Identification of medication discrepancies and potentially inadequate prescriptions in elderly adults with polypharmacy

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Abstract

Introduction: medication reconciliation is the process of comparing the documented prescriptions in medical records with those actually consumed by the patients. Potentially inadequate prescriptions (PIP) are those significantly associated with adverse drug events.

Objectives: 1) to describe the frequency and type of medication discrepancies through medication reconciliation 2) to describe the frequency of PIP.

Methods: in a cross-sectional study of randomly selected elderly people (>65 yo) with more than 10 medications recorded in their electronic medical record (EMR), structured telephone interviews were performed in order to identify medications discrepancies and PIP (using STOPP criteria).

Results: out of 214 randomly selected individuals 150 accepted to participate (70%). The mean number of medications referred to be consumed by patients was 9.1 (CI 95% 8.6-9.6), and the mean number of prescribed medications in their EMR was 13.9 (CI 95% 13.3-14.5). 99% had at least one discrepancy (total 1252 discrepancies); 46% consumed at least one prescription not documented in their EMR and 93% did not consume at least one of the prescriptions documented in their EMR. In 77% of the patients a PIP was detected (total 186), 87% of them were at least within one of the following categories: prolonged used of benzodiazepines or proton pump inhibitors and the use of aspirin for the primary prevention of cardiovascular disease.

Conclusions: there is a high prevalence of medication discrepancies and PIP within the community of elderly adults affiliated to a Private University Hospital.
WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT
Medication discrepancies are frequent in polymedicated individuals
Potentially inadequate prescriptions are risk factors for adverse drug events
Coexistence of these phenomena has been rarely reported

WHAT THIS STUDY ADDS
There is a high prevalence of both medication discrepancies and potentially inadequate prescriptions in elderly polymedicated adults
The pattern of potentially inadequate prescriptions in our country seems consistent with other reports

Introduction

Approximately one third of patients over 60 years old consume daily between 5 to 9 medications and 12% consume 10 or more. The risk of adverse drug events (ADE) increase significantly when the number of consumed medications is 5 or higher(1). Potentially Inadequate Prescriptions (PIP) are those whose benefits are generally outweighed by their potential risks of ADE throughout inadequate dosing or duration of treatment, dangerous interactions or poor clinical effectiveness. PIP can also include the non-prescription of drugs with a significant clinical benefit(2). Medication Discrepancies (MD) are those detected through Medication Reconciliation (MR). MR is a formal process for creating the most complete and accurate list possible of a patient’s current medications and comparing the list to those in the patient record or medication orders. MR was the #8 Patient Safety Goals by the Joint Commission in 2005, and then it was suspended and reformulated within #3 Goal “Improving the safety of using medication”(3). MD are common in all clinical settings, ranging from 70-100% (4, 5), and about one third are linked to potential harm. It is unclear whether interventions aimed at reducing MD prevents ADE or other harms, since most of the research has been focused to inpatient settings and
transitions of care (6). In one outpatient-setting study, MR reduced the number of MD from 89% to 66%, though most of them were in minor discrepancies (7). Another study in our country used STOPP and Beers (8) criteria and found that approximately one third of comorbid elderly adults had PIP(9). This study aims to describe the frequency and type of both MD and PIP in a population of elderly adults with polypharmacy in a Private Academic Community Hospital of Buenos Aires, Argentina.

Methods

Study design and population
We performed a cross-sectional study. Random sequence generation was used to identify eligible participants from our Hospital database (May 31st 2014) of elderly adults (65 years-old or older) with 10 or more active prescriptions in their electronic medical records (EMR). An exclusion criterion was hospital admission or domiciliary care within the last 12 months.

Outcomes
We defined as primary outcomes the proportion of patients with MD and PIP. We defined as secondary outcomes the proportion of types of discrepancies and PIP. We also analyzed the association between the number of MD and PIP and other demographic and clinical variables.

Data Collection
A family physician (JF) called patients from the sample and invited them to participate in a telephone interview using a protocolized oral consent. If the patient accepted, then a form (Appendix I) was used to collect basic demographic characteristics (age, education, marital status) and the complete list of medications currently consumed by the patients (P LIST). Each patient was called three times at a different time and day before catalogued as “non-respondent”.

The P LIST was then compared with the list present in the EMR (EMR LIST) and MD were consigned and classified (see below, table 3). PIP were detected using STOPP criteria applied to the P LIST. Since these criteria require in some cases clinical information, when necessary the physician consulted the EMR or asked directly to the patient for information.

**Sample Size and Statistical Analysis**

Sample size calculation was based on an estimated proportion of medication discrepancies of 75% and a semi-amplitude confidence interval of 7%. From previous experience in our institution we estimated a response rate of approximately 50%. Therefore a randomized sample of 214 patients was needed to achieve 150 individually completed telephone interviews.

We calculated summary statistic measurements using STATA 13 software. We used chi-square test and two sample t-test for dichotomous and continuous hypothesis testing respectively. Measures of associations were tested using regression models. We defined an alpha level of p=0.05.

**Ethics**

This study protocol and its oral consent form were approved by our Hospital's Research Ethics Committee. (Number of approbation 2246, March 27th 2014)
Results

Population Characteristics

Out of the 214 randomly selected individual, 150 accepted to participate with a response rate of 70%. 28 declined the interview and 36 were non-respondent. There were no differences in sex, age and number of prescriptions in the EMR between those who accepted and those who refused or were “non-respondent” (see table 1).

The majority of interviewees were women and half of them were widows. The mean age was 78 years old. The mean number of medication referred to be consumed by patients was 9.1 (95% CI 8.6-9.6) and the mean number of prescribed medications in their EMR was 13.9 (CI 95% 13.3-14.5). See table 2 for additional characteristics.

Table 1. Basic demographic characteristics of those who accepted (n=150) to participate and those who did not (refused or were non respondent, n=64)

<table>
<thead>
<tr>
<th></th>
<th>Accepted</th>
<th>Refused or did not answer</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>78.55</td>
<td>78.42</td>
<td>0.90</td>
</tr>
<tr>
<td>% Female</td>
<td>85%</td>
<td>81%</td>
<td>0.45</td>
</tr>
<tr>
<td>Number of prescriptions in EMR</td>
<td>13.91</td>
<td>13.98</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Table 2. Other demographic characteristics of those who accepted (n=150) and their 95% confidence intervals
Number of prescriptions in EMR & 13.91 (13.32-14.51) 
Number of medications P LIST & 9.1 (8.62-9.57) 
Marriage status & 52% widow  
34% married  
14% single or divorced  
Household constitution & 48% lives alone  
38% lives with relative  
14% lives with caregiver  
Has a written list of medication & 69% (61-76%)  

* P LIST comprises the medication referred to be consumed by patients in the telephone interview. EMR: electronic medical record.

**Medication Discrepancies**

When comparing P LIST with EMR LIST, a total of 1252 discrepancies were found. 99% of patients had at least one discrepancy. The most frequent discrepancy was that in which the patient was not consuming a prescribed medication in the EMR (93%, 95% CI 88-97%), and in a minority of patients (5%, 95% CI 2-9%) they were consuming a duplicated prescription (e.g. two types of benzodiazepines simultaneously). Other clinically relevant discrepancies are described in table 3. The mean number of discrepancies per patient was 8.34 (95% CI 7.65 - 9.04).

When performing linear regression analysis, we found that the number of prescribed medication was strongly associated with the number of medication discrepancies even
after adjusting by sex, age, household constitution and marriage status (Figure 3). For each additional prescription in the EMR, an additional mean of 0.9 medication discrepancies could be found. No other variables were associated with the number of medication discrepancies.

**Figure 2. Number of medication discrepancies and number of prescriptions**

![Figure 2](image)

**Table 3. Proportions of discrepancies found by type (95% confidence intervals)**

<table>
<thead>
<tr>
<th>Discrepancy Type</th>
<th>Proportion (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient did not consume medication in EMR</td>
<td>93% (88-97%)</td>
</tr>
<tr>
<td>Patient consumed medication not listed in EMR</td>
<td>46% (38-54%)</td>
</tr>
<tr>
<td>Difference in regimen</td>
<td>68% (60-75%)</td>
</tr>
<tr>
<td>Difference in dose</td>
<td>51% (42-59%)</td>
</tr>
<tr>
<td>Duplication (consuming duplicated prescription)</td>
<td>5% (2-9%)</td>
</tr>
</tbody>
</table>
Potentially Inadequate Prescriptions

Using STOPP criteria, 186 PIP were detected in 77% of patients (95% CI, 70-83%). The mean number of PIP per patient was 1.24 (95% CI 1.09 - 1.39). The number of PIP per patients is described in Table 4.

Table 4. Proportion of patients and number of PIP

<table>
<thead>
<tr>
<th>Number of PIP</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62 (41)</td>
</tr>
<tr>
<td>2</td>
<td>39 (26)</td>
</tr>
<tr>
<td>3</td>
<td>14 (9)</td>
</tr>
<tr>
<td>4</td>
<td>1 (1)</td>
</tr>
<tr>
<td>No PIP</td>
<td>34 (23)</td>
</tr>
</tbody>
</table>

PIP: potentially inadequate prescriptions

Up to 87% of PIP involved three STOPP criteria: the prolonged use (> 1 month) of benzodiazepines, the use of proton pump inhibitors for a period longer than 8 weeks and the use of aspirin for the primary prevention of cardiovascular disease. For further details see table 5.

Table 5. Description of PIP.
### Potentially inadequate Prescriptions

<table>
<thead>
<tr>
<th>Potentially inadequate Prescriptions</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged use of benzodiazepines</td>
<td>30 (20)</td>
</tr>
<tr>
<td>Prolonged use of proton pump inhibitors</td>
<td>70 (47)</td>
</tr>
<tr>
<td>Aspirin for primary prevention of cardiovascular disease</td>
<td>62 (41)</td>
</tr>
<tr>
<td>Potentially inadequate use of opiates (e.g. prolonged use in constipated patients without the use of laxatives)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Other potentially inadequate use of aspirin (e.g. dose &gt;150 mg daily)</td>
<td>8 (5)</td>
</tr>
<tr>
<td>Potentially inadequate use of NSAID (e.g. prolonged use or in combination with anticoagulants)</td>
<td>10 (7)</td>
</tr>
<tr>
<td>Potentially inadequate use of other psychotropics (e.g. tricyclic antidepressants in dementia)</td>
<td>3 (2)</td>
</tr>
</tbody>
</table>

PIP: potentially inadequate prescriptions. NSAID: Nonsteroidal anti-inflammatory drugs. Percentages do not add up to 100% since some patients had more than one PIP.

**Discussion:**

Medication discrepancies were common between their prescriptions in their EMR and the medication referred to be consumed by patients during their telephone interview. This is consistent with previous findings by Milone et al. (4) where up to 98.5% of patients with 10 or more prescriptions had discrepancies when medication reconciliation was performed by a pharmacist in a family medicine clinic. In that study the most frequent source of
discrepancies was “patient no longer taking medication” (54.1%) followed by “current medication not on list” with an average of 6.6 discrepancies per patient. In table 6 other experiences in medication reconciliation are described. Possible factors associated with the high number of medication no longer taken by the patients are: the inadequate prescription of medication for acute conditions, the inadequate cancellation of old prescriptions when new treatments are indicated, conflicting prescriptions between multiple providers, low adherence and insufficient stock.

Table 6. Medication reconciliation and detection of medication discrepancies.

<table>
<thead>
<tr>
<th>Orrico (10)</th>
<th>85 patients at a medical center</th>
<th>233 discrepancies, 79% associated with the medication control by healthcare personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedell (11)</td>
<td>312 patients in a private practice</td>
<td>76% of patients with discrepancies</td>
</tr>
<tr>
<td>Ernst (12)</td>
<td>450 patients at a medication center</td>
<td>250 discrepancies, 59% of consumed medication not in EMR</td>
</tr>
<tr>
<td>Johnson (13)</td>
<td>100 patients at a family medicine center</td>
<td>581 discrepancies, 41% inactive medication, 29% of consumed medication not in EMR</td>
</tr>
<tr>
<td>Ekedahl (14)</td>
<td>66 patients in the public health sector</td>
<td>82% of patients with discrepancies, included patients were comorbid</td>
</tr>
<tr>
<td>Stewart (5)</td>
<td>219 patients at a medical center</td>
<td>74% of patients with discrepancies, most of over-the-counter medication was not in EMR</td>
</tr>
<tr>
<td>Milone (4)</td>
<td>327 patients family medicine center</td>
<td>98.5% of patients with discrepancies, included patients had &gt;10 prescriptions in EMR</td>
</tr>
</tbody>
</table>
A large proportion of patients with potentially inadequate prescriptions was found in our study sample. Regueiro (9) found a lower proportion in a similar population in our country (21.3%), however the most frequently found STOPP criteria were similar: prolonged use of proton pump inhibitors, potentially inadequate use of aspirin and benzodiazepines. In a systematic review of studies using STOPP criteria to detect PIP (15), a wide range of prevalence of PIP was found (21 to 79%) but the most commonly encountered were also the three most frequently found in our study.

There are several limitations in our study. The use of telephone interviews could have selected a population of elderly adults, nevertheless there was a high response rate and the demographic characteristics of responders were similar to those who did not. Recall could be a source of bias, especially in patients trying to remember long list of prescriptions or when medication taken by the patient and not registered in EMR could not be recalled. Our data collection method, adapted from Stewart (5) and Ekedahl (14) was not validated in our population, but was compatible with our current medical practice of comprehensive medication reconciliation and review.

Conclusions

There is a high prevalence of medication discrepancies and PIP within the community of elderly adults affiliated to a Private University Hospital. Future interventions should be aimed at reducing the number of PIP in order to prevent adverse drug events and improve EMR accuracy by lowering medications discrepancies. Research in this area should also focus on the effect of these interventions in the incidence of adverse drug reactions.

Conflict of interest

The authors declare no conflict of interests.
Appendix I

Abridged version of the form used in telephone interview (translated from Spanish)

<table>
<thead>
<tr>
<th>Age:</th>
<th>Marital status:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex:</td>
<td>Household constitution:</td>
</tr>
<tr>
<td></td>
<td>lives alone / lives with relative / lives with caregiver</td>
</tr>
<tr>
<td>Education:</td>
<td>Has a written list of medication: YES/NO</td>
</tr>
</tbody>
</table>

1) ¿Could you tell me what medication are you currently taking? (spontaneous report)
Name, Dosage, Regimen

2) Review medication in EMR and ask about each prescription

3) Check for duplicates, discrepancies and STOPP criteria

Types of discrepancies:

a. Patient did not consume medication in EMR
b. Patient consumed medication not listed in EMR
c. Difference in regimen
d. Difference in dose
e. Duplication (consuming duplicated prescription)

4) Number of prescriptions

5) Number of medication consumed
References


