

# Factors associated with appropriate knowledge of the indications for prescribed drugs among community-dwelling older patients with polypharmacy

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## Abstract

**Background:** polypharmacy contributes to patients' non-adherence with physicians' prescriptions. Patients' knowledge about the indications for their medicines is one of the factors influencing adherence.

**Objective:** to identify factors associated with appropriate knowledge about the indications for drugs prescribed to older patients with polypharmacy.

**Methods:** in a primary care setting, using home interviews and postal questionnaires, patients aged 60 and over who were taking five or more prescribed drugs simultaneously were asked about their medication. Multiple logistic regression analysis was used to evaluate the association (odds ratio, OR) between medication knowledge and explanatory variables like medication use, sex, age, living situation and educational level.

**Results:** seven hundred and fifty-four participants (mean age 73.2 years) reported an average daily intake of nine (SD 3.0) prescribed drugs. Only 15% of the patients were able to recall the indication for each of their prescribed drugs. Variables that were negatively associated with correct reporting of all indications were taking many prescribed drugs (e.g.  $\geq 10$  versus  $\leq 5$ : OR 0.05), age 80 years or over (versus 60–69 years: OR 0.47) and male sex (OR 0.53). Patients living with a partner were more knowledgeable than patients living alone (OR 2.11). We did not find an association with educational level.

**Conclusion:** among older patients using five or more prescribed drugs, there was little understanding of the indications for their drugs, especially among patients taking the highest number of drugs, patients aged 80 or over, and men. Patients living independently with a partner were more knowledgeable than others.

**Keywords:** polypharmacy, prescription drugs, aged, medication knowledge, primary care, older people

## Introduction

Physicians are increasingly confronted with the challenges of multimorbidity and polypharmacy among their older patients [1, 2]. Although there is no agreed definition of polypharmacy, a widely accepted one is 'the use of five or more chronic medicines' [3]. On average, older patients use 2–9 prescribed medicines [4] and 1–2 non-prescribed medicines [5]. Multiple drug use increases the risk of adverse drug reactions [4], and older

people are more vulnerable to adverse drug-related events, due to their altered pharmacokinetics and pharmacodynamics. Moreover, high numbers of medicines contribute to patients' non-adherence to physicians' prescriptions [6, 7].

Adherence has been demonstrated to be influenced by several variables, including patients' knowledge about the indications for the medicines they take [8–12]. Studies among older people have yielded inconsistent results regarding knowledge about the indications for medications taken [5, 8,

10, 13, 14]. These studies differed in size and setting, and few studies were conducted in primary care. The baseline dataset of the ‘Polypharmacy Intervention Limburg’ (PIL) study [15]—a large study in a primary care setting—offered us the opportunity to analyse various factors possibly associated with medication knowledge, including educational level and living situation. The current study addressed the following research questions: (i) to what extent do patients with polypharmacy know the indications for medicines prescribed to them? (ii) What patient and medication characteristics are associated with appropriate knowledge of these indications?

## Methods

### Study design, setting and context

The current study was a cross-sectional analysis of baseline data collected in the ‘Polypharmacy Intervention Limburg’ (PIL) study, a randomised clinical trial with a stepped wedge design (Netherlands Trial Register, NTR2154) [15]. The Medical Ethics Board *Atrium-Orbis-Zuyd* approved the study protocol (09-T-72 NL3037.096.09). PIL evaluated the effectiveness of a multidisciplinary polypharmacy review programme to optimise drug prescription. Twenty-four general practice centres (employing 43 general practitioners (GPs) and 21 practice nurses), 17 community pharmacists and medical specialists of two regional hospitals participated in the study.

### Study population

Included in the PIL study were patients aged 60 and over who met our criteria for polypharmacy: chronic use—i.e. >3 months a year—of five or more prescribed drugs according to the pharmacy’s information system. Patients were excluded by their GP if they had a life expectancy of <1 year, or were considered incompetent to act for themselves, or had insufficient command of Dutch. This procedure resulted in a list of eligible patients.

Each general practice had to select 30 (for average-sized centres) to 60 (for large-sized centres) eligible patients. The order in which the eligible patients appeared on the list was randomised. Using this randomised list in a top-down fashion, a specially trained practice nurse contacted eligible patients by telephone, provided them with information on the project and asked them whether they were interested in participating. If a patient agreed, they were sent a letter with additional information and an informed consent form. The respondents who consented constituted the study population.

### Data collection

The data for the current analysis were collected between September 2010 and November 2011 as part of the baseline data collection for the PIL study, using home interviews and postal questionnaires.

### Home interviews

Each participating patient was interviewed by a practice nurse who had been specially trained for this purpose. They made an inventory of all medications, prescribed and non-prescribed, used by the patient. For each of the prescribed drugs, the indication as perceived by the patient was recorded. All answers were noted verbatim on a pre-structured form.

### Questionnaires

Patients received postal questionnaires at baseline and every 3 months thereafter. Variables relevant to the current analyses, i.e. educational level and living situation, were taken from the baseline questionnaire.

### Analysis

The purpose of this analysis was to analyse factors (independent variables)—as suggested in the literature and insofar as they were available in our database—which might influence the medication knowledge (dependent variable) of older patients with polypharmacy.

### Dependent variable

**Patients’ medication knowledge.** Patients’ understanding of the indications for their prescribed drugs (i.e. ‘medication knowledge’) was classified by the research assistant as ‘correct’, ‘incorrect’ or ‘unknown’. An indication was classified as ‘correct’ if the patient could correctly recall the purpose of the drug or could mention the correct organ (system) for which the drug was used. For instance, in the case of statin use, answers like ‘for my cholesterol’ and ‘for my heart’ were classified as ‘correct’.

Appropriate medication knowledge can be expressed at medication level and patient level. At medication level, it was expressed as the proportion of prescribed drugs whose indication was reported correctly by the patients. At patient level, it was expressed as the proportion of patients who could accurately recall the indication for their prescribed drugs. We used two cut-off values for ‘correct recall’ (100 and  $\geq 75\%$ , respectively) to enable comparison of our results with those of other studies [5, 13].

### Independent variables

**Patient characteristics.** Patient variables used in the analysis were sex (male, female); age (60–69, 70–79,  $\geq 80$  years); educational level (‘intermediate or high’—i.e. vocational education, secondary education and higher education—versus ‘no or low’) and living situation (‘living independently alone’, ‘living independently with a partner’ or ‘living in a retirement home’).

**Reported medication use.** Prescribed medication was distinguished from non-prescribed drugs. The number of non-prescribed drugs (‘over the counter’) was categorised as 0, 1 or  $\geq 2$ . The number of prescribed drugs as reported by the patient was categorised as  $\leq 5$ , 6–7, 8–9 or  $\geq 10$ . Some

patients reported using less than five prescribed drugs at the time of their home interview. Since the starting point of the medication review procedure (inclusion criterion) was five or more prescribed drugs according to the pharmacy's information system, we decided not to exclude these patients from our study sample.

**Medication categories.** Prescribed medication was categorised by the researchers into seven drug categories: 'Cardiovascular', 'Diabetes mellitus', 'Digestive tract', 'Lung diseases', 'Psychotropic drugs', 'Analgesics' and 'Other medicines'. These categories were the result of previous discussions on medication review by regional groups of GPs affiliated with the Department of Family Medicine of Maastricht University. All drugs were categorised by a research assistant, using the Dutch 'Farmacotherapeutisch Kompas' [16], an ATC-based reference manual for physicians. If the research assistant had doubts about the accuracy of the categorisation, two GP authors (D.B.L., H.S.) made the final decision.

**Statistics**

Categorical and numerical variables are presented as numbers (or proportions, %) and means (with standard deviation, SD), respectively. Multiple logistic regression analyses were used to assess the independent associations between sex, age, educational level, living situation, number of prescribed medicines and number of non-prescribed medicines on the one hand and appropriate medication knowledge (odds ratios (ORs) with corresponding 95% confidence intervals (CI) on the other. A two-sided *P* value of  $\leq 0.05$  was considered statistically significant. All statistical analyses were performed using IBM SPSS Statistics for Windows version 19.0 (IBM Corp., Armonk, NY: IBM Corp. Released 2010).

**Results**

**Study population and prescriptions**

Eight hundred and twenty patients from the PIL baseline dataset were included in the study. Data from 66 patients (8.8%) were incomplete, leaving data of 754 patients available for the current analysis (Supplementary data, Figure 1, available in *Age and Ageing* online). Table 1 shows the characteristics of the study population. Mean age was 73.2 years, and 47.2% were female. The average number of prescribed drugs was 9.2.

Seven hundred and forty-five patients took 6,960 prescribed drugs. Table 2 presents the details for various medication categories. Cardiovascular medication accounted for half of all prescriptions, and virtually every patient used at least one cardiovascular drug.

**Appropriate medication knowledge**

*Medication level*

As shown in Table 2, the study participants correctly recalled the indication for 64.6% of prescribed drugs. Patients failed

**Table 1.** Characteristics of the study sample (*N* = 754)

Characteristics	<i>n</i> (% or SD)
Female sex	356 (47.2)
Age, years	
60–69	219 (29.0)
70–79	304 (40.3)
80+	231 (30.6)
Mean	73.2 (SD 7.6)
Range	60–94
Educational level ( <i>N</i> = 741)	
No or low	528 (71.3)
Intermediate or high	213 (28.7)
Living situation ( <i>N</i> = 749)	
Independent with partner	500 (66.8)
Independent alone	211 (28.2)
Retirement home	38 (5.1)
Number of prescribed drugs (patient reported)	
$\leq 5$	63 (8.4)
6–7	184 (24.4)
8–9	190 (25.2)
$\geq 10$	317 (42.0)
Mean	9.2 (SD 3.0)
Range	3–22
Number of non-prescribed drugs (patient reported)	
0	305 (40.5)
1	244 (32.4)
$\geq 2$	205 (27.2)
Mean	1.1 (SD 1.2)
Range	0–9

to recall the indication for 31.6% of the prescriptions and incorrectly reported the indications for 3.9% of prescribed drugs. Best known were the indications for diabetes drugs (81.9% correct).

*Patient level*

One hundred and thirteen patients (15.0%) were able to correctly report all indications for their prescribed medication. Nearly half of all patients (48.5%) correctly recalled  $\geq 75\%$  of the indications for the prescribed drugs they were taking (Table 3).

**Factors associated with appropriate or inappropriate medication knowledge**

Table 3 reports the factors associated with patients' ability to correctly recall all or at least three-quarters of the indications for their prescribed drugs. Appropriate medication knowledge was negatively related to 'higher age' and to a 'higher number of prescribed drugs', using either the '100%' or the ' $\geq 75\%$ ' criterion for 'appropriate medication knowledge'. It also was negatively associated with 'male sex', using the '100%' criterion. 'Living in an retirement home' was negatively associated with the ' $\geq 75\%$  correct recall' criterion (when compared with those living independently alone), whereas 'living independently with a partner' was positively associated with the '100% correct recall' criterion.

For neither of the appropriateness criteria did we find a statistically significant association between educational level

**Table 2.** Prescribed medication categories among community-dwelling patients aged 60 and over, and correct recall of the indications for the prescriptions

Prescribed medication category	Patients		Prescriptions		
	Number of patients with at least one prescription in this category (% of all patients)		Number of prescriptions per category (% of all medication)	Average number of prescriptions per patient for this category (SD)	Number of prescriptions in this category for which the patient correctly recalled its indication (%)
Cardiovascular	737 (97.7)		3,519 (50.6)	4.7 (2.0)	2,168 (61.6)
Digestive tract	456 (60.5)		601 (8.6)	0.8 (0.8)	412 (68.6)
Diabetes mellitus	268 (35.5)		454 (6.5)	0.6 (0.9)	372 (81.9)
Analgesics	239 (31.7)		320 (4.6)	0.4 (0.7)	221 (69.1)
Psychotropic drugs	207 (27.5)		278 (4.0)	0.4 (0.7)	191 (68.7)
Lung diseases	202 (26.8)		392 (5.6)	0.5 (1.0)	295 (75.3)
Other	529 (70.2)		1,396 (20.1)	1.9 (1.9)	836 (59.9)
All medication	754 (100%)		6,960 (100%)	9.2 (3.0)	4,495 (64.6)

**Table 3.** Appropriate knowledge about prescribed medication and factors associated with it in community-dwelling patients aged 60 and over

	Correct recall <sup>a</sup> of 100% of indications			Correct recall <sup>a</sup> of ≥75% of indications		
	Number	%	Adjusted OR (95% CI) <sup>b</sup>	Number	%	Adjusted OR (95% CI) <sup>b</sup>
Sex						
Female	60/356	16.9	1	174/356	48.9	1
Male	53/398	13.3	<b>0.53 (0.32–0.88)*</b>	192/398	48.2	0.75 (0.53–1.05)
Age, years						
60–69	39/219	17.8	1	124/219	56.6	1
70–79	54/304	17.8	0.97 (0.58–1.62)	159/304	52.3	0.84 (0.58–1.22)
80+	20/231	8.7	<b>0.47 (0.24–0.91)*</b>	83/231	35.9	<b>0.47 (0.31–0.71)**</b>
Educational level (N = 741)						
No or low	81/528	15.3	1	248/528	47.0	1
Intermediate or high	28/213	13.1	0.77 (0.45–1.34)	110/213	51.6	1.24 (0.86–1.78)
Living situation (N = 749)						
Independent alone	22/211	10.4	1	95/211	45.0	1
Independent with partner	90/500	18.0	<b>2.11 (1.17–3.81)*</b>	263/500	52.6	1.23 (0.85–1.76)
Retirement home	1/38	2.6	0.38 (0.05–3.12)	8/38	21.1	<b>0.41 (0.17–0.96)*</b>
Number of prescribed drugs (patient reported)						
≤5	30/63	47.6	1	51/63	81.0	1
6–7	46/184	25.0	<b>0.41 (0.22–0.77)**</b>	95/184	51.6	<b>0.25 (0.12–0.51)**</b>
8–9	24/190	12.6	<b>0.15 (0.07–0.29)**</b>	110/190	57.9	<b>0.32 (0.16–0.66)**</b>
≥10	13/317	4.1	<b>0.05 (0.02–0.11)**</b>	110/317	34.7	<b>0.14 (0.07–0.27)**</b>
Number of non-prescribed drugs (patient reported)						
0	50/305	16.4	1	150/305	49.2	1
1	36/244	14.8	1.00 (0.50–1.69)	114/244	46.7	0.97 (0.67–1.40)
≥2	27/205	13.2	0.79 (0.45–1.41)	102/205	49.8	1.09 (0.74–1.60)
Total	113/754	15.0		366/754	48.5	

Multiple logistic regression analyses (N = 754).

<sup>a</sup>Naming the organ (system) correctly was scored as ‘correct recall’.

<sup>b</sup>Adjusted OR after multivariable regression analysis for the variables Sex, Age, Educational level, Living situation, Number of prescribed drugs and Number of non-prescribed drugs.

\*Significance level, *P* < 0.05.

\*\*Significance level, *P* < 0.01.

or number of non-prescribed drugs and appropriate knowledge about prescribed medication.

## Discussion

### Main findings

In this study in primary care, assessing the medication knowledge of 754 patients over 60 years of age with polypharmacy,

the participants reported a mean daily intake of nine prescribed drugs. Only 15% of the patients could correctly recall the indication for all of their prescribed medications. Factors negatively associated with the correct recall of the indications included a high number of prescribed drugs, age over 80 years and male sex. Patients living independently with a partner were more knowledgeable than others. We did not find an association between educational level and patients’ medication knowledge.

## Prescriptions

Our mean number of nine prescribed drugs per patient is consistent with the results of recent primary care studies among older people (65+) with polypharmacy ( $\geq 5$  drugs), [2, 5, 8, 13, 17] as well as studies among populations of older people including a high percentage of patients with polypharmacy [5, 13], i.e. seven to nine prescribed drugs per patient. An older British study reported an average number of six prescribed medications [17]. Our finding of one non-prescribed drug is consistent with the results of a Canadian study [5]. Virtually all patients (98%) in our study used cardiovascular medication, similar to what was found in a Swedish study (94%) from 2009 [13].

These similarities were observed despite the fact that—as a result of our inclusion criteria—the mean age of our study population (73 years) was relatively young when compared with other studies on older patients with polypharmacy (74.5–86 years) [5, 13, 14]. It should be noted that the prevalence of cardiovascular conditions in our study area is relatively high [18], and in recent years many patients have been included in cardiovascular risk management programmes.

## Appropriate medication knowledge

Patients correctly reported the indication for  $\sim 65\%$  of all their prescribed medications. Other studies have reported somewhat better scores (correct recall of 72–91% of all medications) [5, 17], but one study among older Japanese home care recipients reported a lower level of medication knowledge (34% correct recall) [8]. These studies reported on older patients (mean age 81, 74.5 and 79 years, respectively), with a lower proportion of polypharmacy (24 and 74%) when compared with our study [5, 17].

Only 15% of the patients in the present study could correctly recall the indications for all drugs prescribed to them. A Canadian study reported that  $\sim 65\%$  of patients (age 74.5 years, taking seven prescribed drugs on average, 74% polypharmacy) were able to recall the correct indication for all of their drugs [5]. Our result regarding correct recall of at least three-quarters of the indications for prescribed drugs ( $\sim 50\%$ ) was also lower than results reported in two other studies (71% in patients aged 65+ with multiple illnesses, taking seven to eight drugs on average, 82% polypharmacy; and 60% in a population sample aged 75, taking an average number of five drugs, respectively) [7, 13]. In our study, all patients had polypharmacy, but the mean age was lower.

Best known were the indications for anti-diabetic medication. This is not surprising, since this medication category included not only oral drugs but also insulin injections.

## Factors associated with appropriate or inappropriate medication knowledge

### Number of drugs

We found a strong negative association between the number of prescribed drugs (taking six or more drugs) and medication knowledge. This is in line with a Canadian study

( $n = 193$ , mean number of drugs 8.5: odds ratio 0.3 for taking more than five drugs) [5] and a Swedish study ( $n = 34$ , median number of medicines seven (men) to eight (women): patients taking five or more drugs had worse knowledge) [13].

### Age

In our study population (age range 60–94 years), we found an association between higher age (above 80) and a decreased ability to correctly recall the indications for all prescribed drugs. This is in line with a Canadian study (pharmacy clients aged 65 or over), which found a non-significant odds ratio of 0.7 for patients aged 75 or over when compared with younger patients [5].

### Sex

We found a negative association between medication knowledge and male sex, similar to the results found by Guenette and Moisan [5], who reported that female sex was positively associated with knowledge of the purpose of drugs taken (OR 3.3). However, Modig *et al.* [13] reported no sex difference concerning this topic.

### Living conditions

Patients' living conditions appeared to influence medication knowledge: patients living independently with a partner were more knowledgeable in this respect than others (statistically significant for the '100% criterion'), whereas patients living in a retirement home were less knowledgeable (statistically significant for the ' $\geq 75\%$  criterion'). We are not aware of other studies reporting on this factor.

### Level of education

We had expected that a low level of education would be associated with less medication knowledge. However, we were unable to confirm such an association. Our findings were in line with those of a Canadian study, in which 'years of schooling' was found not to be a determinant of 'good general knowledge' of the purpose of the medicines [5]. Likewise, a Dutch study among 95 home care clients with polypharmacy, aged 75 and older (mean number of medications 9.3), found no relation between education level and 'medication management capacity' [14].

## Strengths and limitations

This study is one of the few to have been conducted in primary care, using data from patients, general practitioners and pharmacists. Our study sample was relatively large and is representative of patients with polypharmacy aged 60 and over as seen in general practice centres in the Southern Limburg area of the Netherlands. We had a low dropout rate before the start of the study (66/820, 8%), and when performing the multiple logistic regression analyses, we encountered few missing data.

We classified medications into six medication categories based on daily practice, rather than using ATC codes. In addition, we used a practical system for classifying patients' understanding of the indications for their prescribed drugs ('correct purpose', 'correct organ (system)') as 'correct' or not. This may impede comparison with studies using the ATC classification [5], but we think it has improved the classification of the drugs and patients' answers in unambiguous categories. Other studies did not present much detail on how correct recall of the indication was classified [5, 7, 17].

A limitation of our dataset was that we could not perform a comprehensive analysis of what patients actually know about their medication, and—more importantly—whether they know how to act if a medication issue should arise (e.g. regarding dosage, interactions, adverse effects).

### Implications

When discussing medication with an older patient using many drugs ('polypharmacy'), GPs should be aware of the possibility that their patient has a low level of understanding. It is especially patients taking many drugs, very old patients (>80), male patients (as found in this study and other studies), patients not living independently with a partner or patients living in a retirement home (as found in this study), who run a risk of not understanding the purpose of the drugs the doctor prescribes.

Such patients may exhibit lower medication adherence. Of course, patient adherence is not a goal in itself; the goal is a balanced medication regime. Nevertheless, increasing patients' knowledge or awareness of the indications for the drugs they are taking might help to improve medication adherence. Some patients might benefit from clear explanations by the doctor, a nurse or the pharmacist. Other patients will probably be more effectively supported in avoiding mistakes with the drugs doctors prescribe if the indication for a drug is specified on the medication container using text, graphic symbols or colours. These patients might also benefit from using a multi-dose drug dispenser [10].

Furthermore, GPs should be aware that questioning a patient—e.g. to find a possible explanation for new signs and symptoms—who might have a low level of understanding about medication use may be unreliable. Discussing necessary adjustments to the medication regime with these patients may be useless. In such patients, the GP should ensure that there is someone who can speak on behalf of the patient, such as a family member or well-informed staff at the retirement home.

GPs and pharmacists are in need of practical tools supporting them in assessing the medication safety of their patients. It is desirable that more research results come available about medication management skills of older patients with polypharmacy [14].

### Conclusion

In this study among older patients with polypharmacy, only a minority of them correctly reported the indications for all prescribed drugs they were taking. Factors negatively

associated with this medication knowledge were a high number of drugs, age over 80 years and male sex. Patients living independently with a partner were more knowledgeable than others. Educational level did not influence patients' medication knowledge.

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### Key points

- Among older patients using five or more prescribed drugs, only a minority could correctly recall the indication for all prescribed drugs they were taking.
  - Use of a high number of drugs, age over 80 years and male sex were negatively associated with medication knowledge, whereas patients living independently with a partner were more knowledgeable than others.
  - No statistically significant association was found between patients' educational level and their medication knowledge.
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### Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

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### Conflicts of interest

None declared.

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