because of non-feasible amid the COVID-19 pandemic. Although it was suggested to provide medication reconciliation service within 24 hours [17], the medication reconciliation was provided within 48 hours amid the COVID-19 pandemic. This could impact the effectiveness of this service.

Further studies will evaluate the impact of medication reconciliation service in hospitalized patients with infectious diseases. Implementing this service (in person or by telephone) could decrease the number of unintentional discrepancies in hospitalized patients with COVID-19 and/or high risk for medication errors. This study was conducted amid COVID-19 pandemic by one clinical pharmacist. This impact on rate of patients received clinical pharmacist-led medication reconciliation both at admission and discharge medication reconciliation at discharge.

Conclusion

Medication reconciliation service provided in-person or by telephone was useful to detect and solve unintentional medication discrepancies during the COVID-19 pandemic.

Declarations

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Conflict of interest disclosure statements

The authors declare no conflict of interest.

Author contributions

All authors contributed to the study conception, design, material preparation, data collection and analysis The first draft of the manuscript was written by Betul Okuyan, and all authors reviewed the manuscript. All authors read and approved the final manuscript.

Data availability

Data are available from the corresponding author on reasonable request.

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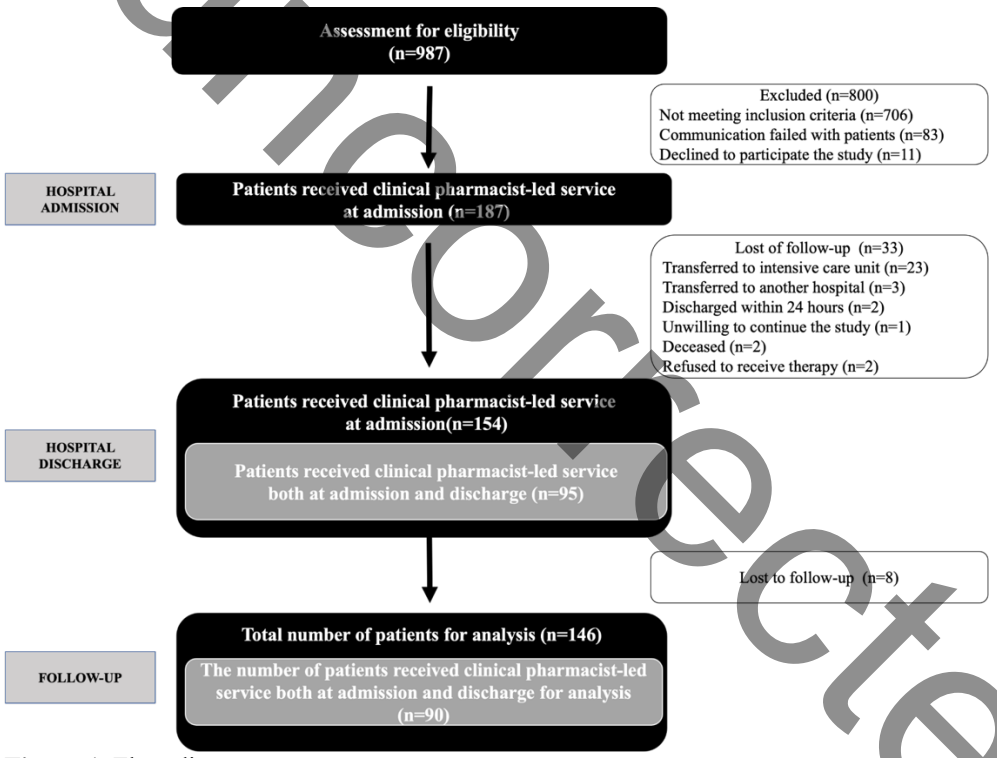

Figure 1. Flow diagram

Table 1. Characteristics of patients

	Total (N=146)	**CP-led services received both at admission and discharge (n=90)**
	n (%)	**n (%)**
Age Median [IQR]	62.0 [54.0-72.0]	62.0 [54.0-72.0]
Sex		
Male	66 (45.2)	38 (42.2)
Female	80 (54.8)	52 (57.8)
Education level*		
<8 y	111 (76.0)	65 (72.2)
>= 8 y	35 (24.0)	25 (27.8)
Had COVID-19		
Yes	76 (52.0)	53 (58.9)
No	70 (48.0)	37 (41.1)
Length of stay (day) Median [IQR]	10.0 [6.0-15.0]	10.5 [6.75-15.0]
Charlson Comorbidity Index Median [IQR]	3.0 [2.0-4.25]	3.0 [2.0-4.0]
The number medications used at home Median [IQR]	5.0 [3.0-8.0]	5.0 [2.0-7.0]
Patient group according to SCOREM Index n (%)		
High risk	71 (48.6)	42 (46.7)
Low risk	75 (51.4)	48 (53.3)
Patient group according to LACE Index at discharge n (%)		
Low risk	31 (21.2)	18 (20.0)
High risk	115 (78.8)	72 (80.0)

*The group was determined according to compulsory education year before 2012 in Turkey

Table 2. The frequency and type of medication discrepancies according to Medication Discrepancy Taxonomy (MedTax)

	Medication Reconciliation at admission (n=146)		**Medication Reconciliation at discharge (n=90)**	
	Intentional Discrepancies	**Unintentional Discrepancies**	**Intentional Discrepancies**	**Unintentional Discrepancies**
	n (%)	**n (%)**	**n (%)**	**n (%)**
Medication mismatched	**866 (90.4)**	**150 (78.9)**	**269 (87.1)**	**2 (66.7)**
Drug comission or addition	616 (64.3)	6 (3.2)	101 (32.7)	-
Drug omission	218 (22.8)	142 (74.7)	140 (45.3)	1 (33.3)
Therapeutic class substitution*	32 (3.3)	2 (1.1)	28 (9.1)	1 (33.3)
Medication partially matched	**92 (9.6)**	**40 (21.1)**	**40 (12.9)**	**1 (33.3)**
Discrepancy in the name of medication				
Unclear or wrong name	-	3 (1.5)	-	1 (33.3)
Different brand name but same generic name	14 (1.5)	1 (0.5)	6 (2.0)	-
Discrepancy in the strength and/or frequency and/or number of units of dosage form and/or total daily dose				
Unclear or wrong strength	-	2 (1.1)	-	-
Omission of strength		14 (7.4)		-
Different strength and different total daily dose	44 (4.6)	7 (3.7)	24 (7.8)	-
Different strength but same total daily dose	1 (0.1)	-	1 (0.3)	-
Same strength and same number of units but different frequency and different total daily dose	4 (0.4)	7 (3.7)	2 (0.6)	-
Same strength but different frequency and different number of units and different total daily dose	4 (0.4)	3 (1.5)	2 (0.6)	-
Same strength but different frequency and different number of units but same total daily dose	1 (0.1)	-	-	-

Discrepancy in the dosage form/route of administration				
Different dosage form but same route of administration	3 (0.3)	-	1 (0.3)	-
Different dosage form and different route of administration	21 (2.2)	1 (0.5)	4 (1.3)	-
Discrepancy in the time of drug administration				
Different time of administration through the day	-	2 (1.1)	-	-
Total	**958**	**190**	**309**	**3**

Table 3. Factors associated with having at least one unintentional discrepancy at admission

	Having at least one unintentional discrepancy at admission (n=84)		
	OR	**CI 95%**	***p-value***
Had COVID-19			
Yes	2.25	(1.15-4.40)	0.018
No	Reference		
Patient group according to SCOREM Index n (%)			
High risk	2.01	(1.031-3.92)	0.040
Low risk	Reference		
The number of medications used at home	1.41	(1.23-1.61)	<0.001

Table 4. Secondary outcomes during follow-up in patients who received CP-led medication reconciliation service

	Total (n=146)	***p*-value**	**CP-led services both at admission and discharge (n=90)**	***p*-value**
30-day hospital readmission n (%)	n=18 (12.3)		n=9 (10.0)	
Patient group according to LACE Index n (%)				
Low risk	1 (5.6)	0.122	1 (11.1)	0.681
High risk	17 (94.4)		8 (88.9)	
Had COVID-19				
Yes	5 (27.8)	0.038*	2 (22.2)	0.029*
No	13 (72.2)		7 (77.8)	
30-day emergency medical service visit n (%)	n=23 (15.8)		n=13 (14.4)	
Patient group according to LACE Index n (%)				
Low risk	1 (4.3)	0.029*	0	0.630
High risk	22 (95.7)		13 (100)	
Had COVID-19				
Yes	12 (52.2)	1000	7 (59.7)	0.924
No	11 (47.8)		6 (40.3)	

* Patient group according to LACE Index; *$p<0.05$