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ORIGINAL RESEARCH ARTICLE

# Trends in Inappropriate Drug Therapy Prescription in the Elderly in Sweden from 2006 to 2013: Assessment Using National Indicators

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## Abstract

**Background** Medication for elderly patients is often complex and problematic. Several criteria for classifying inappropriate prescribing exist. In 2010, the Swedish National Board of Health and Welfare published the document “*Indicators of appropriate drug therapy in the elderly*” as a guideline for improving prescribing for the elderly.

**Objective** The aim of this study was to assess trends in the prescription of inappropriate drug therapy in the elderly in Sweden from 2006 to 2013 using national quality indicators for drug treatment.

**Methods** Individual-based data on dispensed prescription drugs for the entire Swedish population aged  $\geq 65$  years during eight 3-month periods from 2006 to 2013 were accumulated. The data were extracted from the Swedish Prescribed Drug Register. Eight drug-specific quality indicators were monitored.

**Results** For the entire population studied ( $n = 1,828,283$  in 2013), six of the eight indicators showed an improvement according to the guidelines; the remaining two indicators (drugs with anticholinergic effects and excessive polypharmacy) remained relatively unchanged. For the subgroup aged 65–74 years, three indicators showed an improvement, four indicators remained relatively unchanged (e.g. propiomazine, and oxazepam) and one showed an undesirable trend (anticholinergic drugs) according to guidelines. For the older group (aged  $\geq 75$  years), all indicators except excessive polypharmacy showed improvement.

**Conclusion** According to the quality indicators used, the extent of inappropriate drug therapy in the elderly decreased from 2006 to 2013 in Sweden. Thus, prescribers appear to be more likely to change their prescribing patterns for the elderly than previously assumed.

## Key Points

According to the quality indicators used, the extent of inappropriate drug therapy in the elderly decreased from 2006 to 2013 in Sweden.

Prescribers appear to be more likely to change their prescribing patterns for the elderly than previously assumed.

## 1 Background

Medication for older people (those aged  $\geq 65$  years) is often perceived as complex and problematic, and various efforts have been made to improve drug therapy for the elderly, primarily by trying to avoid drugs deemed to be ‘inappropriate’ [1].

Several documents listing criteria for classifying inappropriate prescriptions have been offered. Almost all of these focus on the use of specific drugs by individual elderly patients, e.g. Beers’ criteria [2], the Improving Prescribing in the Elderly Tool (IPET) [3], the Screening Tool of Older persons’ Potentially inappropriate Prescriptions (STOPP) [4], McLeod’s criteria [5], and the Medication Appropriateness Index (MAI) [6]. Some studies

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have used a combination of several of the more well-known criteria [7].

The widely recognized MAI and Beers' criteria were published in the early 1990s. The MAI measures the overall prescription quality in ten areas, without specifying which drugs are to be avoided [6]. Originally, Beers' criteria included a list of drugs to be avoided only in the elderly nursing home population [2] but they were then modified to include community-dwelling elderly [8] and were later updated [9].

In 2003, the Swedish National Board of Health and Welfare issued a proposal based on international developments in the field [2, 5, 8–12] presenting indicators that could be used to evaluate the quality of drug use by the elderly in Sweden [13]. The intention was that the indicators should be applied under a variety of circumstances in order to improve the drug therapy of elderly patients: by supporting the prescription of drugs to the elderly, when monitoring prescribing patterns, and in national monitoring and epidemiological studies. The indicators also enabled investigation of the relationships between drug prescription processes, outcomes and costs over time.

In 2009, a proposal for an updated, expanded version of the quality indicators was presented and in 2010, “*Indicators of appropriate drug therapy in the elderly*” was published [14] (Table 1). Two groups of quality indicators were provided in the document: drug-specific and diagnosis-specific. Some of these indicators are suitable for use in the analysis of registers of dispensed drugs in large populations. It is important to underline that the drug-specific indicators are defined in terms of the number of recipients of the drug as a percentage of the entire elderly population and are therefore primarily relevant on a population level only. Furthermore, because of the increased sensitivity to

drugs with greater age, these indicators are most applicable for the group aged over 75 years [14].

The establishment of the national Swedish Prescribed Drug Register in 2005 enabled analysis of the utilization of dispensed prescription drugs for the entire population [15]. The register provides individual data that can be used for exploring and analyzing the quality of drug use in the elderly for the whole of Sweden. These individual-based data can also be applied in longitudinal studies of the development of drug therapies for the elderly.

The Swedish Prescribed Drug Register has been used in studies of drug treatment in the elderly since 2005 [16–18]. Unfortunately, over the years, the focus of these reports has shifted from drug use among different age groups to housing types, time periods and measuring methods. Consequently, the results are not comparable over time. Thus, no long-term trends concerning these indicators of quality have been reported, and the need for an investigation in this area is apparent.

## 2 Objective

The aim of this study was to assess trends in the prescription of inappropriate drug therapy in the elderly in Sweden from 2006 to 2013 using national quality indicators for drug treatment.

## 3 Methods

To assess changes in the extent of appropriate drug therapy for older people in a national population, we employed a list of drug-specific quality indicators from the publication “*Indicators of appropriate drug therapy in the elderly*” [14], obtained from the Swedish National Board of Health and Welfare, and individual-based data on dispensed prescription drugs in the entire Swedish population aged  $\geq 65$  years over eight 3-month periods (January, February and March) for the period 2006–2013. The data were extracted from the Swedish Prescribed Drug Register [15]. With the assumption that the level of primary non-adherence was unchanged for the drugs included in the indicators during the study period, we used the data on dispensed prescription drugs as proxy for changes in prescription patterns during the study period.

The individual data relating to dispensed prescription drugs were processed without the original personal identification numbers of the recipients; all data were anonymous. Instead, a unique temporary individual identifier, specifying year of birth, was applied and the study population was stratified by age (in 5-year groups). The results are presented with respect to the number of individuals per

**Table 1** Development of “*Indicators of Appropriate Drug Therapy in the Elderly*” by the Swedish National Board of Health and Welfare [14]

Indicator used in the study	Original proposal 2003	Revised proposal 2009	Final guideline 2010
Long-acting benzodiazepines	X	X	X
Drugs with anticholinergic effects	X	X	X
Tramadol		X	X
Propiomazine		X	X
Excessive polypharmacy			X
Three or more psychotropic drugs	X	X	X
Oxazepam		X	X
Zopiclone		X	X

age group in the Swedish population during the corresponding periods.

The number of individuals and the number of dispensed prescription drugs per individual were recorded; a drug was defined as a chemical entity or substance or combination of substances from the fifth level in the Anatomical Therapeutic Chemical (ATC) classification system [19].

### 3.1 Indicators

We selected all the eight (out of 34) drug-specific indicators from the publication “*Indicators of appropriate drug therapy in the elderly*” that were suitable for application to the register and did not require complementary information from patients’ medical records. The selected indicators belonged to three categories of drugs (A, B and C below) that can be considered universally applicable to the elderly.

#### 3.1.1 Category A: Drugs that Older People Should Avoid Unless There are Special Reasons Not to Do So

The guidelines state that the number of elderly patients who use these medications (as a percentage of the total elderly population) should be as low as possible.

- Long-acting benzodiazepines: ATC code N05BA01 (diazepam), N05CD02 (nitrazepam), N05CD03 (flunitrazepam)
- Drugs with anticholinergic effects: ATC code A03AB (glycopyrrolate), A03BA (e.g. atropine), A03BB (e.g. butylscopolamine), A04AD (scopolamine), C01BA (disopyramide), G04BD (e.g. oxybutynin), N02AG (e.g. morphine), N04A (e.g. trihexyphenidyl), N05AA (levomepromazine), N05AF03 (chlorprotixene), N05AH02 (clozapine), N05BB01 (hydroxyzine), N06AA (e.g. clomipramine), R06AA02 (dimenhydrinate), R06AB (e.g. chlorpheniramine), R06AD (e.g. alimemazine), R06AX02 (cypheptadine)
- Tramadol: ATC code N02AX02
- Propiomazine: ATC code N05CM06

#### 3.1.2 Category B: Polypharmacy

The guidelines state that the number of elderly patients receiving polypharmacy should be as low as possible.

- Excessive polypharmacy is defined as concomitant treatment with ten or more drugs regularly or as needed.
- Polypharmacy is also defined as concomitant treatment with three or more psychotropic drugs [from one or more ATC groups N05A (e.g. clozapine), N05B (e.g.

diazepam), N05C (e.g. zolpidem), N06 (e.g. fluoxetine)] regularly or as needed.

#### 3.1.3 Category C: Specific Psychotropic Drugs

The guidelines state that:

- Of all elderly patients treated with tranquilizers (N05B), the proportion (percentage) who use oxazepam (N05BA04) in preference to other alternatives in N05B should be as high as possible.
- Of all elderly patients treated with hypnotics or sedatives (N05C), the proportion who use zopiclone (N05CF01) in preference to other alternatives in N05C should be as high as possible.

### 3.2 Comparability of Data

Since ten or more dispensed drugs during a 3-month period is the most widely used definition of excessive polypharmacy [20–23], comparisons with other studies were possible. As a rule, the filling of one prescription covers consumption for a 3-month period in Sweden. To achieve comparability between indicators and over the years, we selected the same periods for analyses of all the selected indicators.

### 3.3 Swedish Prescribed Drug Register

The Swedish Prescribed Drug Register [15] provides records for the entire Swedish population and covers approximately 82 % of all defined daily doses (DDDs) of medications dispensed in Sweden. The register does not include data on over-the-counter (OTC) medications (13 %), in-hospital medications (4 %), or non-institutional care medications (1 % of all DDDs distributed in Sweden). The register is also not complete with regard to vaccines or non-dose-dispensed drugs in nursing homes.

The Swedish Prescribed Drug Register is individual-based and contains data on dispensed outpatient prescriptions from all Swedish pharmacies from 1 July 2005. The registration of dispensed drugs is mandatory in Sweden. The following data were used in our study: the dispensed drug (substance), date of dispensing, age, and unique identifier (personal identification number) of the patient.

### 3.4 Study Population

The study population included all individuals aged  $\geq 65$  years during eight 3-month periods (January, February and March) from 2006 to 2013. The number of participants increased by 16.2 % from quarter (Q) 1 in 2006 to

**Table 2** The number of individuals in Sweden aged  $\geq 65$  years in 2006–2013, presented in 5-year age groups

Age group (years)	2006	2007	2008	2009	2010	2011	2012	2013
65–69	426,408	443,520	468,154	497,789	530,721	563,074	587,197	595,931
70–74	347,405	351,314	359,473	371,843	384,095	395,524	412,013	422,593
75–79	310,887	309,483	307,083	304,548	303,552	304,799	309,083	311,611
80–84	256,516	252,241	249,637	247,407	245,948	245,289	245,036	245,180
85–89	157,361	162,105	164,951	167,366	166,835	164,396	162,527	161,736
90–94	60,051	60,978	61,654	62,697	66,182	70,835	73,217	73,675
95–99	13,407	13,853	14,295	14,690	15,033	15,327	15,602	15,721
100+	1,375	1,433	1,502	1,591	1,648	1,715	1,803	1,836
Total	1,573,407	1,594,925	1,626,747	1,667,929	1,714,012	1,760,957	1,806,476	1,828,283

Q1 in 2013. The largest increase (39.8 %) occurred in the group aged 65–69 years. The group aged 80–84 years decreased by 4.4 %. The number of individuals in the group aged 65–79 years increased by 22.6 %, and the group aged  $\geq 80$  years increased by 1.9 % (Table 2).

The group aged  $\geq 100$  years was excluded from the graphic representations of the eight indicators because of the small numbers of individuals involved ( $n = 1,836$ , representing 0.1 % of the study population in 2013).

Sums and frequencies were calculated using Microsoft Excel, version 2010 (14.0.6126.5000) SP 1 MSO (14.0.6129.5000), (Microsoft Corporation, Redmond, WA, USA).

The study was approved by the Swedish Regional Ethical Review Board in Linköping.

## 4 Results

### 4.1 Drugs that Older People Should Avoid

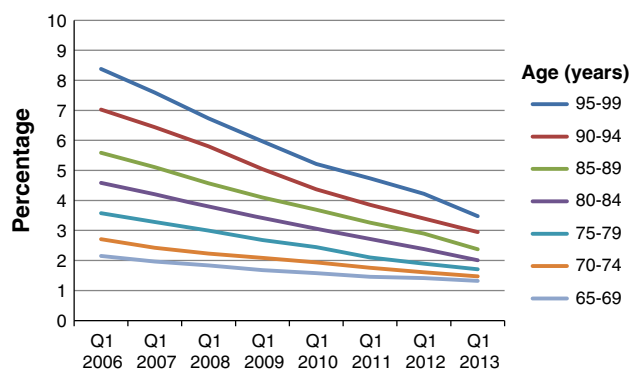
#### 4.1.1 Long-Acting Benzodiazepines

The number of elderly people for whom long-acting benzodiazepines were dispensed, given as a percentage of the total population aged  $\geq 65$  years, decreased from 3.5 % to 1.7 % (–52.2 %) in the period Q1 2006 to Q1 2013. The proportion decreased consistently over the study period and occurred in all age groups, with the greatest decrease seen in the oldest group (95–99 years; –58.5 %; Fig. 1).

#### 4.1.2 Drugs with Anticholinergic Effects

The number of elderly people for whom drugs with anticholinergic effects were dispensed, given as a percentage of the total elderly population, decreased marginally during the study period, from 1.5 % to 1.4 % (–1.2%).

There were decreases in the groups aged  $\geq 80$  years, with the largest decrease in the oldest group (95–99 years;



**Fig. 1** The proportion of elderly individuals in Sweden (aged  $\geq 65$  years), in 5-year age groups, for whom long-acting benzodiazepines were dispensed over the period Q1 2006 to Q1 2013. Q1 Quarter 1

–35.6 %). In the groups aged 65–69 years and 70–74 years, the proportion increased by 28.2 and 16.9 %, respectively (Fig. 2).

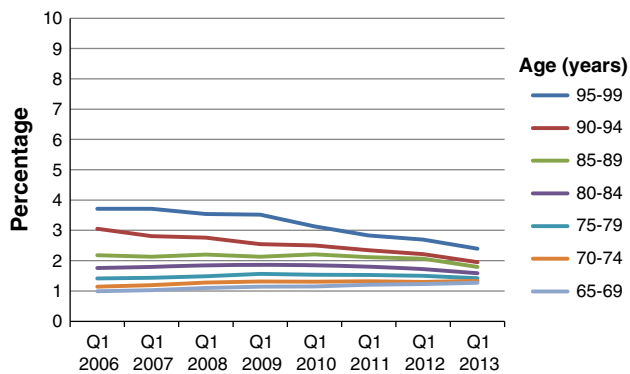
#### 4.1.3 Propiomazine

The number of elderly people for whom propiomazine was dispensed, given as a percentage of the total elderly population, decreased from 2.7 % to 2.0 % (–24.4 %) during the study period (Fig. 3). The decrease was consistent over the study period. The proportion decreased in all age groups, except for the group aged 65–69 years. The largest decrease was seen in the oldest group (95–99 years; –55.5 %).

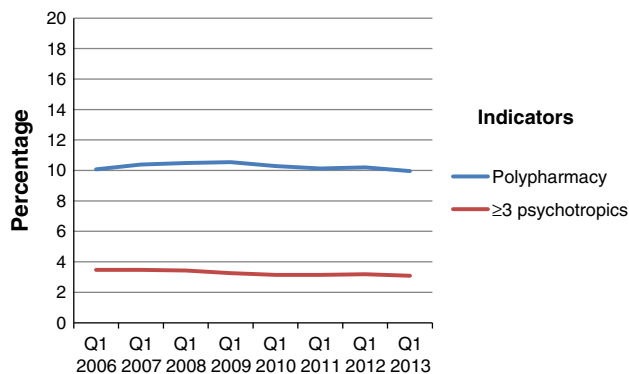
#### 4.1.4 Tramadol

The number of elderly people for whom tramadol was dispensed, given as a percentage of the total elderly population, decreased from 3.9 % to 2.3 % (–41.1 %) during the study period (Fig. 3).

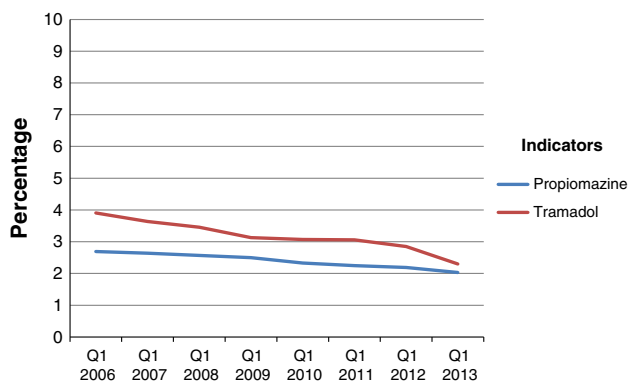
The proportion decreased in all age groups, with the largest decrease seen in the oldest group (95–99 years;



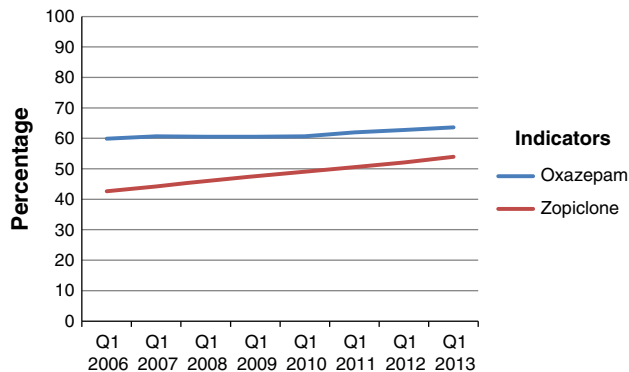
**Fig. 2** The proportion of elderly individuals in Sweden (aged  $\geq 65$  years), in 5-year age groups, for whom drugs with anticholinergic effects were dispensed over the period Q1 2006 to Q1 2013. *Q1* Quarter 1



**Fig. 4** The proportion of elderly individuals in Sweden (aged  $\geq 65$  years) for whom ten or more prescription drugs, or three or more concurrent psychotropic drugs, were dispensed concurrently over the period Q1 2006 to Q1 2013. *Q1* Quarter 1



**Fig. 3** The proportion of elderly individuals in Sweden (aged  $\geq 65$  years) for whom propiomazine and tramadol was dispensed over the period Q1 2006 to Q1 2013. *Q1* Quarter 1



**Fig. 5** The proportion of elderly individuals in Sweden (aged  $\geq 65$  years) receiving tranquilizers for whom oxazepam was dispensed, and the proportion of elderly individuals in Sweden (aged  $\geq 65$  years) receiving hypnotics or sedatives for whom zopiclone was dispensed, over the period Q1 2006 to Q1 2013. *Q1* Quarter 1

–65.3 %). The greatest reduction occurred between Q1 2012 and Q1 2013 (–19.3 %).

## 4.2 Polypharmacy

### 4.2.1 Excessive Polypharmacy

The number of elderly people receiving excessive polypharmacy (ten or more concurrent prescription drugs dispensed regularly or as required), given as a percentage of the total elderly population, decreased marginally during Q1 2006 to Q1 2013, from 10.1 % to 10.0 % (–1.2 %) (Fig. 4). The difference between age groups was marginal.

### 4.2.2 Three or More Concurrent Psychotropic Drugs

The number of elderly people for whom three or more concurrent psychotropic drugs were dispensed, given as a percentage of the total elderly population, decreased from 3.5 % to 3.1 % (–11.0 %) during the study period (Fig. 4).

## 4.3 Individual Psychotropic Drugs

### 4.3.1 Oxazepam

The number of elderly patients for whom oxazepam was dispensed, given as a percentage of the total elderly population receiving any tranquilizer, increased from 59.9 % to 63.6 % (+6.2 %) over the period from Q1 2006 to Q1 2013 (Fig. 5). The largest increase was seen in the three oldest groups (85–89 years, 90–94 years, and 95–99 years; +11.8, +12.4, and +11.0 %, respectively).

### 4.3.2 Zopiclone

The number of elderly patients for whom zopiclone was dispensed, given as a percentage of the total elderly population receiving any hypnotic or sedative, increased from 42.6 % to 53.9 % (+26.5 %) during the study period (Fig. 5). The increase was consistent over the study period.

The largest increase was seen in the oldest groups (85–89 years, 90–94 years, and 95–99 years; +32.8, +34.4 and +46.4 %, respectively).

## 5 Discussion

We found that the extent of inappropriate drug therapy for the elderly ( $\geq 65$  years of age) improved, according to the national guidelines for this age group, over the period 2006–2013 in Sweden. The positive trend was more pronounced for those aged  $\geq 75$  years. Considering that the medication requirements for older patients are commonly described as increasingly complex and problematic, this improvement was unexpected, and offers hope.

### 5.1 Long-Term Trends

The changes to the indicators were relatively constant during the course of the study, particularly for the reduction in prescribing of long-acting benzodiazepines and the increase in prescribing of zopiclone. Similarly, the absence of change in the indicators for drugs with anticholinergic effects and excessive polypharmacy was stable during the whole period.

Our results displayed no clear link between the addition of an indicator to the Swedish guidelines and changes to prescribing patterns. For example, the indicator drugs with anticholinergic effects has changed only marginally since it was added to the guidelines in 2003, and the indicators involving the use of tramadol, propiomazine, oxazepam and zopiclone were already changing in the appropriate direction before their introduction to the guidelines proposal in 2009.

Our findings confirm that, for most of the indicators, there is an ongoing long-term change in the patterns of prescribing. It appears likely that the current debate on drug therapy for the elderly has increased prescribers' knowledge of inappropriate drugs and contributed to the changes to quality indicators. However, it remains unresolved whether the observed trends were the result of changes to the guidelines or whether the guidelines are merely reflecting a change in prescribing practice that was already occurring.

It also remains uncertain whether specific interventions introduced with the aim of affecting the indicators have in fact had any effect. In 2012, the Swedish government offered to reward counties managing to decrease the indicators of inappropriate drugs by 10 % in patients aged  $\geq 65$  years. Two of the 21 counties succeeded at the time [24] but the long-term effects of the intervention remain to be seen.

Our results also suggest that some indicators may have reached a level from which it is difficult to achieve any further progress. This could be because there are few or no alternative therapies available. It could also be the existence of other opposite treatment recommendations, e.g. the Swedish Medical Product Agency state that the use of drugs with anticholinergic effects are probably too low today [25].

With respect to the indicator excessive polypharmacy, while it may be possible to reduce or alter the use of one or two specific drugs, it is difficult to reduce the overall level of polypharmacy since there are many associated factors at a population level, e.g. increasing life expectancy, development of new therapies, increasing use of preventive strategies, and medical guidelines [26].

### 5.2 Comparison with Other Studies

The Swedish Association of Local Authorities and Regions and The National Board of Health and Welfare present the report "*Quality and Efficiency in Swedish Health Care*" every year. Unfortunately, the indicators, monitored age groups and methods of analysis have been altered through the years, resulting in non-comparable data. Thus, there have been no other reports of long-term trends in drug prescribing for the elderly in Sweden. However, official publications have discussed the difficulties associated with achieving change and the perception of stagnation in the process of reducing inappropriate medication to the elderly [27].

Long-term trends in inappropriate prescribing in the elderly have also been poorly investigated internationally [28], and the available studies often describe non-comparable sets of medications and use different measurement tools to estimate the overall prevalence of inappropriate prescribing [29, 30]. Nonetheless, studies have indicated, in line with our results, a slight decrease in the use of potentially inappropriate drugs by elderly patients [28, 31–33].

Our findings that excessive polypharmacy has remained at a constant level during the study period are not consistent with results from official Swedish reports [34, 35]. Although the methods of measurement have changed over the years and may have contributed to the decline, the reports claim that the proportion of the elderly receiving excessive polypharmacy has been reduced. In contrast, a short-term study has indicated that the proportion of elderly receiving excessive polypharmacy in Sweden increased over the period from 2005 to 2008 [36]. The general trend internationally also indicates an increasing prevalence of polypharmacy [37–41]. However, an increasing prevalence of polypharmacy does not necessarily imply increasing

inappropriate prescribing among the elderly. Instead, increased prevalence of polypharmacy can actually be combined with reduced inappropriate prescribing [28].

### 5.3 Strengths and Weaknesses of the Study

The study does not cover all the national indicators of appropriate drug therapies in the elderly. Analysis of other drug- and diagnosis-specific indicators would have required access to the patients' medical records for gathering complementary information records.

Since the indicators of quality chosen by the Swedish National Board of Health and Welfare are 'national standards' in the study population, we have not addressed their possible strengths and weaknesses compared with other quality indicators, despite the availability of alternative choices and the ongoing debate concerning the validity, relevance, measurability, interpretability, and uniqueness of different indicators.

As the study included all individuals in the population, we were able to avoid known problems associated with sampling, recall, interviews, and confidence levels. On the other hand, using registered data on dispensed drugs as an estimate of drug use could result in either over- or underestimation of actual drug use.

### 5.4 Unanswered Questions and Future Research

For patients aged 65–74 years, three of eight indicators showed improvement over the 8-year period. During the same period, the number of individuals in this age group increased by 32 %, whereas the number of individuals aged  $\geq 75$  years hardly increased at all. It remains to be seen whether the overall positive trends in drug-specific quality indicators for all elderly will continue when the increasing number of individuals currently aged  $< 75$  years become older.

During the study period, the prescribing of several drugs included in the indicators declined and it is assumed that other alternative medications have been prescribed instead. The prescribing of alternative drugs and its clinical implications for patients remains to be studied in detail, e.g. the use of other opiates when the prescribing of tramadol declined.

## 6 Conclusions

According to the quality indicators used, the extent of inappropriate drug therapy in the elderly decreased from 2006 to 2013 in Sweden. This improvement was especially evident in the oldest patients, although this group still had the highest proportion of inappropriate drug use.

Overall, the results indicate that prescribers appear to be more likely to change their prescribing patterns for the elderly than previously assumed.

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