
Potentially Inappropriate Medications in Nursing Homes: Sources and Correlates

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Abstract

Objective: To identify clinical correlates of potentially inappropriate drug-prescribing and the relationship between potentially inappropriate medications and different admission sources among newly admitted nursing home residents.

Methods:

Study Design: Prospective observational cohort study. Population and sampling frame: One hundred and seventy five consecutive residents admitted to two nursing homes (NH) in Central Virginia from July 1, to December 31, 2002

Data Source: Administrative data set compiled on admission to the NH

Measurement and Analysis: Potentially inappropriate medications were identified according to Beers' criteria (1). Data elements (age of resident, gender, total number of medications being taken by residents, presence of inappropriate medications and referral source) were abstracted onto a data template (SPSS). Chi-square tests and one-way ANOVA were used to evaluate the possible associations between potentially inappropriate prescribing, patient factors and referral source.

Results: Potentially inappropriate prescribing is common among newly admitted nursing home residents (32%). A large percentage of potentially inappropriate drug prescribing occur prior to nursing home placement and vary significantly by patient age, admission source and number of medications prescribed

The median age of newly admitted NH residents was 82.5 years (range 42-101)

The mean number of medications prescribed was 12.7 (range 0-30), with 50% of residents taking 12 or more medications.

Taking a higher number of medications ($p=.001$) and age younger than 85 years ($p=0.05$) significantly correlated with potentially inappropriate drug prescribing. Forty one out of one hundred and forty seven patients (27.9%) admitted from the acute hospital were taking potentially inappropriate medications forming the largest source of potentially inappropriate drug prescribing. There was a statistically significant difference in potentially inappropriate prescribing among residents from the various referral sources ($p=.006$). There was also a high proportion of potentially inappropriate medication use in patients admitted from other nursing homes (62.5%) and acute rehabilitation centers (80%). Gender, psychotropic medications use and dementia diagnoses were not associated with potentially inappropriate drug use.

Conclusion: Efforts to reduce potentially inappropriate prescribing in long term care should include initiatives to reduce this in other patient care settings, prior to admission to long term care facilities. A careful review of medications on admission to a nursing facility would also go a long way to reduce potentially inappropriate prescribing. Looking at the total number of medications on admission may also be a good way to screen for potentially inappropriate medications in long term care facilities.

INTRODUCTION

Potentially inappropriate and/or excessive medication use among elderly individuals, particularly long term care residents is of concern to regulators and others in the field of

geriatrics. Nevertheless, explicit criteria have been developed and recently revised, and have been incorporated world wide (1, 2)

The nature and scope of issue is only beginning to be

understood and little is known about whether potentially inappropriate medication use is related to patient factors like age, gender, number of medications and/or referral source (i.e. hospital, assisted living facility, acute rehabilitation center, home or long term care facility). Although standards for drug prescribing do not vary according to whether or not patients reside in a long term care facility (LTC), drug prescribing in this setting is subject to more regulations and oversight than in other care sites including hospitals.

The issue of inappropriate prescribing in the geriatric population is an extremely important one, especially since this subset of the population consumes a large percentage of all prescription medications (over 25%), though it forms only about 12% of the total United States population and continues to grow (12).

Polypharmacy is especially worrisome in the elderly because of an increased risk for adverse drug reactions and has been linked with increased risk of hospitalization and increased utilization of ambulatory services. (13, 20).

There have been a few studies done to identify patient factors that predict potentially inappropriate prescribing in elderly patients in different patient care settings (i.e. ambulatory, residential/assisted living, homebound community dwelling patients) (2,3,4,5). Some of these studies were done in patients in long term care. (6,7,8) Patient and physician specific predictors like the number of medications prescribed, age younger than 85 years and presence of a psychiatric illness have been previously reported to be associated with an increased likelihood of potentially inappropriate drug use.(6,7,8) No study however has compared the rate of potentially inappropriate prescribing between various patient care settings.

The aim of our study is to identify significant correlates (age of patient, gender, total number of medications being taken by patient) associated with potentially inappropriate prescribing in residents newly admitted to the nursing home from different patient care settings (acute hospital care, assisted living facility, rehabilitation center, other long term care facility or ambulatory care) and also to determine if there are significant differences in inappropriate prescribing between the different admission sources

METHODS

STUDY DESIGN

Prospective observational cohort study

POPULATION AND SAMPLING FRAME

All new residents (n = 175) admitted consecutively to two nursing homes (NH) in Central Virginia from July 1, to December 31, 2002 were included in the study.

DATA SOURCE

Data was abstracted from the administrative data sets compiled on admission to the NH. The following information were recorded: patient's age, sex, gender, referring source, diagnosis of dementia and the medications prescribed from the referring source.

MEASUREMENT AND ANALYSIS

For the purposes of this study, potentially inappropriate medications were defined as those medications listed in the study by Beers as potentially inappropriate, independent of diagnosis (Table. 1.) This list has been used in other studies of potentially inappropriate prescribing in the elderly. (3, 5, 6)

(Adapted from Fick DM, Cooper JW, Wade WE et al. Arch intern Med. 2003; 163:2716-2724)

Figure 1

Table 1: Beers Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions

Drug	Concerns	Severity rating (high or low)
Propoxyphene and combination products	Few analgesic advantages over acetaminophen, but has adverse effects similar to narcotic drugs	low
Nonsteroidal anti-inflammatory drugs (especially Indomethacin)	CNS adverse effects	High
Narcotic Analgesia - Pentazocine (Talwin)	CNS adverse effects	High
Muscle relaxants and antispasmodics)	Anticholinergic adverse effects	High
Long acting benzodiazepines	Long half life producing prolonged sedation	High
High doses of short acting benzodiazepines	Increased sensitivity to benzodiazepines in elderly	High
Antiarrhythmic - disopyramide (Norpace and Norpace CR)	Potent negative inotrope, may induce heart failure in elderly	High
Digoxin (dose 0.125 mg/d except when treating atrial arrhythmias)	Decreased renal clearance may lead to increased risk of toxicity	Low
Short acting dipyridamole	Orthostatic hypotension	Low
Oral hypoglycemic - Diabinese	Prolonged	High
Gastrointestinal antispasmodic drugs – dicyclomine, hyoscyamine	Anticholinergic, effectiveness uncertain	High
Anticholinergics and antihistamines	Anticholinergic side effects	High
Diphenhydramine	Confusion, sedation	High

Figure 2

Ergot mesyloids	Not effective in doses studied	Low
Ferrous sulfate >325mg/d	Increased incidence of constipation	Low
All barbiturates (except Phenobarbital) except when used to control seizures	Addictive, more side effects	High

Data elements were abstracted onto a data template and analyzed using statistical software (SPSS). Pearson Chi-square tests were used for categorical variables and one-way ANOVA were used for continuous variables. P value <0.05

was identified as statistically significant.

RESULTS

PATIENT CHARACTERISTICS

During the study period, one hundred and seventy five subjects were admitted to the study facilities, with a mean age of 82.5 years (range 42-101). Among those, 46 (26.3%) were 85 years and older, and 129(73.7%) younger than 85 years. Fifty six percent (56%) of the subjects were females, with seventy seven (44%) males. Of the total number of subjects, 36 (20.6%) had a diagnosis of dementia on admission to the NH and 139(79.4%) did not. (Table 2.)

Figure 3

Table 2: Demographics: Patient Characteristics

Patient Factors	Categories	No. of Subjects (%)	Median (range)
Age	Less than 85	129 (73.7)	
	85 and above	46 (26.3)	
Gender	Female	98 (56.0)	
	Male	77 (44.0)	
Diagnosis of Dementia	present	36(20.6)	
	absent	139(79.4)	
Total		175 (100)	82.5 yrs (42 – 101)

REFERRAL SOURCES

The majority of the subjects 147(84%) in the study were admitted from acute care hospitals. Sixteen (9.1%) were admitted from other nursing homes. Five subjects were admitted from acute rehabilitation centers (2.9% of total) during the period of the study. Five (2.9%) subjects admitted from home and two (1.1%) were admitted from assisted living facilities (Table 3.)

Figure 4

Table 3: Referral Sources of Subjects Newly Admitted to the Nursing Home

Referral Sources	No. of subjects (%)
Acute hospitals	147 (84%)
Other nursing homes	16(9.1%)
Acute rehabilitation centers	5(2.9%)
Home	5(2.9%)
Assisted living facilities	2(1.1%)

POTENTIALLY INAPPROPRIATE MEDICATIONS

The mean number of medications taken was 12.68 (range 0 – 30). 50% of all residents in the study were on 12 or more medications. Fifty six (32%) of all the subjects in the study were prescribed at least one of the potentially inappropriate medications identified in Beers' study and 68% (119) were not on medications considered potentially inappropriate. Only thirty nine (22%) subjects were taking psychotropic medications. These include antipsychotics, antidepressants and anxiolytics. Majority of subjects, 136(77.7) were not.

(Table 4.)

Figure 5

Table 4: Demographics: Inappropriate medications and psychotropic medications

Medications	No. of patients with (%)	No. of patients without (%)
Psychotropic medications	39 (22.3)	136 (77.7)
Beer's list medication	56 (32)	119 (68)

RELATIONSHIP BETWEEN PATIENT FACTORS, OVERALL MEDICATION USE AND POTENTIALLY INAPPROPRIATE DRUGS

Overall medication use was associated with potentially inappropriate medications prescribed. 64% subjects on a potentially inappropriate medication were also taking 12 or more medications. (p <.001)

There was no significant association between taking psychotropic medications and number of medications being taken.

A higher percentage of residents younger than 85 years (43.4%) versus 30.4% of residents older than 85 years were more likely to be taking 12 or more medications (p=.042).

Diagnosis of dementia was not associated with overall increase in medication use. A higher proportion of female subjects (40.8%) compared with males (38.9%) were taking 12 or more medications, but this was not found to be of significance (p=.463). (Table 5.)

Figure 6

Table 5: Relationship between patient factors and overall number of medications used

Patient factors	Subjects taking less than 12 medications (%)	Subjects taking 12 or more medications (%)	P value
Subjects taking Beers' criteria medication (%)	20(35.7)	36(64.3)	<.001
Age 85 and above	32(59.6)	14(30.4)	.042
Age less than 85	73(56.6)	56(43.4)	
Subjects with a Diagnosis of Dementia (%)	26(72.2)	10(27.8)	.067
Subjects taking psychotropic medications (%)	22(56.4)	17(43.6)	.105
Males	47(61.1)	30(38.9)	.463
Females	58(59.2)	40(40.8)	

Potentially inappropriate drug use was not significantly associated with gender, age or diagnosis of dementia. (Table 6.)

Figure 7

Table 6: Relationship between patient factors and inappropriate medications

Patient factors	Subjects taking at least one inappropriate medication (%)	Subjects not taking inappropriate medications (%)	P value
Subjects taking 12 or more medications	36(51.4)	34(48.6)	<.001
Age 85 yrs and above	10(21.7)	36(78.3)	.058
Age less than 85 yrs	46(35.7)	83(64.3)	
Subjects taking psychotropic medications (%)	15(38.5)	24(61.5)	.214
Males	24(31.2)	53(68.8)	.483
Females	32(32.6)	66(67.3)	
Subjects with Diagnosis of Dementia (%)	12(33.3)	24(66.7)	.497

Relationship between the different referral sources, overall medications and potentially inappropriate medications prescribed

There was no statistically significant difference in the number of medications taken between patients admitted from home, acute hospital, assisted living facility, acute rehabilitation facility or other nursing homes, though potentially inappropriate medication use differed significantly when compared across referral sources.(p <.006) (Tables 7 and 8.). This is interesting since the number of medications correlates significantly with potentially inappropriate medications used. This may be due to limited statistical power as very small numbers of patients were admitted from assisted living facility, acute rehabilitation centers and home.

Figure 8

Table 7: Relationship of presence of inappropriate medications and patient referral sources to the nursing home

Referral source	Subjects taking at least one inappropriate medication (%)	Subjects not taking inappropriate medications (%)	P value
Acute inpatient care	41(27.9)	106(72.1)	P= .006
Acute rehab care	4(80)	1(20)	
Assisted living facility	0(0)	2(100)	
Another nursing home	10(62.5)	6(37.5)	
Home	1(20)	4(80)	

Figure 9

Table 8: Relationship of patient referral sources and number of medications prescribed

Referral source	Subjects taking less than 12 medications (%)	Subjects taking 12 or more medications (%)	P value
Acute inpatient care	92(62.6)	55(37.4)	P = .242
Acute rehab care	2 (40.0)	3(60.0)	
Assisted living facility	1 (50)	1(50)	
Another nursing home	6(37.5)	10(62.5)	
Home	4(80.0)	1(20.0)	

DISCUSSION

In a prospective observational study, we found that potentially inappropriate prescribing was common among newly admitted nursing home residents and that potentially inappropriate medication use positively correlated with the total number of medications prescribed.

Studies in geriatric patients in different settings have shown widely varying rates of inappropriate prescribing, from as low as 5% to 21% in the outpatient setting (2, 3, 5, 10, 11), about 16% in assisted living facilities (4), 25.4% in nursing home patients. (6, 7)

In our study, the rate of inappropriate prescribing in residents admitted from outpatient settings was 20%, which is similar to previous studies done (2, 3, 5, 10).

The current regulatory focus on drug prescribing among long term care residents, including mostly consultant pharmacist review involves a system to monitor drug prescribing in residents, weeks to months after admission to the facility. These processes and the regulations that prompted them only apply to long term care facilities (7). This tends to imply that long term care facilities are the source of potentially inappropriate drugs rather than the recipient of potentially inappropriate prescribing initiated elsewhere.

In this study, we found that the largest source of potentially inappropriate drug prescribing was the acute care hospital. This finding would suggest that efforts to reduce potentially inappropriate drug use among long term care residents should extend to reducing inappropriate drug use in other care settings as well as to evaluate drugs prescribed at the time of admission to the facility, rather than up to 30 days later.

Although very few subjects in the study were transferred from other long term care facilities (Other nursing homes and acute inpatient rehabilitation centers), those subjects had a higher proportion of potentially inappropriate drug use, as

well as a somewhat higher number of prescription medications compared to patients admitted from home or the hospital. Thus ongoing review of drug prescribing in long term care facilities is likely to be important as well.

The small number of subjects in our sample however limits our ability to draw further inferences.

In general, attempts at evaluating potentially inappropriate prescribing are limited by the relative lack of information that relates to individual prescribing decisions in individual cases, hence it is difficult to discern the distinction between ‘potentially’ inappropriate and ‘actually’ inappropriate in the absence of documented adverse outcomes.

Moreover, qualitatively compiling lists of drugs that are potentially inappropriate tends to imply that all drugs on the list are equal in their potential for harm. This is unlikely to be the case, unfortunately, no good system currently exists to quantify degree of risk and hence ‘inappropriateness’.

Since taking a high number of medications correlated significantly with inappropriate prescribing, identifying residents who are on a high number of medications on admission to the NH may be a good way to screen for potentially inappropriate medications in LTC facilities. This could also potentially cut down on healthcare utilization and cost and improve health-related quality of life. (14, 15, 17, 18)

For optimal medication prescribing in the geriatric population, multidisciplinary education has also been shown to be of great importance. (19, 20, 21, 22)

CONCLUSION

Potentially inappropriate drug use is common among newly admitted nursing home residents. While the rate may higher among residents admitted from other long term care sites, the largest source of potentially inappropriate prescribing among newly admitted long term care facility residents is the acute care hospital. Thus, we conclude that efforts to reduce potentially inappropriate drug use in long term care facilities must include efforts to identify and reduce potentially inappropriate drug use in acute care hospitals as well.

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