

# Medication management by community-dwelling older people: an observational study

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## ABSTRACT

**Title:** Medication management by community-dwelling older people: an observational study.

**Background:** Several factors, such as self-treatment, impaired cognitive status, and living alone, contribute to problems in medication management which can lead to drug-related problems (DRPs). As frequent users of medication, community-dwelling older people are at risk of developing DRPs.

**Aim and research questions:** To explore medication management skills in community-dwelling older people. Two questions were central in this study. First, what are the medication management skills of community-dwelling older people and how are they related to cognition, self-management skills and demographic variables? Second, to what extent do observations of potential DRPs by home health care staff correspond to the potential DRPs experienced by community-dwelling older people?

**Method:** An observational study, with a cross-sectional design. A random sample of home care clients was recruited from one organization. Participants were  $\geq 75$  years old and chronically used five or more medications. The medication management skills, cognition, and the self-management skills were measured respectively using the Medication Management Score (MMS), the Clock Drawing Test (CDT), and the Self-Management Ability Scale. The potential DRPs observed by staff were measured using the Home Observation of Medication related problems by homecare Employees instrument. To verify the existence of potential DRPs observed by the staff, the participants were interviewed about which potential DRPs they experienced.

**Results:** Of 106 eligible clients, 33 participated. Seventy percent scored  $\geq 1$  point(s) on the MMS. A lower score for the CDT showed poor medication management skills ( $r_s = -.397$ ;  $p .025$ ). There was good agreement ( $\kappa .653$ ) between potential DRPs related to medication management problems as observed by the staff and reported during the interview.

**Conclusion:** The community-dwelling older people appeared to have good medication management skills which are negatively influenced by cognitive impairment. Home care staff is able to identify potential DRPs related to medication management problems.

**Recommendations:** Further research should focus on how identification of potential DRPs can lead to safer medication management.

**Keywords:** Home care, Elderly, Medication management, Drug Related Problem, Cognition

## DUTCH SUMMARY

**Titel:** Beheer en gebruik van medicatie door zelfstandig wonende ouderen: een observationeel onderzoek.

**Inleiding:** Verschillende factoren, zoals zelfbehandeling, verminderd cognitief vermogen en alleen wonen dragen bij aan problemen bij het beheer en gebruik van medicatie en kunnen leiden tot medicatiegerelateerde problemen. Als frequente gebruikers van medicatie lopen zelfstandig wonende ouderen risico op het ontwikkelen van zulke problemen.

**Doel en onderzoeksvragen:** Het in kaart brengen van de medicatiemanagement vaardigheden van zelfstandig wonende ouderen. Er stonden in dit onderzoek twee vragen centraal. Ten eerste, wat zijn de medicatiemanagement vaardigheden van zelfstandig wonende ouderen en hoe hebben deze verband met cognitie, zelfmanagement vaardigheden en demografische variabelen? Ten tweede, in welke mate komt de signalering van potentiële medicatiegerelateerde problemen door thuiszorg medewerkers overeen met de ervaring van deze problemen door de zelfstandig wonende ouderen?

**Methode:** Een observationeel onderzoek met een cross-sectioneel design. Vanuit één thuiszorgorganisatie is een willekeurige steekproef van thuiszorgcliënten geworven. Participanten waren 75 jaar en ouder en gebruikten chronisch vijf of meer medicijnen. De medicatiemanagement vaardigheden, cognitie en zelfmanagement vaardigheden zijn gemeten met respectievelijk de Beoordeling Eigen beheer van Medicatie (BEM), de kloktekentest en de Self-Management Ability Scale. De potentiële medicatiegerelateerde problemen die gesignaleerd werden door thuiszorgmedewerkers zijn gemeten met het Rode Vlaggen Instrument. Om het bestaan van geobserveerde problemen te bevestigen, werden de participanten geïnterviewd over hun ervaringen.

**Resultaten:** Van de 106 geschikte cliënten hebben 33 deelgenomen. Zeventig procent scoorde  $\geq 1$  punt(en) op de BEM. Een lagere score op de kloktekentest liet slechte medicatiemanagement vaardigheden zien ( $r_s = -.397$ ;  $p .025$ ). Er was goede overeenstemming ( $\kappa .653$ ) tussen potentiële medicatiegerelateerde problemen met betrekking tot medicatiemanagement problemen zoals geobserveerd door de thuiszorgmedewerkers en gerapporteerd door de ouderen.

**Conclusie:** De zelfstandig wonende ouderen lijken goede medicatiemanagement vaardigheden te hebben welke negatief worden beïnvloedt door een verminderd cognitief vermogen. Thuiszorgmedewerkers zijn in staat potentiële medicatiegerelateerde problemen met betrekking tot medicatiemanagement problemen te signaleren.

**Aanbevelingen:** Verder onderzoek zou zich moeten richten op hoe de herkenning van potentiële medicatiegerelateerde problemen kan leiden tot veiliger medicatiemanagement.

**Trefwoorden:** Thuiszorg, Ouderen, Medicatiemanagement, Medicatiegerelateerd probleem, Cognitie

## INTRODUCTION

Along with the population ageing, the proportion of community-dwelling older people in The Netherlands is also increasing<sup>1</sup>. Dutch older people (persons of  $\geq 65$  years of age) use over three times as much medications as average. In persons of  $\geq 75$  years of age, this increases to almost five times as much. The medication used by this group is predominantly used chronically and the average elderly person uses three different medications on a daily base.<sup>2</sup>

In the Netherlands 5.6% of all unplanned hospital admissions are medication-related. Almost half (46.5%) of these admissions were potentially preventable, e.g. by regular reviews for potential drug-related problems (DRPs).<sup>3</sup> Worldwide, the proportion of medication-related hospital admissions is approximately 5.3%.<sup>4</sup> Older people are twice as likely to have a medication-related hospital admission as people  $< 65$  years of age.<sup>3</sup>

The facilitation of safe and effective use of prescription and over-the-counter medications is defined as medication management<sup>5</sup>. According to Bergman-Evans<sup>6</sup>, self-treatment, lack of coordinated care, recent discharge from the hospital, impaired cognitive status, and a complicated medications regimen can all contribute to medication mismanagement in the population of older people. Living alone, impaired vision, aged  $\geq 75$  years, and more than one prescribing provider are also indicated as factors associated with problems in medication management<sup>7</sup>. Medication mismanagement can lead to DRPs. A DRP is defined as an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes<sup>8</sup>.

There is little evidence about the medication management skills of community-dwelling older people. In a study among community-dwelling older people (aged  $\geq 75$  years) in New Zealand, the people appeared to manage their medication well<sup>9</sup>. Due to differences in health care systems, these results might not be directly applicable to other countries. Maddigan et al.<sup>10</sup> found, in a sample at a rehabilitation hospital, that the effect of cognition is an important predictor of medication management capacity; though this appeared to be conditional on the medication regimen complexity<sup>10</sup>. Furthermore cognitive impairment was found to possibly complicate the older adult's ability to successfully manage medications after hospitalization<sup>11</sup>. However, due to the small and homogeneous sample generalizability is limited. How self-management skills are associated with medication management has not been studied.

In a study about observations and experiences of medication management, home care nurses observed many different kinds of problems in taking medication as prescribed, and recognized and reported adverse effects from medications<sup>12</sup>. These results cannot be generalized because of a low response rate. Griffiths et al.<sup>13</sup> reported about community nurses identifying clients experiencing problems with medications in a small sample of older people. With help of the Safe Medication Assessment tool, district nurses identified several factors highly related to unsafe medication management among elderly people<sup>14</sup>. Two studies in the hospital setting found that nurses can identify patients with increased risk of DRPs<sup>15,16</sup>.

### **Problem statement**

Sixty-three percent of the home care users is >65 years of age<sup>17</sup>. As frequent users of medication, this group is at risk of developing DRPs. In the home situation, health care professionals have little visibility on the medication use of older people, which demands adequate self-management by this group of older people. Home care nurses are in a distinctive position to form a complete picture of a client's situation concerning his medication use<sup>12,18</sup>, and should be able to identify problems in medication management and, if possible, decline the risk of DRPs. However, little is known about the medication management skills of community-dwelling older people and which potential DRPs are observed by home care staff.

### **Aim**

The aim of this study was to explore the medication management skills in community-dwelling older people. With this, home healthcare organisations can create better methods in establishing the most appropriate care for community-dwelling older people concerning medication management, reduce the risk of potential DRPs, and improve quality of care.

### **Research questions**

The following questions were central in this study. 1) What are the medication management skills of community-dwelling older people and how are they related to cognition, self-management skills and demographic variables? And 2) to what extent do observations of potential DRPs by home health care staff correspond to the potential DRPs experienced by community-dwelling older people?

## METHOD

### Design, setting and participants

This observational study, with a cross-sectional study design, was conducted in a home health care setting in The Netherlands during the period from March to June 2012. Using this design, relationships among phenomena at a fixed point in time could be described<sup>19</sup>. A random sample of community-dwelling older people who receive home care was recruited. Participants were eligible if they (1) were aged  $\geq 75$  years and (2) chronically used five or more medications (defined as polypharmacy<sup>20</sup>). Clients who had a terminal illness or were not able to speak and read Dutch language were excluded. Participants were also excluded if they transferred to intramural care or home care service was ended before their data were collected.

Since there are no previous studies whereupon a sample size could be based, it was not possible to calculate the required sample size. According to Polit and Beck<sup>19</sup> the largest possible sample should be used in case it cannot be calculated. Due to practical considerations a sample size of 100 participants was targeted.

### Measurement

#### *Medication management skills*

The older people's medication management skills were measured using the Medication Management Score (MMS) (in Dutch: Beoordeling Eigen beheer van Medicatie, BEM)<sup>21</sup>. The MMS is a resource developed for care homes and gives insight in a person's skills in managing and using medication, and if and how he needs help with this<sup>21</sup>. There is no clinimetric data available and there is not an equivalent instrument developed for home health care. The MMS consists of five parts, however only the general part of the client form was used in this study to explore the ability in medication management. This part consists out of 17 (positively worded) statements about the management and use of medication that need to be answered with 'yes', 'no', '?' (uncertain or sometimes) or 'not applicable'. The total score in this study was the number of times answered with 'no' or '?', indicating a lack in medication management skills. Therefore, a low score represents good medication management skills.

#### *Cognition*

The Clock Drawing Test (CDT)<sup>22</sup> was used to examine the cognition of the participants. Sensitivity and specificity levels are both at a mean of 85% with excellent inter-rater reliability and good concurrent, and predictive validity<sup>23</sup>.

Participants were asked to draw a clock face and to mark in the hands at ten after eleven. In this study the maximum score on the test was five points: (1) clock circle, (1) all figures in the correct order, (1) all figures in the right place, (1) two hands, and (1) right time. To obtain reliable scores the result of the test was assessed by two researchers; the score was based on a consensus between the raters.

### *Self-management skills*

The self-management skills of the community-dwelling older people were assessed using the Self-Management Ability Scale (SMAS-30, version 2/2008)<sup>24</sup>. This is a validated self-report instrument to measure self-management ability in aging individuals<sup>24</sup>. The SMAS-30 consists of 30 questions with answers on a 5- or 6-point scale and is divided into six sub-scales: taking initiatives, self-efficacy, investment behavior, positive frame of mind, multifunctionality, and variety<sup>25</sup>. A higher score indicates more of a self-management ability. The 30 items together have a high internal consistency ( $\alpha=0.91$ ), Cronbach's  $\alpha$ s for the sub-scales range from 0.67 to 0.84, and the instrument has good reproducibility<sup>24</sup>. The reliability and psychometric properties of version 2/2008 are nearly similar to the first version (1/2004). Item scores range from 0-20 and both sub-scale scores and the total score range from 0-100.<sup>25</sup> For singular missing values on a subscale, the item score was calculated as the mean of the remaining items<sup>24</sup>.

### *Observed potential DRPs*

The potential DRPs observed by home care staff were measured using the Home Observation of Medication related problems by homecare Employees (HOME) instrument<sup>26</sup>. This instrument is developed to observe warning signals in medication use in a home health care setting. The list includes 28 questions, and is divided into three categories (process, pill and patient) and fifteen subcategories, which can indicate the existence of a potential DRP. The specificity of the HOME instrument was high (78%-99%) for most the subcategories and the sensitivity was moderate (63%, 63% and 67%) to high (81% and 86%) for five of the fifteen subcategories<sup>26</sup>. The staff member completes the list by indicating which warning signal(s) he/she observed in the two weeks prior to the time of completion of the instrument. Whether or not there was a potential DRP, was determined by category according to the algorithm (Appendix A)<sup>26</sup>. The score for the instrument was the total number of potential DRPs.



### *Experienced potential DRPs*

To verify the existence of potential DRPs observed by the home care staff, the participants were interviewed about which potential DRPs they experienced. This medication interview consisted of structured questions to map out the medication in use and to explore the perspective of the older people concerning the experience of potential DRPs. The interview matches the categories and items of the HOME instrument.<sup>26</sup> This interview has only been used once before to determine the validity of the HOME instrument. The determination of existence of a potential DRP and the scoring equaled that of the HOME instrument.

### **Study procedures**

The home health care organization provided a list of clients aged  $\geq 75$  years. Every third person on the list was informed about the study by home care staff, unless there was an exclusion criterion. If clients were interested in participating, an information letter was handed over by a member of the staff. After 5-7 days, all potential participants received a phone call from one of the authors (AO), inclusion criteria were checked, and remaining questions were answered. Subsequently, an appointment for a data collection visit was made. The recruitment process continued until the required number of eligible participants was reached.

Participants were visited by the researcher or a trained research-assistant. During this visit the MMS, CDT, SMAS-30, and medication interview were completed and demographic characteristics (gender, age, living situation, highest level of education, number of medications, and assistance in medication management) were collected. The interviewer was blinded for the outcomes of the HOME instrument. In order to reach the most complete dataset possible, all instruments were conducted in an interview format. For the SMAS-30 and MMS a set of response cards were used. The home visit took approximately one hour to an hour and a half to complete. The HOME instrument was completed by a staff member and took approximately five minutes. The home care staff was instructed, verbally and in writing, about the use of the instrument by the researcher. The medication interview and the HOME instrument were conducted within approximately two weeks of each other in order to measure the same situation.

### **Ethical considerations**

Ethical approval for the study was obtained from the medical research ethics committee of the University Medical Centre Utrecht. Participants signed an informed consent form before data was collected. Participants could leave the study at any time for any reason if they wished to do so without any consequences. All data were processed anonymously to ensure confidentiality.

### **Statistical methods**

Data analysis was conducted using SPSS Statistics version 19<sup>27</sup>. Descriptive statistics were used to map the participants' demographic characteristics. Since the outcomes concerned ranked variables, correlations between the MMS total score and the CDT, and SMAS-30 were analysed using Spearman's rank correlation coefficient. For this purpose, the CDT was categorized in to three ranks; a score of four or five points was categorized as a high cognition, a score of three as a moderate cognition and a score of zero, one or two was categorized as a low cognition. Differences between the various demographic variables and MMS total score were analyzed using the chi-square test. Agreement between observed and experienced potential DRPs was determined using Cohen's kappa. P values  $<.05$  were considered significant.

## RESULTS

In total 668 potential participants were available, of these 151 were randomly selected (23%), and 106 participants were informed about the study by the home care staff. Fifty people received a phone call and were asked to participate. A total of 34 clients agreed to participate; one participant left the study before data was collected, leaving 33 participants for analyses.

(Figure 1)

The mean age of the study sample was 85.6 years, 73% was female, and 88% of the participants lived alone. Seventy-six percent used a dosing system and 39% of the participants had assistance in medication management, in more than half of these cases this help was from the home health care organization. The mean number of medications that were used was 9.6 (SD 3.4) of which 9.2 (SD 3.3) were prescribed medications. (Table 1)

### *Medication management skills*

The mean MMS (times scored 'no' or '?') in the sample was 1.9 (SD1.9), 70% scored  $\geq 1$  point(s). Most of the participants (73%) know which medications they use and 76% can distinguish between their different medications. Over 90% use their medication at the right time, and all participants that use not daily medication take these on the correct days (in 21% of the cases this was not applicable). The expiration date of the medications (after opening) is checked by almost half of the participants, in 21% this was not applicable. (Table 1)

### *Cognition and MMS*

Over 42% of the participants scored a low cognition at the CDT. The mean score was 3.1 (SD 1.6), representing a moderate cognition. (Table 2) One participant did not perform the CDT, because she stated she could not differentiate between the figures.

There was a fair negative correlation ( $r_s = -.397$ ;  $p .025$ ) between a lower score for the CDT and a higher score on the MMS. A lower score for the CDT showed poor medication management skills. Participants with a higher CDT-score know more often which medications they use ( $p .012$ ). There was no correlation between the CDT-score and knowing the names of the GP and pharmacy ( $p .066$ ), the ability to distinguish between various medications ( $p .087$ ), and the ability to use medication at the right time ( $p .928$ ).

### *Self-management skills and MMS*

The mean total score for the SMAS-30 was 52.5 (SD 13.8) with a range from 20.2 – 72.5. In two cases, multiple items on a subscale were not scored, resulting in a missing value on this particular subscale and the total score. (Table 2)

There was no correlation between the scores of the SMAS-30 and MMS ( $r_s = -.258$ ;  $p .160$ ). As well, there was no correlation between individual items of the MMS and the SMAS-30.

### *Client characteristics and MMS*

Due to the small sample size, there could not be determined how the variables are associated. Not one of the tests met the conditions of the chi-square test.

### *Potential DRPs*

The staff observed a total of 79 potential DRPs with the HOME instrument; an average of 2.4 per client. Most of these potential DRPs related to the absence of a medication list, gastrointestinal and other bleedings, and electrolyte disturbances; respectively in 64%, 39%, and 42% of the cases (Table 3). In two cases it was unknown if the client took the medication as described on the list.

The medication interview detected 119 potential DRPs (average 3.6 per participant). The majority of the potential DRPs were also connected to the categories described above (Table 3). In three cases there were discrepancies between the medication list and the medication as reported by the participant. In addition, there were three cases where the participant could not list the medication he used.

### *Agreement observed and experienced potential DRPs*

For the category K) medication management problems, there was good agreement ( $\kappa .653$ ) between potential DRPs observed by home care staff and reported during the interview. There was a moderate agreement for A) absence of medication list ( $\kappa .476$ ), and E) renal/heart failure ( $\kappa .407$ ). A fair agreement was reached for C) gastrointestinal and other bleedings ( $\kappa .281$ ), and L) medication usage problems ( $\kappa .247$ ). The agreement in categories E, I) risk to fall, and M) pain and (OTC) medication was based on less than 33 cases due to a lack of information to determine the existence of a potential DRP in one or two cases. (Table 3)

In the remaining categories agreement could not be calculated. At least one variable in these categories was a constant. In two cases in category F) digoxin intoxication there was insufficient information to determine the existence of a potential DRP.

## DISCUSSION

Overall, the home healthcare clients aged  $\geq 75$  years in this study appeared to have good medication management skills. A poor level of cognition is an indication for a lack of medication management skills. Self-management ability and medication management skills are not correlated. This study shows that home care staff is able to observe potential DRPs with regard to medication management problems as experienced by the older people. To lesser extent, they are also able to identify potential DRPs when it comes to the absence of a medication list, and problems possibly related to renal/heart failure.

Results from this study seem to be in line with other studies among community-dwelling older people<sup>9,13</sup>. With a mean MMS of 1.9, the participants seem to score low. However, each point is indicating a need for support in medication management. With 70% of the sample scoring  $\geq 1$  point(s), there is a considerable large group that needs support, to greater or lesser extent, with regard to medication management. Support already present may have positively affected the score.

As several studies<sup>10,11,28</sup> have shown before, cognition and medication management skills are correlated. Remarkable is that this correlation did not exist for cognition and the ability to distinguish between various medications, and to take medication at the right time. Perhaps this can be explained by the use of a dosing system by 76% of the sample and/or by the assistance in medication management in 39% of the cases.

With help of the HOME instrument the staff observed a reasonable amount of potential DRPs. The lack of good or moderate agreement on most of the categories might be explained by forgetfulness of the older people or because they do not (explicitly) mention the experience of physical complaints. Also, home care staff may not always have sufficient visibility on the existence of potential DRPs in result of the demand-driven care. Due to the lower sensitivity the instrument does not identify all potential DRPs.

The number of observed and experienced potential DRPs show the importance of identifying potential DRPs, and the substantial part home health care staff can play in this. With a mean of 2.4 potential DRPs observed per client, a large group in need for assistance in medication management, and the correlation between cognition and medication management skills, the HOME instrument, MMS and CDT could be practical assessment tools in the daily work of home care staff.

### *Limitations*

This study had several limitations. As a result of an unexpected slow process of recruitment the sample size remained small. Due to the fact that people could decide whether they wished to participate in this study, some selection bias may have occurred in spite of the random sampling. It is possible that some people feared being confronted with problems during the home visit. The results of this study should therefore be considered carefully.

Second, information about medication management skills was collected through self-report. It is possible that the outcomes are skewed because people give socially desirable answers.

Furthermore, one can question if the HOME instrument and medication interview actually measure potential DRPs. Whether symptoms are medication related is not taken into account. Nonetheless, the fact that a client experiences a potential DRP should always be a reason for home care staff to investigate why certain complaints exist and if they can be decreased.

Because clients were asked to report about the past few weeks this may have caused recall bias. To minimize this problem it was tried to plan the interview and the completion of the HOME instrument within two-three weeks from each other.

Another limitation might be the use of the CDT since concerns have been raised about its scoring system<sup>29</sup>. However, the CDT is the second most used cognitive screening instrument<sup>29</sup> and was chosen for its easy administration and good acceptance among older people<sup>30</sup>.

### *Recommendations*

Further research should focus on the effect of the observations made by home care staff; which interventions are implemented in reaction to the observations and what is their effect on experienced complaints and quality of life. Also the association between potential DRPs and medication should be taken into account.

### **Conclusion**

The community-dwelling older people appear to have good medication management skills which are negatively influenced by cognitive impairment. Home care staff is able to identify potential DRPs related to medication management problems and to lesser extent also to the absence of a medication list and renal/heart failure. Further research should focus on how identification of potential DRPs can lead to safer medication management by community-dwelling older people.

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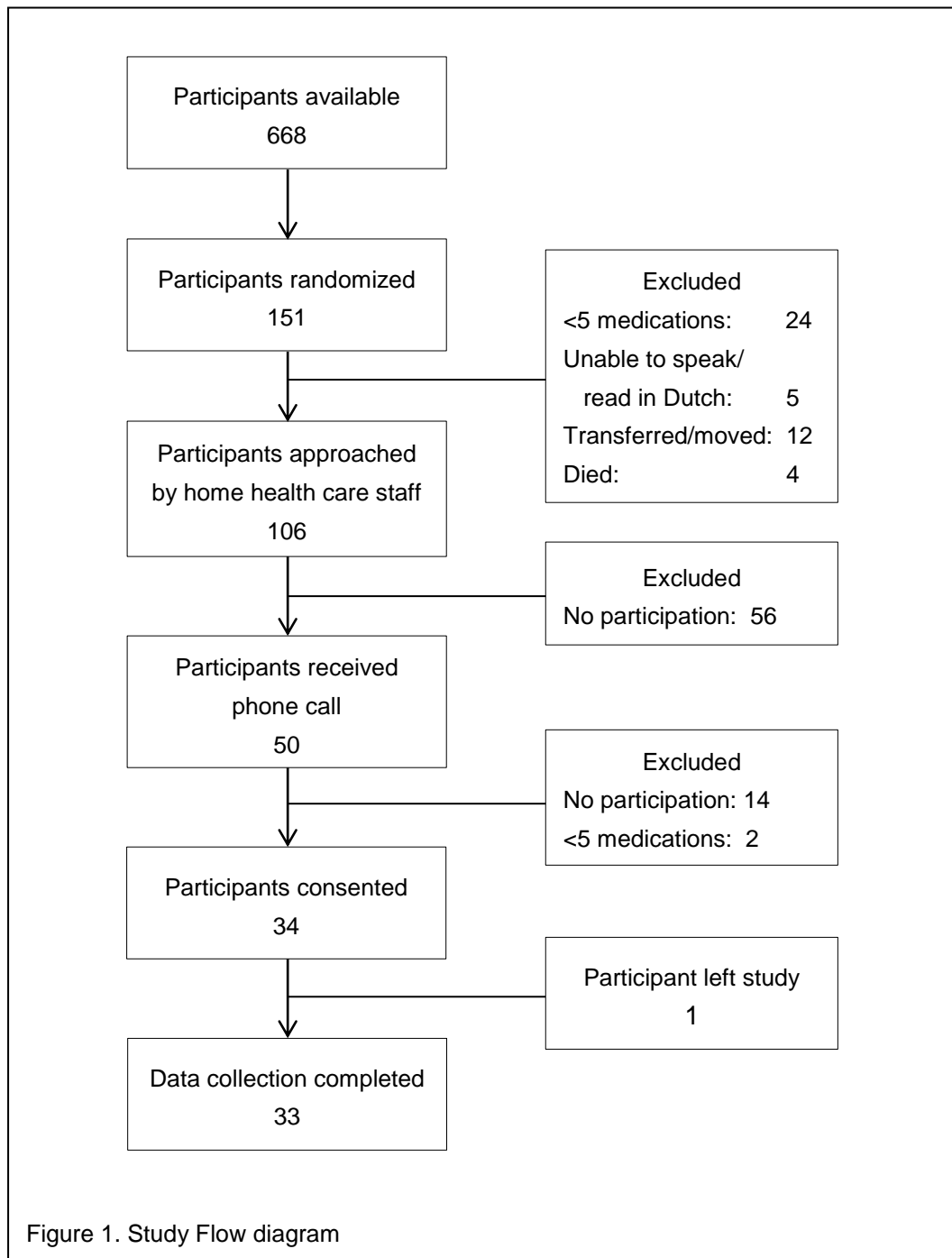
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Table 1. Characteristics of the home healthcare clients (n=33)			
	N (%)	Mean (SD)	Range
Age		85.6 (4.5)	77-95
75-80	4 (12.1)		
81-85	15 (45.5)		
86-90	8 (24.2)		
>90	6 (18.2)		
Number of medications <sup>a</sup>		9.6 (3.4)	5-17
Prescribed medications		9.2 (3.3)	5-17
OTC medications		0.4 (0.6)	0-2
Gender			
Female	24 (72.7)		
Marital status			
Unmarried	3 (9.1)		
Married	3 (9.1)		
Divorced	1 (3.0)		
Widowed	26 (78.8)		
Living situation			
Living alone	29 (87.9)		
Highest level of education			
No education	3 (9.1)		
Low	22 (66.7)		
Middle	8 (24.2)		
High	0 (0)		
Assistance in medication management			
Total	13 (39.4)		
By home health care	7 (21.2)		
Partner/carer	3 (9.1)		
Pharmacy	2 (6.1)		
Other	1 (3.0)		
Use of dosing system	25 (75.8)		
<sup>a</sup> As reported by the participant <b>OTC</b> : over-the-counter			

Table 2. Medication management, cognition, and self-management scores			
	N (%)	Mean (SD)	Range
Medication Management Score		1.9 (1.9) <sup>a</sup>	0-6 <sup>a</sup>
1 I know what medication I use (possibly using a drug list)	24 (72.7)		
2 I know the names of my GP and pharmacy	28 (84.8)		
3 I can use my phone properly	30 (90.9)		
4 I make sure I have the ordered medication at my home in time	28 (84.8)		
5 I contact the pharmacy if my medication is not delivered (in time) or ask someone else to contact for me	18 (54.5)		
6 I can read the pharmacy label on the packaging properly	29 (87.9)		
7 I verify that the delivered medications are the right ones	25 (75.8)		
8 I know to distinguish between the various medications that I use	25 (75.8)		
9 I contact my GP or pharmacy when I think something is wrong with my medication (name, strength, dosage) or ask someone else to contact for me	21 (63.6)		
10 I contact my GP when I think a medication does not work or ask someone else to contact for me	19 (57.6)		
11 I contact my GP in case of unknown complaints or ask someone else to contact for me	29 (87.9)		
12 I can get my medication out of the packaging (open boxes, medicines from the blister print, opening and closing bottles, open (Baxter) bags)	26 (78.8)		
13 I take medication, which I do not have to take daily, on the correct days	26 (78.8)		
14 I use my medications at the right times	30 (90.9)		
15 I check the expiration date of my medication (after opening)	16 (48.5)		
16 I never use old medication	25 (75.8)		
17 I follow the instructions on the label exactly	29 (87.9)		
Clock Drawing Test		3.1 (1.6) <sup>b</sup>	0-5
High cognition	11 (33.3)		
Moderate cognition	7 (21.2)		
Low cognition	14 (42.4)		
Self-Management Ability Scale-30 - Total score		52.5 (13.8) <sup>c</sup>	20.2-72.5
Taking initiatives		46.9 (17.2)	12-80
Self-efficacy		74.7 (17.8)	30-100
Investment behavior		55.3 (15.1) <sup>b</sup>	16-80
Positive frame of mind		55.9 (17.7) <sup>b</sup>	25-95
Multifunctionality		36.1 (20.9)	0-92
Variety		46.7 (15.1)	12-76
<sup>a</sup> Total times scored 'no' or '?' <sup>b</sup> Based on n=32 <sup>c</sup> Based on n=31 <b>GP:</b> general practitioner			

Table 3. Potential drug related problems – observed & experienced			
	HOME N (%)	Interview N (%)	Kappa
<b>Process</b>			
A Medication list is absent	21 (63.6)	21 (63.6)	.476
Medication list present	12 (36.4)	12 (36.4)	
B If present: discrepancies in medication list?	-	3	-
<b>Pill</b>			
C Gastrointestinal and other bleedings	13 (39.4)	24 (72.7)	.281
D Electrolyte disturbances	14 (42.4)	18 (54.5)	-.076
E Renal failure/heart failure <sup>a</sup>	6 (18.2)	12 (36.4)	.407
F Digoxin intoxication	1 (3.0)	-	-
G Constipation	5 (15.2)	3 (9.1)	-.128
H Disturbances of diabetic control	-	2 (6.1)	-
I Risk to fall <sup>b</sup>	3 (9.1)	14 (42.4)	.090
<b>Patient</b>			
J Medication non-adherence	1 (3.0)	-	-
K Medication management problems	1 (3.0)	2 (6.1)	.653
L Medication usage problems	6 (18.2)	1 (3.0)	.247
M Pain and (OTC) medication <sup>a</sup>	7 (21.2)	14 (42.4)	-.008
N Alcohol consumption	-	-	-
O Cognitive and behavioral changes	1 (3.0)	5 (15.2)	-.053
<sup>a</sup> Based on n=32 <sup>b</sup> Based on n=31 <b>OTC:</b> over-the-counter			



## APPENDIX A Algorithm Red Flag Instrument – Medication interview

26. Sino CGM, Bouvy ML, Schop IMB, Jansen PAF, Schuurmans MJ. Early recognition of drug related problems in homecare. 2012.

Red Flag Instrument	Medication interview
<b>Process</b>	<b>Process</b>
<p>A. <u>Presence of medication list</u>                      1. Is there a printout of the list of medication from the pharmacy?</p> <p>Potential DRP if:                      A1 is answered with no</p>	<p>A. <u>Presence of medication list</u>                      1. Do you have a medication list from the pharmacy?</p> <p>Potential DRP if:                      A1 is answered with no</p>
<p>B. <u>Discrepancies in medication list</u>                      1. Does the patient take the medicines on the list?</p> <p>Potential DRP if:                      B1 is answered with no</p>	<p>B. <u>Discrepancies in medication list</u>                      1. Does the medication list, according to the patient, resemble the medication list of the pharmacy?</p> <p>Potential DRP if:                      B1 is answered with no</p>
<b>Pill</b>	<b>Pill</b>
<p>C. <u>Gastrointestinal and other bleedings</u>                      Does the patient have:</p> <ol style="list-style-type: none"> <li>1. Stomach ache?</li> <li>2. Very black feces?</li> <li>3. Regularly occurring nosebleeds?</li> <li>4. Black and blue spots?</li> </ol> <p>Potential DRP if:  <b>One or more</b> questions (C1, C2, C3, C4) are answered with yes</p>	<p>C. <u>Gastrointestinal and other bleedings</u></p> <ol style="list-style-type: none"> <li>1. Did you have stomach ache and/or very black feces in the last four weeks?</li> <li>2. Did you have nosebleeds in the last four weeks?                          2a. How often do you get nosebleeds?</li> <li>3. Do you bruise easily?                          3a. How do you get the bruises?</li> </ol> <p>Potential DRP if:                      C1 is answered with yes <b>and/or</b>                      C2 <b>and</b> C2a are answered with yes and with daily/weekly, respectively <b>and/or</b>                      C3 <b>and</b> C3a are answered with yes and with spontaneous and/or light bump, respectively</p>
<p>D. <u>Electrolyte disturbances</u>                      Does the patient have:</p> <ol style="list-style-type: none"> <li>1. Dizziness when standing up?</li> <li>2. Drowsiness?</li> <li>3. Thirst?</li> </ol> <p>Potential DRP if:  <b>One or more questions</b> (D1, D2, D3) are answered with yes</p>	<p>D. <u>Electrolyte disturbances</u></p> <ol style="list-style-type: none"> <li>1. Did you feel dizzy in the past 4 weeks when you were standing up?                          1a. How often did you feel dizzy?</li> <li>2. Did you feel drowsy or weak in the past 4 weeks?</li> <li>3. Did you feel very thirsty in the past 4 weeks (the urge for extra hydrating)?</li> </ol> <p>Potential DRP if:                      D1 <b>and</b> D1a are answered with yes and with daily/weekly, respectively <b>and/or</b>                      D2 is answered with yes <b>and/or</b>                      D3 is answered with yes</p>

<p>E. <u>Renal failure/heart failure</u>                  Does the patient have:                  1. (Increasingly more) tightness of chest?                  2. Fainting spells?</p> <p>Potential DRP if:                  E1 <b>and/or</b> E2 are answered with yes</p>	<p>E. <u>Renal failure/heart failure</u>                  1. Did you feel tightness of chest in the past 4 weeks?                      1a. Did the chest tightness increase in the past 4 weeks?                  2. Did you feel like fainting in the past 4 weeks?                      2a. Did you see the patient faint in the past 4 weeks?</p> <p>Potential DRP if:                  E1 <b>and/or</b> E1a are answered with yes <b>and/or</b>                  E2 <b>and/or</b> E2a are answered with yes</p>
<p>F. <u>Digoxin intoxication</u>                  Does the patient have:                  1. Nausea, vomiting and/or no appetite?</p> <p>Potential DRP if:                  The patient takes digoxin <b>and</b>                  F1 is answered with yes</p>	<p>F. <u>Digoxin intoxication</u>                  1. Did you feel nauseous in the past 4 weeks and did you need to vomit?                  2. Did your appetite change in the past 4 weeks?</p> <p>Potential DRP if:                  The patient takes digoxin <b>and</b>                  F1 is answered with yes <b>and/or</b>                  F2 is answered with eats less or smaller quantities than usual</p>
<p>G. <u>Constipation</u>                  Does the patient have:                  1. Abdominal pain and/or no bowel movement for more than 5 days?</p> <p>Potential DRP if:                  G1 is answered with yes</p>	<p>G. <u>Constipation</u>                  1. On average, how often do you have a bowel movement?                      1a. When was your last bowel movement?                      1b. Did you experience abdominal pain?                      1c. What action, if any, have you taken to resolve your complaint?</p> <p>Potential DRP if:                  G1 is answered with once a week <b>and/or</b>                  G1a is answered with <math>\geq 4</math> days ago <b>and/or</b>                  G1b is answered with yes <b>and/or</b>                  If action is undertaken to resolve the problem (G1c)</p>
<p>H. <u>Disturbances of diabetic control</u>                  Does the patient have:                  1. For diabetes: Irregular heart rhythm and transpiration?                  2. For diabetes: Feeling of hunger?</p> <p>Potential DRP if:                  The patient is a diabetic <b>and</b>                  H1 <b>and/or</b> H2 are answered with yes</p>	<p>H. <u>Disturbances of diabetic control</u>                  1. Did you have a hypo in the past 4 weeks? (symptoms: sweating, irregular heart rhythm, feeling of hunger)</p> <p>Potential DRP if:                  The patient is a diabetic <b>and</b>                  H1 is answered with yes</p>

<p>I. <u>Risk to fall</u>          1. Has the patient fallen recently without a clear cause?</p> <p>Potential DRP if:          I1 is answered with yes</p>	<p>I. <u>Risk to fall</u>          1. Did you fall in the past year?</p> <p>Potential DRP if:          I1 is answered with yes</p>
<p><b>Patient</b></p>	<p><b>Patient</b></p>
<p>J. <u>Medication non-adherence</u>          1. Does the client regularly forget to take his/her medication?          2. Does the week package contain medicine from previous days?          3. Does the robot-dispensed dosing aid contain pouches of medicine from previous days?</p> <p>Potential DRP if:  <u>One or more</u> questions (J1, J2, J3) are answered with yes</p>	<p>J. <u>Medication non-adherence</u>          1. Can you estimate how often you took your medication in the past 4 weeks?          2. How difficult is it for you to take your medicines on a regular base (on set times)?          3. How important is it for you to take your medicines?</p> <p>Potential DRP if:          J1 is answered with never/rarely/half the time/usually <u>and</u> J2 <u>or</u> J3 are answered with very difficult/difficult/a little bit difficult or a little bit important/not important at all, respectively.</p>
<p>K. <u>Medication management problems</u>          Is the supply of medicine in house:          1. Disordered?          2. Regularly insufficient?</p> <p>Potential DRP if:          K1 <u>and/or</u> K2 are answered with yes</p>	<p>K. <u>Medication management problems</u>          1. How frequent could you not complete your medication stock?          2. Can you show how you store the medication?</p> <p>Potential DRP if:          K1 is answered with once a quarter <u>or</u> K2 is answered with moderately organized/poorly organized.</p>
<p>L. <u>Medication usage problems</u>          1. Does the client have problems taking the medication?          2. Does the client have trouble opening the packaging?</p> <p>Potential DRP if:          L1 <u>and/or</u> L2 are answered with yes</p>	<p>L. <u>Medication usage problems</u>          1. Did you experience any difficulties in the past 4 weeks with taking your medicines?</p> <p>Potential DRP if:          L 1 is answered with yes</p>



<p>M. <u>Pain and (OTC) medication</u></p> <ol style="list-style-type: none"> <li>Does the client have pain?</li> <li>Does the client take more than 8 pain relievers day without a prescription?</li> <li>Does the client use other pain relievers without a prescription?</li> </ol> <p>Potential DRP if:  <u>One or more</u> questions (M1, M2, M3) are answered with yes</p>	<p>M. <u>Pain and (OTC) medication</u></p> <ol style="list-style-type: none"> <li>Did you experience physical pain in the past 4 weeks?</li> <li>Did you use any medicines in the past 4 weeks for complaints of physical pain?           <ol style="list-style-type: none"> <li>Which medicines?</li> <li>How frequent do you use these medicines?</li> <li>Do the medicines help?</li> </ol> </li> </ol> <p>Potential DRP if:  M1 is answered with yes <u>and</u> M2 with no <u>or</u>  M1 is answered with yes <u>and</u> M2 with yes <u>and</u> M2c with never/hardly/sometimes</p> <p>The patient uses more than 8 acetaminophen a day or another analgesic without a prescription</p>
<p>N. <u>Alcohol consumption</u></p> <ol style="list-style-type: none"> <li>Does the patient drink more than 3 glasses of alcohol a day?</li> </ol> <p>Potential DRP if:  N1 is answered with yes</p>	<p>N. <u>Alcohol consumption</u></p> <ol style="list-style-type: none"> <li>Do you drink alcohol?</li> <li>How often do you drink alcohol?</li> <li>How many glasses do you drink on an average drinking day?</li> </ol> <p>Potential DRP if:  N1 is answered with yes <u>and</u>  N2 is answered with daily <u>and</u>  N3 is answered with four to six/more than six.</p>
<p>O. <u>Cognitive and behavioral changes</u></p> <ol style="list-style-type: none"> <li>Is the patient seriously different than usual?</li> </ol> <p>Potential DRP if:  O1 is answered with yes</p>	<p>O. <u>Cognitive and behavioral changes</u></p> <p>Questions addressed to the patient:</p> <ol style="list-style-type: none"> <li>Are you worried about your memory or do you suffer from forgetfulness?       <ol style="list-style-type: none"> <li>Are these problems aggravated in the past four weeks?</li> </ol> </li> </ol> <p>Question to be answered by family (caregiver):</p> <ol style="list-style-type: none"> <li>Did the behavior of Mr./Ms. change in the past four weeks?</li> </ol> <p>Question to be answered by the homecare nurse:</p> <ol style="list-style-type: none"> <li>How do you describe the (cognitive) behavior of the patient?</li> </ol> <p>Potential DRP if:  O1 <u>and</u> O1a are answered with yes <u>and/or</u>  O2 is answered with yes <u>and/or</u>  If the homecare nurse observed deviant behavior (O3)</p>