International Journal of Clinical Pharmacy (2022) 44:27–33
https://doi.org/10.1007/s11096-021-01300-8

RESEARCH ARTICLE

# Exploring pharmacist involvement in the discharge medicines reconciliation process and information transfer to primary care: an observational study

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Received: 31 January 2021 / Accepted: 17 June 2021 / Published online: 5 July 2021


## Abstract

*Background* Medication errors can occur because of incomplete or poorly communicated information at the transition from hospital to community. Following an audit in 2016, a project was undertaken to determine if pharmacists could improve the quality of medication information in discharge summaries by introducing a discharge medication reconciliation process. Pharmacists recorded any changes to the patient's medication in the electronic prescribing system during their inpatient stay and summarised these changes on discharge. *Objective* To compare medication information in discharge summaries with recognised standards for the clinical structure and content of patient records, and to assess the impact of the pharmacist process on compliance with certain elements of these standards. *Setting* A 750 bed teaching district general hospital in England. *Method* A retrospective observational study examining all patient discharge summaries over a 1 week period for compliance to national standards. *Main outcome measure* The main outcome measures were compliance with standards for medication started, stopped or changed in hospital and any differences between extent of recording this information by doctors and pharmacists. *Results* Data were collected and analysed for 243 patients, of whom 94 (38.7%) attracted a discharge medicines reconciliation process by a pharmacist. Discharge summaries were compliant with basic standards for changed medication in 42% of patients or 51.4% with the input of a pharmacist. This increase of 9.4% was statistically significant ($p = 0.0365$). At an enhanced level, pharmacists increased compliance from 39.1 to 46.5%, this did not represent a significant increase ($p = 0.0989$). *Conclusion* Pharmacists undertaking a discharge medication reconciliation process significantly improves the quality of discharge summaries.

**Keywords** Hospital · Medication discrepancies · Medication reconciliation · Transitions of care

## Impact on practice

- Contributions from pharmacists can improve the quality of communication on medication changes at discharge from hospital.
- Hospital electronic prescribing systems in England can provide a means of tracking medication changes.

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## Introduction

The World Health Organisation (WHO) recognises that the occurrence of medication discrepancies at hospital admission, internal transfer, discharge and other transition points is a global problem [1]. In particular, the WHO technical report highlights two relevant studies. A systematic review by Lehnbom and colleagues reported that 25–80% of patients discharged from hospital had at least one medication discrepancy or failure to communicate in-hospital medication changes at discharge [2]. A national multi-site audit examined discharge summaries in England and found that 79% of patients had at least one new medication started (with the reason documented for approximately half of the cases), 27% of patients had at least one medication stopped (with the reason documented for 57% of cases), and 23% of patients had at least one dose changed (with a reason documented

for 39% of cases). Unintentional omissions of preadmission medication were noted for one third of patients [3].

Discharge summaries are often carried out by junior doctors who may feel inadequately prepared for this task [4, 5], though other human factors such as work environment, workload, and physical and mental well-being may also contribute to mistakes in prescribing [6]. As well as being prone to errors and constituting a patient safety risk, discharge letters—the standard communication tool between hospitals and primary care, be they electronic or paper—have long been a frustration for general practitioners [7]. Studies have identified failures and variation in the processing of discharge summaries in primary care [8].

The medication profile or regime for a patient admitted to and then discharged from a hospital should commence at admission with medication reconciliation. In an acute setting this is the process of identifying an accurate list of a person's current medication and comparing it with the current list in use, which should be undertaken within 24 h. [9]. The information can be obtained from a variety of sources such as: discussion with the patient, medication brought to hospital by the patient, general practitioner surgery patient records, repeat prescription slips, hospital case notes, and community pharmacy patient medication records. The list should include name, dosage, frequency and route of administration. [9]. Previous unpublished work in our 750 bed teaching district general hospital in Cornwall from 2016 found that in 48% of 50 discharges the medication changes since admission were not explained in the discharge summary. Since this initial audit, we have introduced within the pharmacy department a discharge medication reconciliation (DMR) process at the point of discharge to account for medication changes that occurred during admission [10]. Ongoing monitoring has shown that where medication reconciliation has been undertaken by the pharmacy team at admission, then a DMR occurs in approximately one-third of these patients. The pharmacy team keep track of the patient's medication journey using a series of notes applied to the patient's electronic prescribing (EPMA) record during the inpatient episode. These notes are then compiled at the point of processing the discharge prescription into a single DMR note. Typically, this is undertaken by the pharmacist involved in the dispensing process who has access to the EPMA system.

The quality of medication information provided to primary care in the national health service should be informed by the Royal College of Physician (RCP) Standards [11]; the key elements of which are shown in Box 1.

Discharge summaries in our hospital are electronic, completed through a series of mandatory fields, with discharge medication information exported from the EPMA system into the electronic discharge template. Hence with this standardised information, data fields a–i (in Box 1) and field m are completed. Our study therefore focused

**Box 1** Professional records standards body (PRSB) discharge record standards

| Element |
|---|
| a) Medication name |
| b) Form |
| c) Route |
| d) Quantity supplied |
| e) Site |
| f) Method |
| g) Dose amount description |
| h) Dose timing description |
| i) Dose directions description |
| j) Additional instructions<br>Allows for:<br>Requirements of adherence support, eg. compliance aids, prompts and packaging requirements<br>Additional information about specific medicines e.g. where specific brand required<br>Person requirements eg. unable to swallow tablets |
| k) Indication |
| l) Comment/recommendation |
| m) Dose direction duration |
| For medications that have been changed, ie. additions, amendments and discontinued, in addition to the above, also record**:** |
| n) Description of amendment |
| o) Indication (for medication change) |

on the information for medication that have been changed (stopped, started or amended) as this cannot currently be mandated by electronic means.

### Aim of the study

The present study aimed to compare medication information in discharge summaries with some of the RCP Standards for the clinical structure and content of patient records, and to assess the impact of the pharmacist DMR process on compliance with these standards.

### Ethics approval

Ethics approval was not sought after consideration of Health Research Authority criteria about research and service evaluation. This was a retrospective assessment involving no changes to the service or standard of care delivered to patients and using data from a database. Participants were not randomised, and the findings were contextual to processes within our hospital. We used the NHS Health research authority tool (http://www.hra-decisiontools.org.uk/research/index.html) which helped confirm that no ethical approval was required for this project. The principles of ethical research, such as confidentiality and anonymity, were followed.

## Method

### Study design, setting and population

This single-centre, retrospective, observational study was conducted at a 750-bed teaching district general hospital in England. Data were extracted retrospectively using the JAC EPMA database v2014.1 for discharges for one week in September 2018. This time period was chosen as it was approximately two years since the introduction of the DMR process in September 2016, and prior to a major system upgrade that occurred in May 2019 and so avoided any confounding factors due to change in functionality or user experience with what was then a new version of the EPMA system.

Relevant data were recorded for patients who had received an admissions medication reconciliation service (so providing the patient's list of medicines at admission). Discharge medication could have been for short courses e.g. antibiotics, as well as ongoing treatment. Only regular medication with a systemic effect (including regular inhalers) were included in the analysis. Medicines prescribed as required were excluded.

### Patient data collection

A single pharmacist (AH), who had completed 3/94 DMRs as part of their routine clinical role, reviewed all the medication data comparing the admissions medication reconciliation profile (compiled by the pharmacy team) with the discharge summary produced by the discharging doctor and noted if it included any information added as part of the DMR process by the pharmacy team. Alterations to the patients' medication were allocated into one of four categories (Box 2).

The discharge summary was deemed as compliant at a basic level if a started, stopped or changed medication was acknowledged by either the doctor or pharmacist. The discharge summary was deemed as compliant at an enhanced level if a started, stopped or changed medication was both acknowledged and a reason for the decision given by either the doctor or pharmacist. Reasons for medication starting, stopping or changing were recorded as present if they were overtly referred to in the discharge summary or implied by class/category or disease state and the treatment was standard. Examples of broad descriptions deemed to explain alterations in medication included: Patient admitted with acute myocardial infarction (ICD-11 code BA41) and secondary prevention started; Commenced on antibiotics for bacterial pneumonia (ICD-11 code CA40.0); Patient suffered with functional constipation (ICD-11 code DD91.1) (hence *laxatives on discharge prescription*).

Data collection and descriptive statistics were performed using Excel software (Microsoft Corporation). Percentages and frequencies were employed to describe the magnitude of the compliance with standards. Difference in overall compliance between doctor versus doctor and pharmacist input

**Box 2** Categorisation of medication changes between admission and discharge

| | |
|---|---|
| Continuing | No changes to the dose, frequency or formulation were made |
| Changed | The virtual therapeutic moiety remained the same but the dose, frequency or formulation was changed |
| Stopped | Medication was stopped either permanently or temporarily pending a review |
| New | Medication was additional since admission |

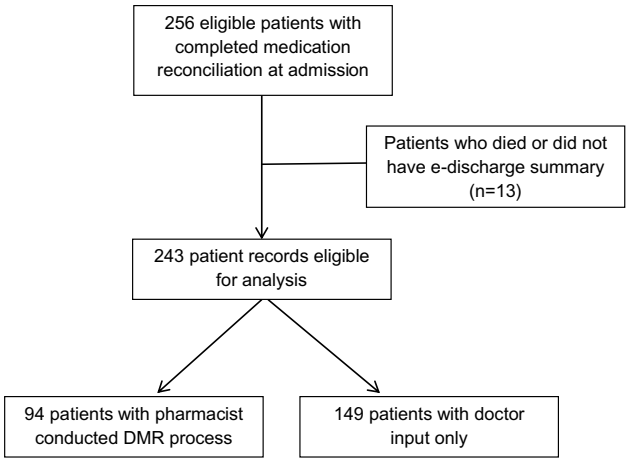


**Fig. 1** Flowchart outlining the number of patients involved in the study

was tested using a Chi-squared test. Results were considered statistically significant at a significance level of $P < 0.05$.

## Results

During this one-week period in September 2018, 349 patients were discharged, and 256 (73.4%) of these patients had undergone a completed medication reconciliation at admission (Fig. 1). Thirteen of these 256 patients were lost to follow up as either the patient died in hospital (3) or no e-discharge summary was produced on discharge (10). Hence, data were collected and analysed for 243 patients, of whom 94 (38.7%) attracted a DMR process by a pharmacist. Patient characteristics are shown in Table 1.

These 243 patients were prescribed 1433 regular medication at admission (mean 5.9 per patient) and 1540 at discharge (mean 6.3 per patient). A total of 548 new short-term medications were prescribed to 160 patients and a total of 308 new ongoing medications were prescribed to 146 patients. The analysis of alterations to the patient's list of admission medication is shown in Table 2, documented at a basic level or at an enhanced level.

Discharge summaries were most effective at communicating the use of short-term medication (total of 548) to primary care (100% at a basic level and 84.9% enhanced). Medicines that were changed were the least likely to be communicated appropriately (53.9% at a basic level and 44.9% enhanced), however this category had the smallest number of medication (89).

There were a total of 192/243 discharge summaries that should have communicated amendments to the ongoing medication regime (new, changed or stopped medicine), leaving just over one-fifth (51, 21%) of these 243 discharge

**Table 3** Compliance with standards overall

| | Basic level[a] | Enhanced level[b] |
|---|---|---|
| Doctor input only | 42% (102/243) | 39.1% (95/243) |
| Doctor and pharmacist input | 51.4% (125/243) | 46.5% (113/243) |

[a]Acknowledgement only, [b]Acknowledgement and reason

**Table 1** Patient demographic and clinical characteristics (n = 243)

| Characteristics | Count n |
|---|---|
| Mean patient age, years | 69 (range 3–98) |
| Mean number of regular medications on admission | 5.9 (range 0–20) |
| Mean number of regular medications on discharge | 6.3 (range 0–20) |
| Mean number of new regular/ongoing medications on discharge | 1.3 (range 0–7) |
| Mean number of new short-term medications on discharge | 2.3 (range 0–15) |
| Mean number of regular medications continued with no changes | 4.7 (range 0–19) |
| Mean number of medications stopped during the admission | 0.7 (range 0–8) |
| Mean number of medications changed during the admission | 0.4 (range 0–3) |

**Table 2** Compliance with standards for new, changed or stopped medicines

| | Basic level[a] | Enhanced level[b] |
|---|---|---|
| New medications intended for continuation | 57.8% (178/308) | 52.3% (161/308) |
| New short-term medications not intended to be re-prescribed in primary care | 100% (548/548) | 84.9% (465/548) |
| Changed medication | 53.9% (48/89) | 44.9% (40/89) |
| Stopped medication | 56.7% (101/178) | 51.1% (91/178) |

[a]Acknowledgement only, [b]Acknowledgement and reason

**Table 4** Discharge summaries (n = 243) that complied with individual standards

| | Number with information meeting standard at basic level[a] for medication that is: | | | Number with information meeting standard at enhanced level[b] for medication that is: | | |
|---|---|---|---|---|---|---|
| | New | Changed | Stopped | New | Changed | Stopped |
| Doctor input only | 149 | 198 | 177 | 143 | 197 | 172 |
| Doctor and pharmacist input | 164 | 209 | 190 | 155 | 204 | 188 |

[a]Acknowledgement only, [b]Acknowledgement and reason

summaries that contained no medication amendments apart from new short-term medication.

Table 3 shows the overall compliance of discharge summaries with the discharge standards for doctor input only and for doctor and pharmacist input. Pharmacist input increased overall basic compliance by 9.4 percentage points (from 102 to 125 out of 243 summaries) and enhanced compliance by 7.4 percentage points (from 95 to 113 out of 243). This was a significant difference at the 95% confidence interval using a Chi-squared test at the basic level of compliance ($X^2$ (1, $N = 243$) = 4.37, $p = 0.0365$). However, at an enhanced level of compliance was not statistically significant ($X^2$ (1, $N = 243$) = 2.72, $p = 0.0989$). Table 4 illustrates the absolute improvement for the three individual compliance standards at both a basic and enhanced level for doctor input only compared to doctor and pharmacist input.

There were 94 DMR notes applied to the 243 discharge summaries in this data set. The patients that attracted a DMR (mean age 72, mean number of regular admission medicines 6.6, and mean number of regular discharge medicines 6.9) were similar to the main cohort. Overall, in 15.2% (37/243) the pharmacist's DMR improved the medicines information on the discharge summary at a basic level, and in 12.3% (30/243) at an enhanced level, although did not necessarily make the discharge summary fully compliant. Analysis of just those discharge summaries that attracted a DMR note showed that 40% (37/94) had an impact on discharge letter standards at a basic level, and 31.9% (30/94) of the DMR notes had an impact at an enhanced level.

## Discussion

In the current study, conducted in an English teaching district general hospital, where pharmacists added a DMR note to 39% (94/243) of discharges, we found that 102 (42%) of 243 discharges met the basic RCP standards for all medicines when there was doctor input only, and that this increased to 125 (51.4%) with the contribution of the pharmacist. These results were statistically significant ($p$ value < 0.05) The results suggest that pharmacist input into describing the medication journey at discharge can add significant benefit. However, of the 94 discharges containing a DMR note there was some degree of duplication by the pharmacist of the doctors' medication discharge information in just under one-quarter (22.4%) at a basic level, and 20% at an enhanced level. Due to the discharge process at our trust, pharmacists cannot view doctors' information simultaneously whilst entering their own information, which raises concerns with our process and the clinical collaboration from a clinical and workflow viewpoint. Hence, some of the DMR notes were superfluous because that information has already been completed by the doctor.

If pharmacists could avoid such duplication by not entering medication information text already completed by doctors and instead target patients more effectively, a significant step change in the amount of compliant medicines information on discharge summaries could occur. Our DMR notes are also transmitted to community pharmacies as part of the Transfer of Care Around Medicines (TCAM) service so they serve a dual purpose [12]. Community pharmacies neighbouring our hospital are not in receipt of the full discharge summaries and therefore rely on the DMR process to understand any amendments to the medication of their regular patients who have been in hospital.

We did not consider the time investment by the pharmacist to complete the DMR process in this study. Others have reported from a small-scale study in one Irish hospital that the pharmacy team spending additional time on medication reconciliation at admission is associated with economic burden and may not yield benefit in terms of capturing clinically significant errors [13]. An Australian study concluded that pharmacists spent a median of five additional minutes per patient (range 2–16 min) correcting and inputting medication information into the electronic discharge summary, though logistics, timing and pharmacist workload were barriers to delivering this service [14].

Another Australian study evaluated the accuracy of medication lists and medication change information in electronic discharge summaries (EDS) produced using an integrated e-prescribing and EDS system. The authors found that 50/85

(59%) EDS contained one or more medication list discrepancies [15]. Noting that less than half of the changes made to patients' pre-admission medications were mentioned or explained in the EDS, they comment that poor document of medication changes was not surprising since determining and entering this information into the EDS was a manual process. Our study in a hospital also with an e-prescribing system found a similar proportion of changed medicines that were mentioned and explained at 40/89 (44.9%). A large prospective study from the Netherlands found that 28% of new medications were started without the reason mentioned in the discharge letter [16]. We found that 147/308 (47.7%) new long-term medicines were similarly not mentioned and explained.

Our discharge summaries communicated effectively information about short-term medication such as antibiotics, laxatives and analgesics. These were almost always explained overtly or indirectly and are perhaps less of a concern to a GP as there is no expectation of a continued need to prescribe. At a basic compliance level a mention in the discharge summary is acknowledgement of an intentional decision to prescribe. They are very often linked to the reason for admission and their use, often symptomatic, is easily interpretable from information contained within the discharge summary.

Medicines reconciliation is a crucial first step for the process of transmitting compliant discharge information to the GP surgery and documenting the medication journey. In our initial patient cohort only 73% (256/349) patients had a complete medicines reconciliation undertaken. Medicines reconciliation modules for EPMA systems, unavailable in our hospital at the time of the study, have the potential to allow EPMA systems to electronically understand that a medicine has been started/stopped or changed as there will be a coded data starting point for the system. This will improve the transmission of acknowledgements of medication changes if not the reason for change on discharges. The accuracy of this automated data transmission will clearly be reliant on the correct data input. As identified, not all patients undergo a medication reconciliation process and therefore even with medicines reconciliation functionality in systems there will need to be a separate model for information transfer to GPs where no starting point to the medicines journey exists.

In their review to identify patient safety risks associated with the medical discharge letter, Schwarz and colleagues noted that hospital pharmacists play a key role in preparing the discharge medication information transferred to GPs upon patient discharge and should work closely with hospital doctors to ensure accurate medication information that is quickly communicated to GPs at transitions of care [17]. Reasons for such deficits in discharge summaries include systems insufficiencies (e.g. medication reconciliation process, staffing challenges), lack of understanding others' roles (e.g. unclear which provider should be completing the discharge summary), information communication breakdowns (e.g. inaccurate information communicated to the primary medical team), patient issues (e.g. patient preferences misaligned with recommendations) and poor collaboration processes (e.g. lack of structured interprofessional rounds) [18]. This final point of collaboration is important as we observed some duplication of entry of information by the pharmacist and the doctor in approximately one-fifth of discharges.

Some limitations about this study are acknowledged. There has to be caution in generalising the findings as this was a single site study involving data collected retrospectively on a sampling basis over a short study period, so there is the potential for an inaccurate reflection of the overall picture. We purposively excluded those patients who did not have medicines reconciliation on admission. We do not know if these patients are different in other ways from our sample of patients e.g., at higher or lower clinical risk, though typically they may have been day case patients for whom we do not undertake a medicines reconciliation process. The patient sample may have biased the data collection towards older adult medical patients as they are more likely to be subject to polypharmacy (a mean of 6.3 medicines at discharge). However, this patient group is potentially more likely to experience medication changes in a hospital inpatient stay [19]. We did not categorise non-compliance with RCP standards by risk level depending on the medicine the patient received. There was also no follow up to determine if non-compliance within the discharge summary resulted in the recognised problem of unintended changes to medication regimes occurring in primary care [20]. However, the strengths of our study were that a complete week of data was reviewed across a full range of specialities. Clinical interpretation of the discharge summary was applied by the researcher as stated in the methods to avoid allocating discharge summaries as non-compliant when they would be unlikely to be viewed as such by a GP.

Despite the above limitations, we argue that further work building on this study could be undertaken to improve the existing DMR process. A mechanism for reviewing the doctor's medication handover to the GP by the pharmacist could be useful whilst adding DMR information to prevent duplication or allow speedier reconciliation. A nomenclature for documenting the medication journey on the EPMA system would be a useful development though requiring doctors and pharmacists to be trained to use this. Further training for pharmacists on the process of documenting medicines changes on the EPMA system will be introduced.

## Conclusion

Pharmacists can have an impact on the accurate transmission of medication information to general practice although our results leave scope for further improvement. Further research is required into the time taken for pharmacist to perform the process and the clinical impact of this intervention.

**Funding** The authors received no specific funding for this work.

**Conflicts of interest** The authors declare that they have no conflicts of interest. The main researcher, as part of their role as a clinical pharmacist, had undertaken 3/94 of the DMRs in this cohort.

## References

1. World Health Organization. Medication safety in transitions of care. Geneva: World Health Organization; 2019.
2. Lehnbom EC, Stewart MJ, Manias E, Westbrook JI. Impact of medication reconciliation and review on clinical outcomes. Ann Pharmacother. 2014;48(10):1298–312.
3. Shah C, Hough J, Yl J. Medicines reconciliation in primary care: a study evaluating the quality of medication-related information provided on discharge from secondary care. Eur J Hosp Pharm. 2020;27(3):137–42.
4. Yemm R, Bhattacharya D, Wright D, Poland F. What constitutes a high quality discharge summary? A comparison between the views of secondary and primary care doctors. Int J Med Educ. 2014;5:125–31.
5. Royal College of Physicians. E-discharge summaries learning resourceproject. Final report v1.1. London: Royal College of Physicians. 2019.
6. Dean B, Schachter M, Vincent C, Barber N. Causes of prescribing errors in hospital inpatients: a prospective study. Lancet. 2002;359(9315):1373–8.
7. Redmond P, Carroll H, Grimes T, Galvin R, McDonnell R, Boland F, et al. GPs' and community pharmacists' opinions on medication management at transitions of care in Ireland. Fam Pract. 2016;33(2):172–8.
8. Spencer RA, Spencer SEF, Rodgers S, Campbell SM, Avery AJ. Processing of discharge summaries in general practice: a retrospective record review. Br J Gen Pract. 2018;68(673):e576.
9. National Institute for Health and Care Excellence. Medicines optimisation quality standard [QS120]. London: NICE; 2016.
10. Wilcock M, Hill A, Wynn A, Kelly L. Accuracy of pharmacist electronic discharge medicines review information transmitted to primary care at discharge. Int J Clin Pharm. 2019;41:820–4.
11. NHS Digital. PRSB standards for the structure and content of health and care records. 2018.
12. Wilcock M, Sibley A, Blackwell R, Kluettgens B, Robens S, Bastian L. Involving community pharmacists in transfer of care from hospital: Indications of reduced 30-day hospital readmission rates for patients in Cornwall. Int J Pharm Pract. 2020;28(4):405–7.
13. Walsh EK, Kirby A, Kearney PM, Bradley CP, Fleming A, O'Connor KA, et al. Medication reconciliation: time to save? A cross-sectional study from one acute hospital. Eur J Clin Pharmacol. 2019;75(12):1713–22.
14. Elliott RA, Tan Y, Chan V, Richardson B, Tanner F, Dorevitch MI. Pharmacist-physician collaboration to improve the accuracy of medication information in electronic medical discharge summaries: effectiveness and sustainability. Pharmacy (Basel). 2020;8(10):2.
15. Tan Y, Elliott RA, Richardson B, Tanner FE, Dorevitch MI. An audit of the accuracy of medication information in electronic medical discharge summaries linked to an electronic prescribing system. Health Inf Manag. 2018;47:125–31.
16. Uitvlugt EB, Suijker R, Janssen MJA, Siegert CEH, Karapinar-Çarkit F. Quality of medication related information in discharge letters: a prospective cohort study. Eur J Intern Med. 2017;46:e23–5.
17. Schwarz CM, Hoffmann M, Schwarz P, Kamolz LP, Brunner G, Sendlhofer G. A systematic literature review and narrative synthesis on the risks of medical discharge letters for patients' safety. BMC Health Serv Res. 2019;19(1):158.
18. Pinelli V, Stuckey HL, Gonzal JD. Exploring challenges in the patient's discharge process from the internal medicine service: a qualitative study of patients' and providers' perceptions. J Interprof Care. 2017;31(5):566–74.
19. Mixon AS, Neal E, Bell S, Powers JS, Kripalani S. Care transitions: a leverage point for safe and effective medication use in older adults—a mini-review. Gerontology. 2015;61(1):32–40.
20. Krause O, Glaubitz S, Hager K, Schleef T, Wiese B, Junius-Walker U. Post-discharge adjustment of medication in geriatric patients: a prospective cohort study. Z Gerontol Geriatr. 2020;53(7):663–7.