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SHORT RESEARCH REPORT

Validity of a nationwide medication record system in the Netherlands

Elien B. Uitvlugt[1] · Bart J. F. van den Bemt[2,3] · Wai Lung Chung[1] · Jaap Dik[4] · Patricia M. L. A. van den Bemt[5] · Fatma Karapinar-Çarkit[1]

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Abstract

Background In the Netherlands, a nationwide Medication Record System based on pharmacy dispensing data is used to obtain information about patients' actual medication use. However, it is not clear to what extent the information of the Nationwide Medication Record System corresponds to the medication information obtained with the Best Possible Medication History. *Objective* To examine the validity of medication dispensing records collected from the Nationwide Medication Record System by comparing them to the Best Possible Medication History. *Method* An observational study was performed. Patients from several hospital departments were included at admission. To obtain the Best Possible Medication History, pharmacy technicians performed medication reconciliation at admission, using dispensing records from the Nationwide Medication Record System and information from the patient himself. Primary outcome is percentage of patients with no discrepancies between the Nationwide Medication Record System and the Best Possible Medication History. Descriptive analysis was used. *Results* Eighty-two patients were approached and 66 (80%) were included, with in total 478 medicines in the Best Possible Medication History. Seventeen percent of the patients had no discrepancies and 33% (n = 156) of the medication records contained a discrepancy between the Nationwide Medication Record System and the Best Possible Medication History. Most common type of discrepancy was omission (44%). *Conclusion* Even with a Nationwide Medication Record System medication reconciliation with the patient remains essential to obtain complete information about patient's actual medication use.

Keywords Clinical pharmacy · Computerized medical records systems · Continuity of Patient Care · Information systems · Medication errors · Medication reconciliation

Impacts on practice

- In only 17% of the patients admitted to the hospital, the medication dispensing records from the nationwide system in the Netherlands completely corresponds with the best possible medication history.
- Even with the use of a nationwide medication record system, active medication reconciliation with the patient remains essential to obtain an accurate medication overview in patients admitted to hospital.

Introduction

In recent years, several studies have shown that transitions in healthcare are a risk factor for unintended discrepancies between medication what a patient is actually using and what is listed [1–4]. This can affect the patient safety as discrepancies can result in medication related harm. It is estimated that 11–59% of these discrepancies at time of hospital admission are clinically important [1]. In order to reduce unintended medication discrepancies, medication reconciliation is recommended [5]. Multiple sources of medication information can be used for medication reconciliation to gain insight in the medication history (e.g. general practitioner

✉ Fatma Karapinar-Çarkit
f.karapinar@olvg.nl

1 Department of Hospital Pharmacy, OLVG, Jan Tooropstraat 164, 1061AE Amsterdam, The Netherlands

2 Department of Pharmacy, Sint Maartenskliniek, Nijmegen, The Netherlands

3 Department of Pharmacy, Radboud University Medical Centre, Nijmegen, The Netherlands

4 Pharmacy Monnikenhof, Vianen, The Netherlands

5 Department of Hospital Pharmacy, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

or community pharmacy dispensing records). In the Netherlands, an electronic Nationwide Medication Record System (NMRS) is available since 2011. The NMRS exchanges medication dispensing data from all pharmacies in the Netherlands, provided that the patient consents to exchanging information. The system is accessible 24-h a day for physicians and pharmacists. At the end of 2016, 73% of the general practitioners, 98% of the community pharmacists and 93% of the hospital pharmacists were connected to the NMRS. Nine million patients (out of 17 million citizens) have given their explicit consent to exchange their medication dispensing data and two million messages with medication dispensing data were exchanged per month in 2017.

To obtain the Best Possible Medication History (BPMH) of a patient the NMRS together with information provided by the patient are used. However, it is not known whether the NMRS alone would be sufficient to obtain a complete overview of patients' actual medication use.

Therefore, a study was designed to compare the information in the NMRS with the information from the BPMH (patient information added to the information of the NMRS).

Aim

The aim of this study is to examine validity of medication dispensing records collected from the NMRS by comparing the NMRS information to the BPMH in patients admitted to hospital.

Ethics approval

The study was approved by the local review board of the OLVG hospital (number 15u.065).

Methods

An observational study was conducted at the 550-bed OLVG teaching hospital in the Netherlands from July to August 2017. Adult patients admitted for at least 24 h at the pulmonology, cardiology, internal medicine, gastro-enterology, neurology or acute care department were included at admission if they used at least one medication intended for chronic use. Patients were excluded if no NMRS information was available or if patients were not able to be counseled for medication reconciliation.

To obtain the BPMH, pharmacy technicians performed a protocolled medication reconciliation interview at hospital admission using medications dispensing records from the NMRS and information from the patient. To examine the accuracy and completeness of the NMRS, the NMRS was compared to the BPMH (gold standard: NMRS + patient information). Only active prescription lines from the NMRS were included. Medication intended for chronic use was considered active if the theoretical stop date exceeded or was within 1 month of the admission date. In case medication was only used "if needed" it was considered active if the theoretical stop date was within 3 months of the admission date. In case of insulins and coumarins (variable use), it was considered active if it was dispensed within 6 months before the admission date. Short treatments of medications, e.g. antibiotics, which did not exceed the admission date, were not considered as active.

Discrepancies between the NMRS and the BPMH were classified as following:

- Omission (if medication was not active or present in the NMRS but should be based on patient information).
- Dosage scheme (if the frequency and/or dose in the NMRS was different compared to the patient information).
- Commission (if medication was active in NMRS but should not be regarding to patient information).

The primary outcome of this study was the percentage of patients with no discrepancies between the NMRS and BPMH. Secondary outcomes were mean number of discrepancies per patient, percentage of medicines with a discrepancy between the NMRS and the BPMH, type of discrepancies and the type of medication involved in the discrepancies. Medication was classified according to the ATC-system.

All data were collected in Microsoft Excel 2010 (Microsoft, Redmond, WA). Descriptive statistics were used to examine the percentage of patients with no discrepancies, the percentage and type of discrepancies between NMRS and BPMH.

Results

A total of 82 patients were approached for this study and 66 (80%) were included. Exclusion reasons were: NMRS not available (n = 13), medication reconciliation not performed (n = 2) and no use of chronic medication (n = 1). Table 1 describes the characteristics of the included patients. Mean age was 66 year, and the mean number of medication per patient was 7.2 (SD 4.0). Total number of medicines in the BPMH was 478, including 77 (16%) OTC-medicines.

In 17% (n = 11) of the patients the NMRS completely corresponded with the BPMH. Mean number of discrepancies in the NMRS per patient was 2.4 (SD 2.1).

Table 1 Characteristics of the included patients (n = 66)

Patient characteristics	N = 66
Male, n (%)	35 (53)
Age (years), mean SD	66.4 (17.0)
Number of medications, mean SD	7.2 (4.0)
Admission ward	
Pulmonology, n (%)	7 (10.6)
Cardiology, n (%)	3 (4.5)
Internal medicine, n (%)	16 (24.2)
Gastro-enterology, n (%)	15 (22.7)
Neurology, n (%)	22 (33.3)
Acute care, n (%)	3 (4.5)

Thirty-three percent (n = 156) of the medicines contained a discrepancy between the NMRS and BPMH. Of these 156 medicines, 38 (24%) included OTC-medicines.

Forty-four percent (n = 69) of these discrepancies was due to an omission, 28% (n = 44) due to a commission and 28% (n = 43) due to an incorrect dosage scheme. The three groups of medication with the highest absolute number of discrepancies were medication acting on the nervous system (n = 45, 29%), the alimentary tract and metabolism (n = 36, 23%), and the respiratory system (n = 16, 10%) (Fig. 1).

Discussion

This study shows that in only 17% of the patients the NMRS completely corresponded to the BPMH. The mean number of discrepancies in the NMRS per patient was 2.4. This is in line with a previous study in the UK which compared records from a national electronic summary care record system with pharmacist's medication reconciliation and found 2.2 discrepancies per patient [6]. Another comparable British study revealed that 84% of the medication profiles from an electronic provincial medication database contained at least one discrepancies compared to the BPMH, similar to the results in the current study [7]. They found that insulin, warfarin, salbutamol and pain relief medications were often inaccurate in the medication database which corresponds with the medication found in this current study, except for warfarin.

There are several explanations for the discrepancies identified in this study. Discrepancies due to dose and frequency issues can be explained by the fact that the NMRS is linked to pharmacy dispensing systems and pharmacists are not always informed regarding medication being prescribed intermittently or dose changes between dispensing moments [8]. So the NMRS provides dispensing information instead of prescription information. In 44% of the discrepancies medication was missing in the NMRS. An explanation for this can be that patients must provide consent before a pharmacy is allowed to exchange dispensing records of the NMRS. In the Netherlands, 20% of the patients go to more

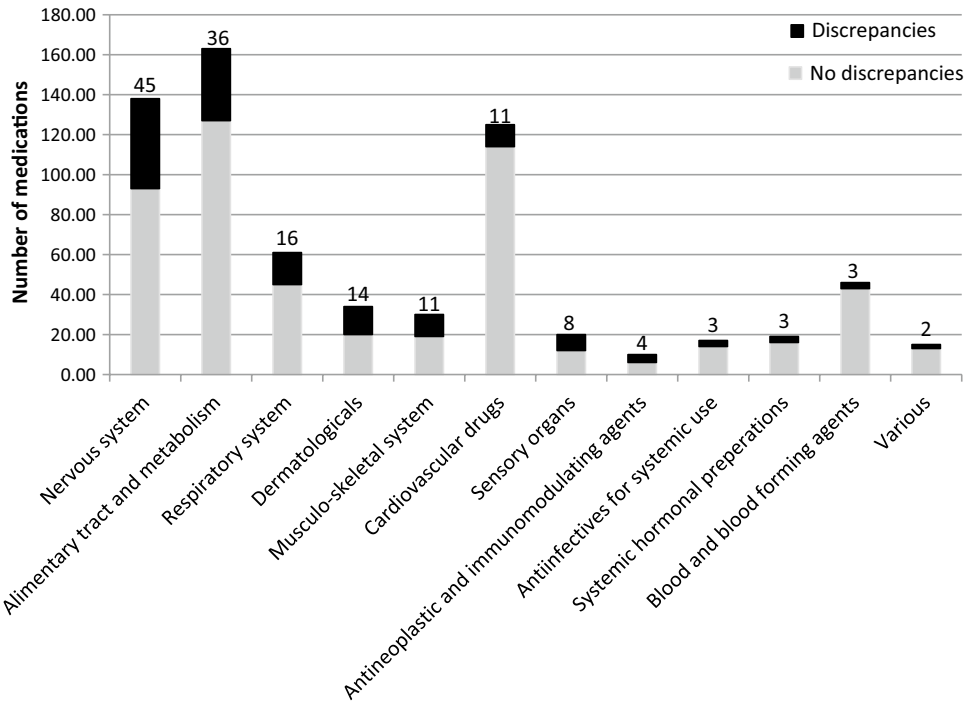

Fig. 1 Number of discrepancies between the Nationwide Medication Record System (NMRS) (n = 156) and the Best Possible Medication History (BPMH), per medication type. The black part of the bar represents the number of discrepancies

than one pharmacy and consent must be given separately for each pharmacy [9]. In addition, omissions can be explained by over-the-counter medication which are not registered in the NMRS. Finally commissions can be explained as discontinuation of medication is not always communicated by prescribers, and even if it is communicated, it is not always processed in the pharmacy. The infrastructure to communicate discontinuation of medication orders is inefficient [10].

To our knowledge, this is the first study investigating the validity of the Dutch NMRS. However, some limitations need to be discussed. First, this study included a small number of patients in one hospital limiting the generalizability, but as a preliminary study, the results could be helpful for optimizing the NMRS and including more hospitals is encouraged for the future. Second, the NMRS was compared to the BPMH, which included at least the NMRS and a patient interview. In practice, additional sources could be used for medication reconciliation besides the NMRS and patient interview, for example medication boxes. It was not registered in which part of the patients additional sources were used. Therefore, it is not possible to exactly establish to what extend the NMRS contributes to the BPMH. But our goal was to see whether the NMRS is sufficient as a single source, and this study clearly showed that is not the case compared to the addition of at least the patient interview as a source.

Despite the fact that the NMRS is used for more than 6 years, it is still a challenge to obtain a complete medication overview. This could be explained by the many different parties that are involved in the pharmacotherapy of a patient with various visions and interests, resulting in a fragmentation of power and responsibilities for the NMRS. So, more cooperation between the different parties and using prescription information instead of dispensing information is needed to obtain a more complete overview and to improve the patient safety.

Conclusion

This study shows that the NMRS alone is not reliable to reflect patients' actual medication use, as in only 17% of the patients the NMRS completely corresponded to the BPMH, making clear that even with the use of a nationwide medication record system in the Netherlands, medication reconciliation with the patient is still essential.

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