Received: 26 September 2023 | Accepted: 3 July 2024

DOI: 10.1111/bcpt.14053

ORIGINAL ARTICLE

BCPT Basic & Clinical Pharmacology & Toxicology

Medication management in Danish home health care: Mapping of tasks and time consumption

Heidi Stubmark[1,2] | **Søren Post**[3] | **Emma Bjørk**[1,2] | **Anton Pottegård**[1,2] | **Carina Lundby**[1,2,4]

[1]Hospital Pharmacy Funen, Odense University Hospital, Odense, Denmark

[2]Clinical Pharmacology, Pharmacy and Environmental Medicine, Department of Public Health, University of Southern Denmark, Odense, Denmark

[3]Reagens, Skårup, Denmark

[4]Research Unit of General Practice, Department of Public Health, University of Southern Denmark, Odense, Denmark

Correspondence
Carina Lundby, Hospital Pharmacy Funen, Odense University Hospital, Solfaldsvej 38, Entrance 208, DK-5000 Odense, Denmark.
Email: carina.lundby.olesen@rsyd.dk

Funding information
The study did not receive any funding.

Abstract

We aimed to map tasks related to medication management and time consumption in Danish home health care. Nursing staff ($n = 30$) from five municipalities were followed during a 10-week period and tasks related to medication management, time consumption and information on citizens' medication were registered. A total of 269 courses were registered, including 163 (61%) home visits, 76 (28%) in-office courses, 29 (11%) in-clinic courses and 1 (0.4%) acute visit. Of defined categories related to medication management, 'record-keeping and communication' (62%, $n = 167$), 'dispensing' (48%, $n = 129$) and 'identification' (30%, $n = 81$) were most often performed. During half of courses (55%, $n = 147$), the nursing staff was interrupted at least one time. The median time spent on medication management was less than the time allocated in most of allocated time slots (82%), with a median excess time of 5.1 min (range 0.02–24 min). Citizens ($n = 32$) used a median of 11 (interquartile range [IQR] 9–13) regular medications and 2 (IQR 1–4) as-needed, and 69% ($n = 22$) used high-risk situation medications. In conclusion, employees in Danish home health care perform diverse medication-related tasks and are frequently interrupted in their work. Employees spend less time than allocated but do not fully solve all tasks according to best practice guidance.

KEYWORDS
home health care, medication management, medication safety, polypharmacy, time management

Plain English Summary

We mapped medication-related tasks and time spent on these tasks in the Danish home health care. We did this by following nursing staff from five municipalities during their everyday work for 10 weeks. We followed nursing staff during 269 courses, most often home visits (61%). Nursing staff most often performed tasks related to record keeping and communication about medication (62%) and dispensing of medication (48%). During half of courses (55%), nursing staff were interrupted in their work. Nursing staff generally spent less time than allocated to medication management but did not fully solve all tasks according to best practice guidance.

1 | INTRODUCTION

Polypharmacy, often defined as concurrent use of five or more medications,[1] is common among older people and increases with age.[2–4] Polypharmacy is associated with a number of challenges in older people, including increased risk of side effects, hospitalization and death.[2,5] Further, daily consumption of a high number of tablets can be challenging for many older people.[6]

Home health care (HHC) is responsible for managing medication for many older people with tasks including, for example, dispensing and administration.[7–11] As the number of medications increases, so does the complexity and time consumption of the medication management for nursing staff working in the HHC.[12] Further, employees in the HHC are exposed to a high workload and a busy, stressful working environment,[13] which could potentially lead to an increased risk of medication-related errors. Nearly 70% of medication-related errors in the Danish HHC are related to dispensing or administration.[14]

Older people constitute a growing proportion of the population,[15] thus placing larger demands on employees in the HHC, who will have to care for more people and handle more medication. To improve work procedures and avoid unnecessary medication management and potential medication errors, it is essential to improve our understanding of the medication management in the HHC, including whether the time spent on medication management reflects the time allocated to this.

With this study, we aimed to map tasks related to medication management as well as investigate the time consumption on this in the Danish HHC. Additionally, we aimed to document medication use in the HHC.

2 | METHODS

We mapped the medication-related tasks and the time spent on these tasks in the Danish HHC by following nursing staff during their daily work, including during home visits as well as work in-office and in-clinic. When possible, during home visits and work in-clinic, we obtained written and informed consent from citizens to register factors related to their medical treatment.

2.1 | Setting and participants

We invited 14 municipalities from four of five Danish regions to participate. Contact to municipalities was established through personal network within the author group and based on experiences from previous projects.[16,17]

In Denmark, citizens can apply for municipal HHC after referral from a physician.[18] Municipalities are obliged to provide services tailored to citizens' needs, for example, nursing, care and guidance. Each municipality is responsible for employment of nurses, health care assistants, social and health care workers and other personnel who can manage these services. In terms of medication management, nurses handle complex medication dispensing and administration, such as medical treatment involving more physicians, medical treatment including both manually and automated multi-dose dispensed medications, and medical treatment including medications with changing doses. Health care assistants manage less complicated medication dispensing and administration, while social and health care workers are responsible for nonmedication-related care, such as personal care and cleaning, but simple medication administration may be delegated.[19–22]

2.2 | Workshops with municipalities

To prepare the data collection and ensure better interpretation of the study findings, we conducted two workshops with representatives from the participating municipalities.

During the first workshop (January 2022), we introduced the project to 14 representatives, including pharmacists, nurses and municipality managers and consultants. The participants were selected by the municipalities and were all involved in medication management within the HHC. We presented a draft data collection tool outlining different tasks and subtasks related to medication management. Tasks and subtasks were based on best practice guidance on medication management in the HHC by the Danish Patient Safety Authority[11] as well as local guidelines from the participating municipalities. Best practice

guidance could, for example, include instructions on how to dispense and administer medication as well as how to handle high-risk situation medications.[11] Together with the municipality representatives, we agreed on eight major categories related to medication management as follows: (1) 'identification', (2) 'ordering and storage', (3) 'dispensing', (4) 'administration', (5) 'record-keeping and communication', (6) 'reporting of adverse events', (7) 'interruptions' and (8) 'unsuccessful visits' (Table 1).

During the second workshop (May 2022), we presented preliminary results to three municipality-selected representatives and received their input to ensure that our interpretation of the data correlated with real-life practice.

2.3 | Data collection

Data were collected from February to April 2022. One author (HS) followed nursing staff during their usual work to register the tasks related to medication management and time consumption. Employees were followed during day shifts on weekdays, for a total of 10 days in three of the municipalities and for 4 days in the remaining two municipalities. Selection of nursing staff to follow was determined by the municipalities. No formal criteria were applied in this selection. While some municipalities selected specific employees in advance, others pointed out specific employees on the day of data collection, based on who had a significant number of medication-related tasks planned for the given day.

Medication-related tasks were categorized according to pre-defined categories and time consumption was registered. Time measurement was initiated at observable moments, i.e., when any medication-related activity began. This could, for example, be when nursing staff found medication for administration or when citizens initiated medication-related communication. At all times, HS had a timer ready to initiate time measurement. Information related to the citizens' medical treatment was registered when it was possible to obtain written and informed consent. Nursing staff identified citizens eligible to provide consent (based on health status and cognitive function), which was collected by HS. For these citizens, the following information was obtained: sex, age, number of medications (regular, as-needed), use of predefined high-risk situation medications according to the Danish Patient Safety Authority (antidiabetics, anticoagulants, methotrexate, potassium, opioids, gentamicin, digoxin),[23,24] number and types of medical formulations, whether the citizen was self-administering, whether the citizen themselves collected their medication at the pharmacy, whether the citizen's medication was predispensed at the pharmacy, how the medication was stored, the citizen's medical status (estimated by the employee as either stable or unstable) and, finally, if the citizen was newly initiated in HHC (within a month) or had recently been discharged from a hospital (within a week). Information regarding collection of the medication was obtained through communication with the citizen, while the remaining information was obtained through communication with the employee, including the citizen's medication list.

Data were collected and stored using the Research Electronic Data Capture (REDCap) tool.[25,26] The data collection instrument was developed prior to the data collection; however, minor adjustments to the instrument were made during the first two weeks of the data collection. For example, we started registering the timing of interruptions, for example, whether an interruption occurred before, during or after a home visit.

2.4 | Ethics

The study was registered in the Region of Southern Denmark's repository (approval 21/59856). The Regional Committee on Health Research Ethics waived registration as the study did not contain any intervention element (case number 20212000-149). Employees and citizens were included based on informed and written consent. Patient anonymity is preserved. The study was conducted in accordance with the Basic & Clinical Pharmacology & Toxicology policy for experimental and clinical studies.[27]

3 | RESULTS

Five municipalities, representing three of five Danish regions (Capital, Southern Denmark, Zealand) and including both rural and urban municipalities, agreed to participate in the study. The municipalities pointed out a total 30 employees (range 4–9) eligible for following to register tasks related to medication management and time consumption, including 26 (87%) nurses and four (13%) health care assistants.

3.1 | Medication-related tasks and subtasks

A total of 269 courses related to medication management were registered. Of these, 61% ($n = 163$) were home visits (including 19 unsuccessful visits), 28% ($n = 76$) were in-office, 11% ($n = 29$) were in-clinic (including one unsuccessful visit) and 0.4% ($n = 1$) was an acute visit. Of all

TABLE 1 Number and proportion of tasks performed according to predefined medication-related categories and subtasks (including 'identification', 'ordering and storage', 'dispensing', 'administration', 'record-keeping and communication', 'reporting of adverse events', 'interruptions' and 'unsuccessful visits') during the 269 courses registered (including home visits, in-office courses, in-clinic courses and acute visits).

	n	%
Identification	**129**	**48**
Updating electronic medication record	120	93
Preparation of medication list	23	18
Other	44	34
Ordering and storage	**81**	**30**
Ordering of medication	65	80
Pick up medication at the pharmacy	5	62
Maintaining orderliness	7	8.6
Other	48	59
Dispensing	**137**	**51**
Setting up medication	90	66
Ensuring accordance between medication list and packages	129	94
The actual dispensing	126	92
Controlling the dispensing	119	87
Add broaching dates	4	2.9
Check if there is enough medication for next dispensing	102	74
Documentation	113	82
Tidying	96	70
Other	77	56
Administration	**42**	**16**
Finding medication	13	31
Ensuring accordance between medication list and packages	22	52
Preparation of medication	22	52
The actual administration	36	86
Administration of other than peroral formulations	32	76
Observation of citizen	2	4.8
Documentation	38	90
Tidying	22	52
Other	14	33
Record-keeping and communication	**167**	**62**
Assessment of effects and adverse effects	11	6.6
Deviations	6	3.6
Communication[a]	147	88
Updating citizen's conditions	13	7.8
Follow-up	38	23
Other	19	11
Reporting of adverse events	**0**	**0**
Interruptions[b]	**147**	**55**
Before the visit	23	16
During the visit	99	67

(Continues)

TABLE 1 (Continued)

	n	%
After the visit	5	3.4
Unknown[c]	35	24
Unsuccessful visits	**20**	**7.4**

[a]Medication-related communication with citizen, relative, colleague, pharmacy or physician.
[b]An interruption was defined as any event causing the nursing staff to divert attention from their current task, resulting in a pause. This could, for example, be stopping medication dispensing to answer a phone call or to respond to a question from a citizen.
[c]The category of interruptions was expanded during the second week of data collection to include the time of interruption. Thus, the timing of interruptions observed prior to this update is unknown.

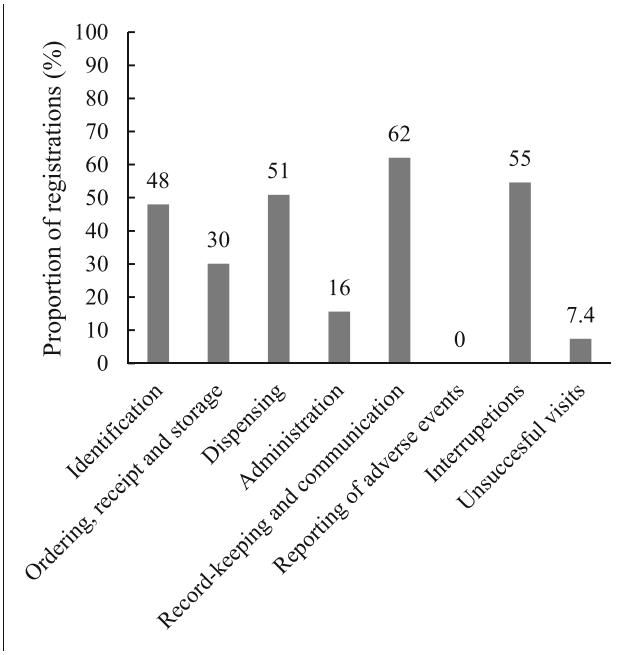

FIGURE 1 Proportion (%) of tasks performed according to predefined medication-related categories (including 'identification', 'ordering and storage', 'dispensing', 'administration', 'record-keeping and communication', 'reporting of adverse events', 'interruptions' and 'unsuccessful visits') during the 269 courses registered (including home visits, in-office courses, in-clinic courses and acute visits).

269 courses, 62% ($n = 167$) included 'record-keeping and communication', 51% ($n = 137$) included 'dispensing', 48% ($n = 129$) included 'identification' and 30% ($n = 81$) included 'ordering and storage' (Figure 1 and Table 1). In 7.4% ($n = 20$) of all courses, the employee was not able to complete the given task(s) successfully. Most often ($n = 19$), these unsuccessful tasks were due to citizens being out of home during scheduled visits, while one unsuccessful task was observed in-clinic. Considering only home visits and in-clinic courses ($n = 192$), the proportion of unsuccessful visits increased to 10%.

The proportion of registered tasks performed according to the predefined categories and subtasks related to medication management is presented in Table 1. Within 'identification' and 'ordering and storage', the most frequent subtasks were 'updating electronic medication record' (93%, $n = 120$) and 'ordering of medication' (80%, $n = 65$). For the category 'dispensing', 'ensuring accordance between medication list and packages' (94%, $n = 129$) and 'the actual dispensing' (92%, $n = 126$) were the most common subtasks, while this applied to the subtasks 'documentation' (90%, $n = 38$) and 'the actual administration' (86%, $n = 36$) in the category 'administration'. Within 'record-keeping and communication', the most common subtask was 'communication' (88%, $n = 147$). Reporting of adverse events was not observed. Across the eight categories, some subtasks otherwise considered critical[11] were frequently omitted. For example, 'setting up medication' was only observed in 66% ($n = 90$) of the courses in the 'dispensing' category, while 'ensuring accordance between medication list and packages' was only observed in 52% ($n = 22$) of the courses in the 'administration' category.

3.2 | Interruptions during medication management

Interruptions were observed in more than half of courses (55%, $n = 147$) (Figure 1), with the highest occurrence during home visits (69%, $n = 112$) (Table 1). Interruptions primarily occurred during home visits (67%, $n = 99$), while interruptions before and after home visits were less common (16%, $n = 23$ and 3.4%, $n = 5$, respectively). For 24% ($n = 35$) of all interruptions, the timing is unknown, as this variable was added to the data collection instrument after data collection initiation (see Section 2.3).

A total of 422 interruptions were observed, with a median of 1 (range 0 to 11). Around half of courses (45%, $n = 122$) had no interruptions, 44% ($n = 119$) had 1–4 interruptions and 10% ($n = 28$) had ≥5 interruptions (Figure 2A). Among the 147 courses where interruptions were observed, 33% ($n = 48$) had 1 interruption, 25% ($n = 37$) had 2 interruptions, 24% ($n = 34$)

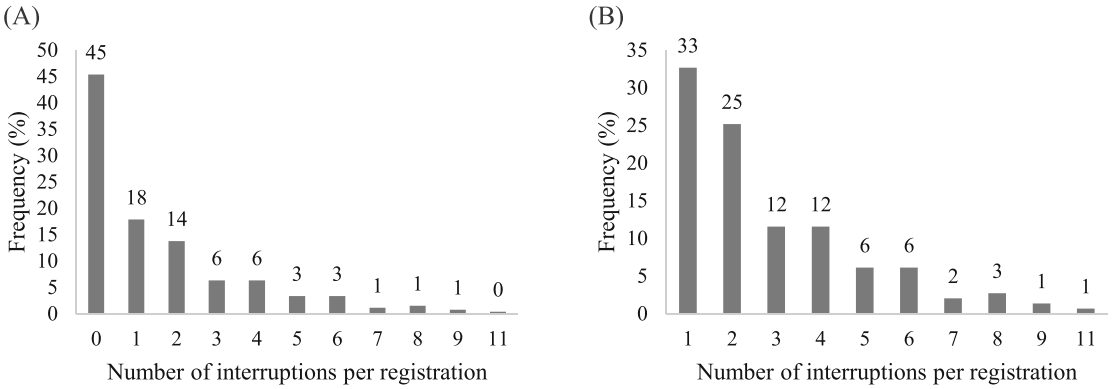

FIGURE 2 Frequency (%) and distribution of number of interruptions[a]: (a) for tasks performed during the 269 courses (including home visits, in-office courses, in-clinic courses and acute visits) and (b) for tasks performed specifically during the 147 courses (including home visits, in-office courses, in-clinic courses and acute visits) where interruptions were observed. [b]An interruption was defined as any event causing the nursing staff to divert attention from their current task, resulting in a pause. This could, for example, be stopping medication dispensing to answer a phone call or to respond to a question from a citizen.

had 3–4 interruptions and 19% ($n = 28$) had ≥5 interruptions (Figure 2B). Interruptions were observed in association with both home visits, in-office tasks and in-clinic tasks. The majority of interruptions (99%; $n = 146$) was caused by the citizen, a relative or a colleague. Other interruptions included technical issues and practicalities, for example, missing internet connection or missing dosette box.

3.3 | Time consumption on medication management

For 155 of the 269 courses, the time allocated to medication management was registered (Table 2). In general, the nursing staff spent less time on medication management than allocated. Specifically, in only 3 of 17 allocated time slots (5, 46 and 48 min, respectively), the time spent exceeded the time allocated. Most often, the time spent was less than the time allocated, with excess time ranging from median 0.02 to 24 min. In 12 of 14 (86%) of these cases (71% of all allocated time slots), there was less than median 7 min to spare. However, for two courses, the time spent on medication management was considerably longer than allocated. These two courses concerned longer home visits with 46 and 48 min allocated, respectively.

3.4 | Medication use among citizens in HHC

During home visits and in-clinic, written and informed consent to register information related to medication was obtained from 32 citizens (Table 3). The citizens had a median age of 83 years (interquartile range [IQR] 76–86), and 59% ($n = 19$) were women. They used a median of 11 (IQR 9–13) regular medications and 2 (IQR 1–4) as-needed medications. High-risk situation medications[23] were used by 69% ($n = 22$) of the citizens, most commonly potassium (50%, $n = 11$), antidiabetics (36%, $n = 8$) and anticoagulants (32%, $n = 7$). Most citizens (77%, $n = 24$) self-administered their medications, and two thirds (66%, $n = 21$) were considered medically stable.

4 | DISCUSSION

We mapped medication-related management tasks and time consumption in the Danish HHC. We found that tasks related to the categories 'record-keeping and communication', 'dispensing' and 'identification' were most common, and that time spent was generally less than time allocated. Best practice guidance was not fully adhered to. Interruptions occurred in more than half of courses and were most frequently observed during home visits. Finally, we showed that citizens in the HHC comprise a group of older people using multiple medications, often including high-risk situation medications, such as potassium, antidiabetics and anticoagulants.

The principal strength of this study is our close cooperation with the municipalities, which ensured accordance between our interpretation of findings and real-life practice. However, several limitations should also be acknowledged. First, only one observer followed employees and registered tasks, time consumption and medication information, limiting the amount of data possible for collection within the data collection period.

TABLE 2 Number of courses with a certain time allocated (min) to medication management ($n = 155$), median time spent on medication management (min) and median difference (min) between time allocated and time spent on medication management.

Allocated time (min)	$n = 155$	Time consumption (min) Median (IQR)	Difference (min) Median (IQR)
5	2	5.3 (3.6;8.7)	2 (0.3;3.7)
7	3	1.8 (1.5;2.9)	−5.2 (−5.5;-4.1)
10	16	7.8 (4.1;10)	−2.2 (−5.9;-0.04)
15	18	13 (5.4;20)	−1.5 (−9.6;4.6)
16	13	11 (9.9;18)	−5.0 (−6.1;1.8)
20	11	20 (13;35)	−0.02 (−6.9;-15)
21	2	17 (14;19)	−4.4 (−7.0;-1.8)
25	8	19 (13;23)	−5.7 (−12;-2.4)
26	11	21 (16;24)	−4.6 (−10;-2.5)
30	38	25 (21;33)	−5.3 (−9.1;2.7)
35	4	32 (28;37)	−3.1 (−6.5;1.9)
36	6	29 (25;33)	−6.9 (−11;-3.5)
40	5	24 (23;29)	−16 (−17;-11)
45	15	40 (33;47)	−5.2 (−12;2.3)
46	1	64	18
48	1	92	44
60	1	36	−24

Abbreviation: IQR, interquartile range.

However, having only one observer eliminated potential challenges with interobserver reliability.[28] Second, nursing staff might have changed behaviour due to being observed, a phenomenon known as the Hawthorne effect.[29] Registering time spent might have inclined employees to work faster to appear more effective. On the contrary, they might have been particularly attentive and taking extra time to avoid mistakes and adverse events. However, each employee was explicitly informed that their performance was not subject to scrutiny and, further, to keep up with their busy schedule, taking extra time seems unlikely. Third, the data collection was limited to five municipalities, and differences in practices between rural and more urban municipalities might limit generalizability. Moreover, data were only collected during day shifts on weekdays, potentially limiting generalizability further. Also, no formal criteria were applied in the selection of nursing staff, with some municipalities selecting employees to follow based on their number of medication-related tasks. This might possibly lead to a distorted or unrepresentative depiction of complex medication management. Finally, we only obtained informed consent from 32 citizens, which might also lead to a distorted or unrepresentative depiction of medication complexity among citizens in HHC, thus also limiting generalizability.

The registered subtasks related to medication management suggest that tasks, in some cases, were not fully solved according to best practice guidance. For example, 126 actual dispensings were observed, but for only 90 of these, 'setting up medication' was done—a process that is supposed to reduce the risk of medication errors. Similarly, of 36 registered actual administrations, only 22 included 'ensuring accordance between medication list and packages' before the medication was administered. These subtasks are essential since most medication errors in the Danish HHC are related to dispensing or administration,[14] and omitting them could potentially lead to adverse events. For both 'dispensing' and 'administration', 'tidying' was also not observed for every task. However, this does not necessarily mean that the employee did not care to tidy up, as some citizens (or relatives) insisted on doing this. Further, some employees preferred completing the documentation back at the office later in their shift as opposed to doing it during the home visit, and since the observer sometimes followed multiple employees in one day, these potential afternoon documentations may have been missed.

A large proportion of tasks were interrupted by the citizen, relatives and colleagues, in association with home visits, in-office tasks and in-clinic tasks. Interruptions during medication administration[30,31] and dispensing[32,33]

TABLE 3 Citizen characteristics.

Characteristic	Citizens ($n = 32$)
Sex, n (%)	
Male	13 (41)
Female	19 (59)
Age, years	
Median (IQR)	83 (76–86)
Number of regular medications, n	
Median (IQR)	11 (9–13)
Number of as- needed medications, n (%)	
Median (IQR)	2 (1–4)
Number of citizens using high-risk situation medications,[a] *n* (%)	**22 (69)**
Antidiabetics	8 (36)
Anticoagulants	7 (32)
Methotrexate	2 (9.1)
Potassium	11 (50)
Opioids	6 (27)
Gentamicin	0 (0)
Digoxin	6 (27)
Number of citizens using different formulations, *n* (%)	
Tablets and capsules	32 (100)
Creams, gels and ointments	10 (31)
Inhalation	10 (31)
Intravenous injections	1 (3.1)
Other injections	2 (6.3)
Patches	1 (3.1)
Eye drops	8 (25)
Feeding tube	0 (0)
Other	4 (13)
Number of citizens self-administering their medications, *n* (%)	**31 (97)**
Yes	24 (77)
Partly	4 (13)
No	3 (9.7)
Person responsible for collecting medication at pharmacy, *n* (%)	
Citizen	7 (22)
Relative	11 (34)
Home health care or delivery	14 (44)
Place for storage of medication,[b] *n* (%)	
Private, organized	23 (72)
Private, unorganized	2 (6.3)
Private, municipalities' system	19 (59)
At the municipality	1 (3.1)
Medical status of citizens (stable vs unstable) as assessed by employee, *n* (%)	
Stable	21 (66)
Unstable	11 (34)

Abbreviation: IQR, interquartile range.

[a]As defined by the Danish Health Authority.[24]

[b]Some citizens had their medication stored several places.

in hospitals and pharmacies, respectively, are associated with an increased risk of errors, which is potentially also valid for the HHC, raising concerns for patient safety. In addition, the many interruptions may contribute to a stressful working environment for the employees that must manage complex tasks on a tight schedule.[12,13] Interruptions are not only time-consuming but also disrupts the employees and their focus, potentially further increasing the risk of compromised patient safety.

In general, we found that the time spent on medication management was less than the time allocated, which is not in immediate accordance with the general perception that the working environment for nursing staff is very busy.[13,34,35] However, as mentioned previously, in some cases, the full extent of the medication management may not have been observed, and for multiple tasks, one or more subtasks were omitted. Additionally, multitasking was common, primarily involving communication with citizens or colleagues. In these cases, only the primary task (defined as the task being interfered with) was registered. For these reasons, we might underestimate the time spent on medication management. Thus, with the majority of tasks having less than 7 min to spare, the allocated times might not be sufficient if (1) the full extent of the medication management was observed, (2) the employee fully adhered to best practice guidance and (3) the employee did not multitask.

The citizens used a median of 11 different regular medications, which is slightly more than found in Norwegian home-dwelling older people using a mean of 9 regular medications.[9] As 87% of the employees followed were nurses, expectedly more medically complex citizens were visited, which could possibly explain the high number of medications used. Further, two in three citizens used one or more high-risk medications, which adds to the complexity of medication management, as it requires increased attention from nursing staff during administration and dispensing.[11,24] The higher number of citizens using high-risk medications could thus also relate to the fact that primarily nurses were followed.

Future research should elucidate how employees experience their work in the HHC in terms of time constraints. Our results suggest that limited time presumably instigates employees to create their own routines and omit subtasks, in order to have time for other tasks during their shift, but it is yet to be determined if this is in accordance with the employees' own perception. This knowledge would be valuable for developing and optimizing work procedures in the HHC. Ensuring adequate time allocation for tasks related to medication management may make employees more inclined to follow best practice guidance, thus reducing the risk of potential medication errors and adverse events. Further, implementation of automated multidose medication dispensing in the municipalities is highly debated at the moment, as it has the potential to free up time for nursing staff and has been shown to significantly reduce medication errors.[36] There are, however, challenges related to its implementation. For example, medication management will likely become less flexible; for example, it will be more difficult to change medications and doses, which has been shown to increase medication use and potentially inappropriate treatment.[37–40] Although implementation of automated multidose medication dispensing would significantly reduce time spent on medication administration and dispensing, it would consequently also require new work procedures for municipal medication management. Future research should thus look into how the municipalities can make use of automated multidose medication dispensing in the HHC in a safe and sustainable way and how to identify which citizens in the HHC that would benefit the most from automated multidose medication dispensing.

In conclusion, we found that the tasks most commonly done in the Danish HHC were related to 'record-keeping and communication', 'dispensing' and 'identification', but, for multiple tasks, best practice guidance was not fully followed. Interruptions were frequent and typically caused by the citizen or a colleague. The median time consumption was generally less than time allocated. However, several factors might have led to an underestimation of the time consumption, including incomplete observation of the full medication management process and multitasking. The citizens in the HHC comprise a group of older people using multiple medications, often including high-risk situation medications, such as potassium, antidiabetics and anticoagulants, making the medication management both time-consuming and complex. Strategies are needed to address the issue of interruptions and, further, to ensure that employees fully adhere to best practice guidance in order to reduce the risk of medications errors and subsequent potential adverse events and thereby improve patient safety.

ACKNOWLEDGEMENTS

We thank the municipalities for providing invaluable input to both design, data collection, and interpretation of the study. We also thank the nurses and health care assistants as well as the citizens for participating. Finally, we acknowledge Open Patient data Explorative Network (OPEN).

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Søren Post https://orcid.org/0009-0000-8854-1909
Emma Bjørk https://orcid.org/0000-0001-6794-1479
Anton Pottegård https://orcid.org/0000-0001-9314-5679
Carina Lundby https://orcid.org/0000-0002-2121-6252

REFERENCES

1. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. *BMC Geriatr*. 2017;17(1):230. doi:10.1186/s12877-017-0621-2
2. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. *Expert Opin Drug Saf*. 2014;13(1):57-65. doi:10.1517/14740338.2013.827660
3. Meyer-Massetti C, Meier CR, Guglielmo BJ. The scope of drug-related problems in the home care setting. *Int J Clin Pharmacol*. 2018;40(2):325-334. doi:10.1007/s11096-017-0581-9
4. Kornholt J, Christensen MB. Prevalence of polypharmacy in Denmark. *Dan Med J*. 2020;67(6).
5. Kongkaew C, Hann M, Mandal J, et al. Risk factors for hospital admissions associated with adverse drug events. *Pharmacotherapy*. 2013;33(8):827-837. doi:10.1002/phar.1287
6. Notenboom K, Beers E, van Riet-Nales DA, et al. Practical problems with medication use that older people experience: a qualitative study. *J am Geriatr Soc*. 2014;62(12):2339-2344. doi:10.1111/jgs.13126
7. Sino C, Dooren van Haverkamp A, Schuurmans M. Recognition of drug related problems by home healthcare employees: a Dutch observational study with self reports. *J Nurs Educ Pract*. 2013;3(8):3. doi:10.5430/jnep.v3n8p41
8. Holmqvist M, Ekstedt M, Walter SR, Lehnbom EC. Medication management in municipality-based healthcare: a time and motion study of nurses. *Home Healthc Now*. 2018;36(4):238-246. doi:10.1097/NHH.0000000000000671
9. Næss G, Kirkevold M, Hammer W, Straand J, Wyller TB. Nursing care needs and services utilised by home-dwelling elderly with complex health problems: observational study. *BMC Health Serv Res*. 2017;17(1):645. doi:10.1186/s12913-017-2600-x
10. Vaartio-Rajalin H, Näsman Y, Fagerström L. Nurses' activities and time management during home healthcare visits. *Scand J Caring Sci*. 2020;34(4):1045-1053. doi:10.1111/scs.12813
11. Styrelsen for Patientsikkerhed. Korrekt håndtering af medicin: Et værktøj for plejecentre, hjemmepleje, hjemmesygepleje, bosteder m.v. Published November 2019. Accessed June 28, 2024. https://stps.dk/Media/638217399683998559/Korrekt%20h%C3%A5ndtering%20af%20medicin.pdf
12. Kjellberg J, Ibsen R. *Analyse Af Udviklingen i Hjemmesygeplejen i Fredericia Kommune*; 2017.
13. Arbejdstilsynet. *Hjemmepleje Og Plejehjem*. https://at.dk/om-os/interne-retningslinjer/brancheundervisningsnotater/hjemmepleje-og-plejehjem/
14. Patientombuddet. *Medicinering i Hjemmeplejen Og i Plejebolig*; 2012. http://www.patientombuddet.dk
15. World Health Organization. *Global Health and Aging*.
16. Reilev M, Lundby C, Jensen J, Larsen SP, Hoffmann H, Pottegård A. Morbidity and mortality among older people admitted to nursing home. *Age Ageing*. 2019;49(1):67-73. doi:10.1093/ageing/afz136
17. Lundby C, Jensen J, Larsen SP, Hoffmann H, Pottegård A, Reilev M. Use of medication among nursing home residents: a Danish drug utilisation study. *Age Ageing*. 2020;49(5):814-820. doi:10.1093/ageing/afaa029
18. Sundhedsministeriet. *Sundhedsloven*. Published online 2022.
19. Frederiksberg Kommune. *Indsatskatalog for klinik sygeplejeindsatser, Til brug for Planlægger og kliniksygeplejersker*. Published online 2018.
20. *Sønderborg Kommune. Ydelseskatalog for Sundhedslovsydelser*; 2019.
21. Holm-Petersen C, Topholm EHE, on behalf of Det Nationale Forsknings- og Analysecenter for Velfærd. *Organisering af hjemmeplejen og hjemmesygeplejen – Fordele og ulemper ved monofaglig og tværfaglig organisering*. Published online 2022.
22. Vinge S, Topholm EHE, on behalf of Det Nationale Forsknings- og Analysecenter for Velfærd. *Social- og sundhedshjælpere og social- og sundhedsassistenter i kommunerne*. Vol. 182.
23. Styrelsen for Patientsikkerhed. *Syv Risikosituationslægemidler, Der Kræver Din Særlige Opmærksomhed*; 2018. https://stps.dk/da/laering/risikoomraader/risikosituationslaegemidler/~/media/46476517346E49F7A165D70B9520C489.ashx
24. Styrelsen for Patientsikkerhed. *Risikosituationslægemidler: En Guide Til Sikker Medicinhåndtering*; 2021. https://stps.dk/da/udgivelser/2021/risikosituationslaegemidler-en-guide-til-sikker-medicinhaandtering/~/media/1E6429B8918943BB8CF2E3AC4BB84B24
25. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. doi:10.1016/j.jbi.2008.08.010
26. *The REDCap Consortium: Building an International Community of Software Platform Partners - ScienceDirect*. Accessed May 10, 2022. https://www-sciencedirect-com.proxy1-bib.sdu.dk/science/article/pii/S1532046419301261
27. Tveden-Nyborg P, Bergmann TK, Jessen N, Simonsen U, Lykkesfeldt J. BCPT 2023 policy for experimental and clinical studies. *Basic Clin Pharmacol Toxicol*. Published online. 2023. doi:10.1111/bcpt.13944
28. Gwet KL. Computing inter-rater reliability and its variance in the presence of high agreement. *Br J Math Stat Psychol*. 2008;61(1):29-48. doi:10.1348/000711006X126600
29. Sedgwick P, Greenwood N. Understanding the Hawthorne effect. *BMJ*. 2015;351:h4672. doi:10.1136/bmj.h4672
30. Westbrook JI, Woods A, Rob MI, Dunsmuir WTM, Day RO. Association of interruptions with an increased risk and severity of medication administration errors. *Arch Intern Med*. 2010;170(8):683-690. doi:10.1001/archinternmed.2010.65
31. Johnson M, Sanchez P, Langdon R, et al. The impact of interruptions on medication errors in hospitals: an observational study of nurses. *J Nurs Manag*. 2017;25(7):498-507. doi:10.1111/jonm.12486

32. Flynn EA, Barker KN, Gibson JT, Pearson RE, Berger BA, Smith LA. Impact of interruptions and distractions on dispensing errors in an ambulatory care pharmacy. *Am J Health-Syst Pharm*. 1999;56(13):1319-1325. doi:10.1093/ajhp/56.13.1319
33. James KL, Barlow D, McArtney R, Hiom S, Roberts D, Whittlesea C. Incidence, type and causes of dispensing errors: a review of the literature. *Int J Pharm Pract*. 2009;17(1):9-30. doi:10.1211/ijpp.17.1.0004
34. Thomson MS, Gruneir A, Lee M, et al. Nursing time devoted to medication administration in long-term care: clinical, safety, and resource implications. *J am Geriatr Soc*. 2009;57(2):266-272. doi:10.1111/j.1532-5415.2008.02101.x
35. Smith S, Murphy E, Hannigan C, Dinsmore J, Doyle J. Supporting older people with multimorbidity: the care burden of home health-care assistants in Ireland. *Home Health Care Serv Q*. 2019;38(3):241-255. doi:10.1080/01621424.2019.1614506
36. Kommunernes Landsforening og Danske Regioner. *Dosispakket medicin - en analyse*. 2023. Accessed June 28, 2024. https://www.kl.dk/media/iwnam2yi/dosispakket-medicin-hovedrapport.pdf
37. Sjöberg C, Edward C, Fastbom J, et al. Association between multi-dose drug dispensing and quality of drug treatment—a register-based study. *PLoS ONE*. 2011;6(10):e26574. doi:10.1371/journal.pone.0026574
38. Wallerstedt SM, Fastbom J, Johnell K, Sjöberg C, Landahl S, Sundström A. Drug treatment in older people before and after the transition to a multi-dose drug dispensing system—a longitudinal analysis. *PLoS ONE*. 2013;8(6):e67088. doi:10.1371/journal.pone.0067088
39. Sjöberg C, Ohlsson H, Wallerstedt SM. Association between multi-dose drug dispensing and drug treatment changes. *Eur J Clin Pharmacol*. 2012;68(7):1095-1101. doi:10.1007/s00228-012-1230-9
40. Kwint HF, Faber A, Gussekloo J, Bouvy ML. Effects of medication review on drug-related problems in patients using automated drug-dispensing systems: a pragmatic randomized controlled study. *Drugs Aging*. 2011;28(4):305-314. doi:10.2165/11586850-000000000-00000

How to cite this article: Stubmark H, Post S, Bjørk E, Pottegård A, Lundby C. Medication management in Danish home health care: Mapping of tasks and time consumption. *Basic Clin Pharmacol Toxicol*. 2024;135(4):464-474. doi:10.1111/bcpt.14053