



## RESEARCH ARTICLE

## Potential Clinical Consequences of Medication Process Problems in Older Home Care Patients

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### Abstract

**Background:** Home care professionals regularly observe drug-related problems during home care provision. Problems related to the process of the medication therapy could involve discrepancies in medication prescriptions between the hospital discharge letter and the medication administration record lists (MARL) or insufficient drug delivery. The objective of this study is to determine the potential clinical consequences of medication process problems observed by home care professionals, since those consequences have not been assessed before.

**Methods:** A retrospective descriptive study design was performed. An expert panel performed an assessment procedure on the clinical consequences of medication process problems. Such problems were reported by home care professionals during routine care (May 2016 until May 2017) using the eHOME system, which is a digital system developed to assist in the reporting and monitoring of drug-related problems. Using a three-point scale, an expert panel assessed the potential clinical consequences of those medication process problems among older home care patients (aged 65 years and over).

**Results:** 309 medication process problems in 120 out of 451 patients were assessed for potential discomfort or clinical deterioration. The problems involved the following: medication discrepancies (new prescription not listed on the MARL [ $n = 69$ , 36.7%]; medication stopped by the prescriber but still listed on the MARL [ $n = 43$ , 22.9%]; discrepant time of intake [ $n = 25$ , 13.3%]; frequency [ $n = 24$ , 12.8%]; and dose [ $n = 21$ , 11.2%], therapeutic duplication listed on

the MARL [ $n = 5$ , 2.6%]; and discrepant information on route of administration [ $n = 1$ , 0.5%]; an undelivered MARL [ $n = 103$ , 33.3%]; undelivered medication [ $n = 16$ , 5.2%]; and excessive medication delivery [ $n = 2$ , 0.7%]. Furthermore, 180 (58.2%) out of 309 medication process problems were assessed as having the potential for moderate or severe discomfort or clinical deterioration in patients.

**Conclusions:** The majority of medication process problems may result in patient discomfort or clinical deterioration.

### Keywords

Drug-related problems, Medication process problems, Medication, Medicines, Home care patients, Home care, Clinical impact, Discomfort, Clinical deterioration, Older people, Geriatrics

### Abbreviations

MARL: Medication Administration Record List; DRPs: Drug-Related Problems

### Introduction

Many older people, aged 65 years and older, live at home for as long as possible, with the assistance of home care [1]. The term home care is defined differently across countries [2]. In the Netherlands, it involves visits by home care professionals (i.e., registered nurses, licensed practical nurses, or nurse assistants) who provide short- and long-term care to mon-

itor patients' health, assist in (instrumental) activities of daily living (ADL) (e.g., washing), educate, and/or assist in therapies (e.g., pharmacotherapy) tailored to each person's needs [2,3].

The majority of older home care patients use multiple drugs and are at an increased risk of drug-related problems (DRPs) because of age-related changes in pharmacodynamics and pharmacokinetics (leading to adverse drug effects) [4-7] and in cognitive, physical, and visual function (leading to incorrect use [8-10]). Furthermore, many different health care professionals are involved in the process of prescribing, dispensing, and administration, which can result in problems in the organization of medication care, such as insufficient drug delivery and insufficient administration of prescription on the medication administration record list (MARL) [11,13,17]. These problems may be seen as medication process problems. DRPs such as adverse drug effects and usage problems may have clinical consequences [10,14-16]; therefore, it is important to observe and, where possible, resolve the DRPs. In this regard, home care professionals are the only health care professionals who actually visit patients' homes on a regular basis and are therefore well-positioned to observe DRPs [18,20-23]. Medication process problems, including an incomplete MARL and insufficient medication delivery, are frequently observed problems by those professionals [17-23]. It is likely that process problems result in inaccurate medication administration by home care professionals, which in turn could affect patients' quality of life or could result in medication-related hospital admissions and mortality. However, whether the problems have the potential to result in a negative impact on patients' health is unknown. Therefore, the objective of this study is to determine the potential clinical consequences of medication process problems observed during home care provision by home care professionals.

## Methods

### Design

Medication process problems in patients living at home that have been reported by home care professionals, between May 2016 and May 2017, was used for this study. An expert panel assessed these problems for clinical consequences.

### Setting

Seven home care teams of a large Dutch home care organization participated. Each team consisted of approximately 12 registered nurses and/or licensed practical nurses, and each team provides care to about 65 adult patients per year. The teams provide assistance in activities related to ADL, stoma care, wound care, and/or pharmaceutical care.

## Pharmaceutical care by home care professionals

Pharmaceutical care by home care professionals is mostly delivered to patients with cognitive, visual, and/or functional impairment, and it consists of assistance with medication intake; administering medications and monitoring therapeutic effects, side effects, and medication adherence; and providing education and information. Solid oral drugs, intramuscular and subcutaneous injections, and topical drugs (e.g., eye drops, creams, and transdermal products) are primarily administered. Most of the solid oral drugs are delivered in so-called multidose dispensing systems (MDDs) [24]. Home care nurses and licensed practical nurses may administer medications or deliver assistance in medication intake after verifying the prescription on the MARL. Patients or their relatives can collect medication and the printed MARL at a pharmacy, or the pharmacy can deliver them to patients' homes.

## Reports of medication process problems

In the eHOME system, home care professionals reported medication process problems during pharmaceutical care provision. eHOME [25] is a digital version of the home observation of medication-related problems by homecare employees (HOME) instrument, designed to observe and report DRPs [21]. The home care professionals were involved in previous research in the development of eHOME and were therefore trained to use it in clinical practice [25].

Medication process problems involved an undelivered MARL, undelivered drugs, errors in drug administration, and/or medication discrepancies. A medication discrepancy is defined as any difference observed between a medication prescription listed on the MARL and a new prescription either listed on a hospital discharge letter or communicated verbally by an authorized prescriber to a patient or home care professional.

## Determining potential discomfort or clinical deterioration

The potential consequences of the reported medication process problems of patients aged 65 years and over were evaluated by two assessors [EH; pharmacoepidemiologist and AB; physician] independently. Problems that were reported repeatedly for a single patient, because of consecutive care moments, were assessed only once. The assessment was based on the question regarding what impact could be expected if the problem was not solved, for instance if patients received inappropriate medication treatment (e.g. wrong dose, wrong time of intake, or no medication administered). This assessment was performed using the three-point scale developed by Cornish, et al. (2005) [26]. In this scale, class 1 problems

are those that are unlikely to cause discomfort or clinical deterioration, while class 2 refers to problems that have the potential to cause moderate discomfort or clinical deterioration, and class 3 problems are those with the potential to cause severe discomfort or clinical deterioration [26]. Cases without a unanimous classification score were discussed by the assessors [EH; AB] until consensus was reached, and if no consensus could be reached, then a third assessor [MLB; pharmacist] determined the final score.

### Data analysis

Descriptive statistics were used to describe general patient characteristics (number of patients, number of patients with and without problems, age, and gender) and medication process problems (numbers, percentages, range, and interquartile range [IQR]). Baseline differences were tested for age between the group of patients without and with medication process problems, with an independent sample *T* test. Analyses were performed using statistical software SPSS version 24.0 (Armonk, NY, IBM Corp.).

This study was not subject to the Medical Research Involving Human Subjects Act, since only anonymized data of patient records were used. Furthermore, patients were informed about this study by written communication through the home care organization.

### Results

The home care teams provided care to 451 older patients in this 1-year period. Most of the patients were female (67.8%) and 75 to 84 years of age (39.9%). In 120 patients (26.6%) out of the 451 patients, at least one medication process problem was reported (Table 1).

A total of 373 medication process problems were re-

ported, of which 64 were reported more than once and excluded from the assessment of clinical consequences. No statistical differences in age was found between the group of patients without medication process problems and the one with problems ( $p = 0.44$ ).

In total, 309 (range 1-14, IQR 1-3) medication process problems were assessed for potential discomfort or clinical deterioration. The problems involved medication discrepancies ( $n = 188$ , 60.8%) (new prescription not listed on the MARL [ $n = 69$ , 36.7%]; medication stopped by the prescriber but still listed on the MARL [ $n = 43$ , 22.9%]; discrepant time of intake [ $n = 25$ , 13.3%], frequency [ $n = 24$ , 12.8%]; dose [ $n = 21$ , 11.8%]; therapeutic duplication listed on the MARL [ $n = 5$ , 2.6%]; and discrepant information on route of administration [ $n = 1$ , 0.5%]); an undelivered MARL [ $n = 103$ , 33.3%]; undelivered medication [ $n = 16$ , 5.2%]; and excessive medication delivery [ $n = 2$ , 0.7%] (Table 2).

Of the 309 problems, 41.8% ( $n = 129$ ) were deemed unlikely to cause discomfort or clinical deterioration (class 1), while 37.5% ( $n = 116$ ) were assessed to potentially cause moderate discomfort or clinical deterioration (class 2), and 20.7% ( $n = 64$ ) were assessed to potentially result in severe discomfort or clinical deterioration (class 3) (Table 3). Some process problems from class 1 involved a Calmurid cream that had been prescribed but was not listed on the MARL; Triamcinolone acetate 0.1% ear drops, which had been stopped but were still listed on the MARL; and an undelivered MARL with a Hydrocortisone Vaseline cream 1% prescription. Examples of process problems from class 2 are medicines (Lactulose oral solution 15 ml. and Artelac eye drops four times per day) that were not listed on the MARL and an undelivered MARL with a Vidisic eye drop prescription. Finally, class 3 process problems

**Table 1:** Patient characteristics.

	N	%
Patients total	451	
Gender, female	306	(67.8)
Age of the 451 patients		
(mean)	(81.6)	
65-74	92	(20.4)
75-84	180	(39.9)
≥ 85	179	(39.7)
Patients with a medication process problem	120	(26.6)
Gender of the 120 patients, female	80	(66.7)
Age of the 120 patients		
(mean)	(82)	
65-74	16	(13.3)
75-84	53	(44.2)
≥ 85	51	(42.5)

**Table 2:** Medication process problems ( $n = 309$ ).

	N	%
<b>Medication discrepancy</b>	<b>188</b>	<b>60.8</b>
New medication not listed on the MARL	69	36.7
Medication stopped by the prescriber but still listed on the MARL	43	22.9
Discrepant time of intake	25	13.3
Discrepant frequency	24	12.8
Discrepant dose	21	11.2
Therapeutic duplication listed on MARL	5	2.6
Discrepant information on route of administration	1	0.5
<b>Undelivered MARL</b>	<b>103</b>	<b>33.3</b>
<b>Undelivered medication<sup>a</sup></b>	<b>16</b>	<b>5.2</b>
<b>Excessive medication delivery<sup>a</sup></b>	<b>2</b>	<b>0.7</b>

<sup>a</sup>Medication was not delivered in MDD.

**Table 3:** Potential clinical consequences and details of medication process problems.

Potential clinical consequence	Medication process problems <i>n</i> (%)	Examples of medication process problems
Class 1 <sup>a</sup>	129 (41.8)	Calmurid cream for daily use has been prescribed but is not listed on the MARL (medication discrepancy).
		Triamcinolonacetonide 0.1% ear drops have been stopped by the prescriber; however, ear drops are still listed on the MARL (medication discrepancy).
		No medication list has been delivered with the prescription order: Hydrocortisone Vaseline cream 1% (undelivered MARL).
Class 2 <sup>b</sup>	116 (37.5)	Lactulose (oral solution, dose 15 ml, twice a day) is not listed on the MARL (medication discrepancy).
		An ophthalmologist prescribed Artelac eye drops (four times per day); however, the prescription is not listed on the MARL (medication discrepancy).
		The Vidisic eye drop has not been delivered (undelivered medication).
Class 3 <sup>c</sup>	64 (20.7)	The medication list with the prescription of Insulin is not delivered (undelivered MARL).
		No Isosorbide Mononitrate Retard 60 mg delivered (undelivered medication).
		The dose of Lantus has been changed from 18 IE to 10 IE once a day; however, the MARL still lists 18 IE once a day (medication discrepancy).

<sup>a</sup>Problem was unlikely to result in discomfort or clinical deterioration; <sup>b</sup>Problem had the potential to result in moderate discomfort or clinical deterioration; <sup>c</sup>Problem had the potential to result in severe discomfort or clinical deterioration.

included an undelivered MARL with an Insulin and Isosorbide Mononitrate prescription and a discrepancy in Insulin prescription.

## Discussion

In 26.6% of the patients, one or more medication process problem was reported. The majority of the problems (58.2%) may have moderate or severe clinical consequences.

Previous studies of medication discrepancies in a hospital setting have indicated that discrepancies could result in clinical consequences [17,26,27]. In our study, 58.2% of the medication process problems could result in clinical consequences. Although 41.8% would potentially have no clinical consequences for patients, these problems can still cause confusion and incorrect pharmaceutical care and therefore need to be resolved. Interprofessional collaboration by health professionals involved in the medication therapy of older people is suggested for the observation and addressing of process problems.

Several medication process problems in the home care setting, such as medication discrepancies and an absent MARL, have been reported in previous research [18,19,28-30]. Medication discrepancies in our study were observed in hospital discharge letters and in verbal communication handovers. Discharge letters to hand over new medication prescriptions were only used after hospital admissions. Moreover, prescribers in other care settings (e.g., general practice) used verbal communication to hand over new prescriptions to patients or home care professionals. Verbally communicated handovers should be avoided in the future, since they have error potential [31].

More prescribers should instead use structural report letters to hand over new prescriptions. The most preferable option, however, is one digital patient system to access the information regarding new prescriptions for all involved (i.e., prescribers, pharmacies, patients, and home care professionals).

In case of an absent MARL, home care professionals are not allowed to administer medication. However, medications belonging to the high-risk medicines group (e.g., insulin and anticoagulants) can have a particularly serious clinical impact on patients if they are not administered. A system with electronic MARLs (eMARLs) has thus been suggested as a solution in previous research, so that care providers can easily access information about the pharmacotherapy and subsequently administer medication [19,32,33].

In this study, the insufficient delivery and excessive delivery of prescription drugs were reported. Extra home visits are needed when medications are eventually delivered, and delayed medication administration will be the result. In addition, the excessive delivery of prescription drugs can result in potentially unnecessary pharmaceutical expenditure, and its cause should be evaluated and resolved. We suggest that pharmacies deliver the absent medication to patients' homes and that the problem of the excessive medication delivery be reviewed within an interprofessional team of home care professionals, general practitioners, and pharmacists.

## Limitations

This study assessed only the potential clinical deterioration or discomfort of medication process problems on the assumption that the problems were



not solved and that medications were not (properly) administered to patients. However, whether medication problems actually resulted in clinical deterioration or discomfort is unknown.

## Conclusion

Home care professionals observe various medication process problems. The majority of the problems may have moderate or severe clinical consequences in older patients.

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## Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Statement of Equal Authors' Contribution

All listed authors made an equal contribution to this research.

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