



# Assessment of polypharmacy in elderly patients by using data from dispensed medications in community pharmacies: analysis of results by using different methods of estimation

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## Abstract

**Background** Estimating the prevalence of polypharmacy is essential for the evaluation of public health. Many different methodologies are used to determine the number of drugs used by a patient. **Objective** To analyse and compare three different methods (simultaneous, cumulative and continuous medication) to determine the number of drugs used by a patient, to estimate the prevalence of polypharmacy and to evaluate the possible association between polypharmacy and the gender and age of patients. **Method** Cross-sectional observational study carried out between April and September 2015. Data were acquired from prescriptions corresponding to 3972 patients aged 65 years old or older in ten community pharmacies in Argentina. **Results** The prevalence of polypharmacy varied significantly according to the method used. Major polypharmacy (use of five or more drugs) was detected in 20.5–47.1% of the patients. The association between gender, age and polypharmacy was statistically significant only when using the continuous medication method. The prevalence of minor polypharmacy (use of two to four drugs) was similar with the three methods. **Conclusion** These results contribute to deciding which is the best method to determine polypharmacy according to the objective of future studies and considering the advantages and disadvantages of each of them.

**Keywords** Community pharmacy · Drug utilization · Elderly · Methodology · Polypharmacy · Potentially inappropriate medication

## Impacts on Practice

- Our results may help to identify patients who are under polymedication, and thus in need of pharmaceutical care, and to analyse drug-to-drug interactions and adverse drug events.
- A Prescription database for elderly patients (etc.) is very simple to prepare in Argentina, and the information provided can be very useful for both prescribers and phar-

macists to promote a more rational use of the medications of the patients they serve.

## Introduction

Polypharmacy is defined as “the administration of several drugs simultaneously or administration of an excessive number of drugs” [1]. Various methods to calculate the number of drugs used by patients have been proposed. Goedken et al. [2] compared 14 different ways used to determine the number of drugs used by patients, whereas Monégat et al. [3] presented a review of the many methods found through a bibliographical research.

The elderly population is the most affected by polypharmacy and its consequences. The increase in the prevalence of age-related chronic diseases is accompanied by an increase in the use of medications, which in turn enhances the probability of the presence of unfavourable pharmacological interactions [4].

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A good knowledge of the different methods to determine the number of drugs used by a patient and their impact on the concept of polypharmacy is crucial to understand the problem. In view of this, we used, for the same database, the three methods most used in previous studies.

## Aim of the study

We compared three methods (simultaneous, cumulative and continuous medication) to determine the number of drugs used by elderly patients, with the aim to estimate the prevalence of polypharmacy and the association between polypharmacy and the gender and age of patients.

## Ethics approval

The study was approved by the Bioethics Committee of the School of Biochemical and Pharmaceutical Sciences of the National University of Rosario, Santa Fe, Argentina.

## Methods

Data were acquired from prescriptions corresponding to 3972 patients aged 65 years old or older, between April and September 2015, in ten pharmacies. Patients can only buy their medicines at an assigned pharmacy and the prescribing physician has a list of medications that the patient uses and can prescribe them only once a month. In case the patient needs another medication, the medication is dispensed at the same pharmacy.

Data recorded from each prescription were: date of dispensation, medications dispensed (drug name, dosage, route and number of packages), and gender and age of the patients. Dispensed medications or drugs are pharmaceutical products that are a fundamental component of both modern and traditional medicine [5]. The dispensed medications were coded according to the fifth level of the ATC code [6].

The prevalence of polypharmacy was calculated from the number of patients who displayed minor (use of two to four drugs) or major polypharmacy (use of five or more drugs) [7], according to the following methods.

**Method 1: *Simultaneous medication***, which referred to the number of drugs used simultaneously on a random day within the six-month study period (1 July 2015). We assumed that the use of a drug started on the day of dispensing and considered a daily intake equivalent to a defined daily dose (DDD) [7]. The length of a treatment was established as the amount of drug purchased divided by the corresponding DDD. The drug regimen

on each day of the six-month period was calculated for all patients.

**Method 2: *Cumulative medication***, which referred to the monthly average of the different drugs prescribed in a period of three or more consecutive months. Patients who had withdrawn their medications for three or more consecutive months were selected, the medications dispensed each month were counted according to the fifth level of the ATC code, and then the monthly average was obtained for each individual.

**Method 3: *Continuous medication***, which referred to the number of drugs purchased in the first and second three-month periods of our study. This method was used to count which drugs an individual used in two different time periods. For each patient, the drugs prescribed in the first three-month period were identified according to the fifth level of the ATC code, and then those that were prescribed again during the second three-month period were counted.

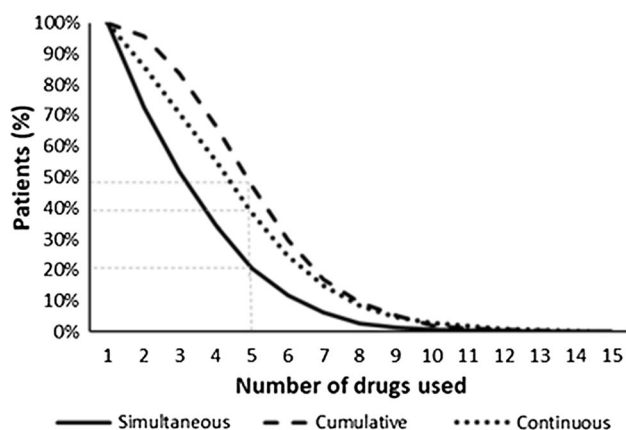
Descriptive analyses were reported as frequencies and percentages for qualitative variables, and the Chi-square test was used. To evaluate the association between polypharmacy and age and gender, we used logistic regressions, considering the variables that were found to be significant ( $p$  value  $< 0.1$ ) in the bivariate analysis for each method. We calculated the odds ratio (OR) and its 95% CI to describe the significant associations between the number of drugs and characteristics of the patients. A  $p$  value  $< 0.05$  was considered statistically significant.

## Results

From the 3972 patients of the database, 2208 were used in method 1, 1391 in method 2, and 2193 in method 3.

The prevalence of polypharmacy varied according to the method used (Fig. 1), and this relationship was significant ( $p$  value  $< 0.001$ ). The prevalence of polypharmacy was highest when determined by method 2, followed by methods 3 and 1. Method 1 allowed detecting major polypharmacy in 20.52% of the patients, method 3 in 38.66%, and method 2 in 47.09%. Minor polypharmacy showed a prevalence of 52.13% by method 1, of 48.38% by method 2 and of 47.24% by method 3, i.e. quite similar values.

Table 1 shows the percentages of patients who presented monopharmacy (use of only one drug) or minor polypharmacy versus major polypharmacy, according to age and gender, using the three methods. When using methods 1 and 2, we found no association between the level of polypharmacy and gender or age, although the percentage of individuals with major polypharmacy was slightly higher in the group aged 75 years old or older.



**Fig. 1** Prevalence of polypharmacy according to the method used and the threshold to determine polypharmacy

We found statistically significant association between the level of polypharmacy and age and gender, using method 3. Then, to evaluate the impact of the patients' characteristics on the probability of presenting major polypharmacy, we used a logistic regression model considering the variables found to be significant in the bivariate analysis. That is, we estimated the odds of presenting polypharmacy according to gender, age and the interaction between these factors.

The interaction term was statistically significant ( $p$  value = 0.020). For men, there was no significant association between age and polypharmacy ( $p$  value = 0.431), whereas for women, the odds of major polypharmacy was 1.37 times higher for patients aged 75 years old or older (OR 1.37, CI 95% 1.11–1.69). The patients under 75 years old showed no significant relation between gender and polypharmacy ( $p$  value = 0.715), whereas for patients of 75 years old or older, the odds of major polypharmacy was 1.48 times higher for women than for men (OR 1.48, CI 95% 1.14–1.91).

## Discussion

We estimated the prevalence of polypharmacy in patients aged 65 years old or older by means of three methods. We found that the prevalence of minor polypharmacy was similar with the three methods (between 47.24 and 52.13%) but that the prevalence of major polypharmacy varied from 20.35 to 47.09%. Latin American authors have reported that the prevalence of major polypharmacy varies between 24.10 and 50.00% [8, 9]. The lowest prevalence of major polypharmacy was found using simultaneous medication method, and the highest prevalence was found using the cumulative method. This may be due in part because cumulative method gives equal weight to drugs prescribed for a short period which are added to the total whatever the duration of its use [3].

Selecting the method to determine the number of drugs used by patients may depend to the objective of each study. If the aim is to know if excessive medication carries health risks and to attempt to reduce adverse effects, it is suggested to use cumulative indicators that take into account each medication added to the list. If the aim is to analyse drug interactions, it is suggested to use simultaneous indicators, to appreciate risk exposure on a daily basis from the combination of administered medications.

When using the continuous medication method, we found that the percentage of patients with major polypharmacy was significantly higher for the patients aged 75 years old or older. This could be because, in this case, intercurrent illnesses and short-term treatments are no longer considered and only medications administered continuously are considered important.

We found a significant association between gender and level of polypharmacy only when using the continuous method. Hofer-Dueckelmann [10] discussed the higher prevalence of polypharmacy among women and mentioned various possible reasons.

**Table 1** Distribution of patients according to gender, age and level of polypharmacy

Patients' characteristics	Simultaneous medication		Cumulative medication		Continuous medication	
	MP or minor PP	Major PP (%)	MP or minor PP	Major PP (%)	MP or minor PP	Major PP (%)
Gender						
Female	80.03%	19.97	51.86%	48.14	59.90%	40.10
Male	78.41%	21.59	54.95%	45.05	64.27%	35.73
	<i>p</i> value=0.373		<i>p</i> value=0.273		<i>p</i> value=0.048	
Age						
65–74	80.08%	19.92	54.64%	45.36	63.60%	36.40
75 or more	78.97%	21.03	51.36%	48.64	59.33%	40.67
	<i>p</i> value=0.518		<i>p</i> value=0.221		<i>p</i> value=0.040	

MP monopharmacy, PP polypharmacy

This study has some limitations. The database used did not include drugs purchased without medical indication, such as drugs delivered over the counter or herbal medicines, and we did not consider patients receiving no medications or those who had sufficient quantities from previous dispensing. Also, for the continuous method, we considered the DDDs for each medication to calculate the number of drugs in use on each day, assuming a daily intake of one DDD. However, some drugs are used at doses other than the DDD or do not have a DDD, a fact that could influence the determination of prevalence of polypharmacy. Nevertheless, this work contributes to the knowledge of some methods to estimate the prevalence of polypharmacy.

## Conclusions

We described and compared three methods to determine polypharmacy. This analysis shows that comparisons and conclusions about drug use are sensitive to the method used to summarize the information. It is necessary to be careful when selecting a methodology and to do it according to the objectives of each study.

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**Conflicts of interest** Luciana Chiapella, Jorgelina Montemarani Menna and María Eugenia Mamprin report no conflict of interest in the conduction of this study or the preparation of this manuscript.

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