

# RESEARCH AND REPORTS



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## POTENTIALLY INAPPROPRIATE MEDICATIONS ORDERED FOR ELDERLY RESIDENTS OF ASSISTED LIVING HOMES AND ASSISTED LIVING CENTERS

Mark Rhoads

Amy Thai

**Objective:** To determine the number of medications considered potentially inappropriate ordered for residents of assisted living homes and assisted living centers.

**Design:** Retrospective review of medication profiles.

**Patients:** The combined census (N = 588) of residents of 163 assisted living homes and assisted living centers.

**Main Outcome Measures:** Demographic characteristics, prevalence data for medication orders, and potentially inappropriate medication orders, based on the "Beers criteria" and other literature sources.

**Results:** The data demonstrate that potentially inappropriate routine or p.r.n. medication orders, based on the Beers criteria, were in effect during the study period for 28.8% of all residents. Additionally, 76.1% of the residents of assisted living homes and 72.5% of the residents of assisted living centers were female. Furthermore, 73.1% of the residents of the assisted living homes and 78.7% of the residents of the assisted living centers were over 81 years of age.

**Conclusions:** As the average age of the U.S. population continues to increase, more people will use the services offered in assisted living homes and assisted living centers. Use of potentially inappropriate medication, based on the Beers criteria, is high. As drug regimen review is not routinely performed in these types of facilities, monitoring for potentially inappropriate medication use should be performed regularly by consultant pharmacists.

**Key Words:** Assisted living homes, Assisted living centers, Beers criteria, Drug-related problems, Inappropriate medication.

**Abbreviations:** DRP = drug-related problem; ALH = assisted living home; ALC = assisted living center; ALF = assisted living facility; MAR = medication administration record.

Consult Pharm 2002;17:587-93.

### INTRODUCTION

It is projected that as the average age of the U.S. population continues to increase, medication use by the elderly (65 years of age or older) will increase. As more medications are used, a greater risk of drug-related problems (DRPs) exists. Studies have demonstrated that the costs associated with DRPs are significant, and that the risk of such problems is reduced through consultant pharmacist-conducted drug regimen review. In a study published in 1995, Bootman et al. estimated that the costs of drug-related morbidity and mortality in the United States were more than \$76 billion annually.<sup>1</sup> In a subsequent study published in 1997, Bootman et al. determined that consultant pharmacists helped to reduce costs associated with DRPs in nursing facilities by \$3.6 billion annually.<sup>2</sup> In another study, it was found that in one recent year alone, more than 2 million hospitalized U.S. patients experienced serious adverse drug reactions and 106,000 died as a result of these medication effects.<sup>3</sup> A recent study determined that in the United States, the overall cost of drug-related morbidity and mortality was more than \$177 billion in 2000.<sup>4</sup>

Many studies have identified the elderly as being at increased risk for adverse outcomes as the result of DRPs. Certain medications are more likely to increase the risk of DRPs in the elderly. An article by Beers et al. identified certain criteria for determining those medications that create a higher risk for DRPs when used in nursing home residents.<sup>5</sup> Later, Beers updated the defined criteria to include all elderly patients, not just those residing in nursing facilities.<sup>6</sup> In this second study, a severity rating was also established. Subsequent to these studies, the U.S. Centers for Medicare & Medicaid Services (CMS, formerly the U.S. Health Care Financing Administration) revised its

**MARK RHOADS, RPH, FASCP**, is Consultant Pharmacist and Director of Pharmacy, Danny's SunScript Pharmacy, Tucson, Arizona. **AMY THAI, PHARM.D.**, is a year 2002 graduate of the University of Arizona College of Pharmacy, Tucson.

**ADDRESS FOR CORRESPONDENCE:** Mark Rhoads, RPh, SunScript Pharmacy, 5395 E. Erickson Dr., Tucson, AZ 85712; 520-795-4271; fax 520-795-8979 (mark.rhoads@sunh.com).

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Interpretive Guidelines for surveyors in 1999 to include the monitoring of potentially inappropriate medications used to treat residents. These Interpretive Guidelines do not apply to community-based facilities such as assisted living homes (ALHs) and assisted living centers (ALCs). According to state regulations, the inclusive term “assisted living facilities” is subdivided into two defined categories: (1) ALHs, which are licensed for 10 or fewer residents; and (2) ALCs, which are licensed for 11 or more residents. Historically, these two types have had differences in staffing, number of licensed staff present, and services offered. ACHs are generally defined as those facilities with 10 or fewer licensed beds; ALCs are licensed for more than 10 beds. These facilities provide assistance with residents’ activities of daily living. Currently, there are no federal regulations that address monitoring of use of medications considered potentially inappropriate in the community setting.

A literature search revealed limited studies published to date that determine the patterns and occurrence rates of potentially inappropriate medication use in ALHs or ALCs. One study, by Zhan et al., did explore the occurrence rates of inappropriate medication use in elderly persons residing outside of nursing facilities.<sup>7</sup> The data in this study were derived from the 1996 Medical Expenditure Panel Survey. Another study, conducted by Spore et al., evaluated the frequency of inappropriate medication use in board-and-care facilities in 10 U.S. states.<sup>8</sup> The U.S. General Accounting Office (GAO) conducted a survey in 1996 to assess the quality of care, including medication use, in ALFs located in four different states. According to the resultant GAO report, the third most frequently cited problem area in ALFs was medication-related deficiencies and complaints, including failure to provide ALF residents with appropriate

medications.<sup>9</sup> In another study, Armstrong et al. identified that medication usage patterns in ALFs were similar to those in nursing facilities, where more intense care and monitoring is provided.<sup>10</sup> Specifically, the authors found that the mean number of routine medications used in ALFs was greater than that previously identified in either national or regional studies in nursing facilities. The study by Armstrong et al. was limited in that it reviewed medication profiles for orders from a single month in a single metropolitan area pharmacy.

The purpose of the current study was to determine the number of medications considered potentially inappropriate ordered for residents of ALHs and ALCs.

## METHODS

The pharmacy involved in this study is located in a state that recently mandated quarterly medication reviews by a physician, pharmacist, or nurse in all assisted living residences. All ACHs or ALFs receiving at least one prescription medication from this pharmacy were included in the study. Residents in the study lived in a single metropolitan community in the southwestern United States. Using the pharmacy database, patient demographics were collected, and a single month of routine and as-needed (p.r.n.) medication orders were reviewed for potentially inappropriate medications based on the “Beers criteria” (Table 1).<sup>5,6</sup> Each medication was assigned an explanation of the potential problem and potential high or low severity rating.<sup>6</sup> These data were then stratified according to facility type. An independent t-test was used to compare the mean number of medication orders and mean number of potentially inappropriate medication orders per resident. An alpha level of 0.05 was used to determine statistical significance.

**TABLE 1. MEDICATIONS CONSIDERED POTENTIALLY INAPPROPRIATE FOR THE ELDERLY**

Medication	Potential Problem Code	Potential Severity
Amitriptyline	A	High
Barbiturates	B	High
Belladonna alkaloids	A	High
Carisoprodol	A, C	Low
Chlordiazepoxide	D	High
Chlorpropamide	E	High
Chlorzoxazone	A, C	Low
Clindium/chlordiazepoxide	A, D	High
Clonazepam	D	High
Cyclandelate	F	Low
Cyclobenzaprine	A, C	Low
Cyproheptadine	A	Low
Diazepam	D	High
Dicyclomine	A	High
Diphenhydramine	A	Low
Dipyridamole	H	Low
Disopyramide	A	High
Doxepin	A	High
Ergot mesyloids	F	Low
Flurazepam	D	High
Hydroxyzine	A	Low
Hycosyamine	A	High
Indomethacin	G	Low
Isoxsuprine	F	Low
Meperidine (oral)	C	High
Meprobamate	B	High
Metaxalone	A, C	Low
Methocarbamol	A, C	Low
Methyldopa	I	High
Orphenadrine	A, C	Low
Oxybutynin	A	Low
Pentazocine	G	High
Promethazine	A	Low
Propantheline	A	High
Propoxyphene	G	Low
Reserpine	G, H	Low
Ticlopidine	C	High
Trimethobenzamide	F	Low

Potential problem code key: A = anticholinergic side effects; B = addictive; C = minimally effective as compared to other agents, and possibly toxic; D = increases risk of falls and fractures, short half-life benzodiazepines preferred; E = excessive risk of hypoglycemia due to long half-life; F = lack of evidence of effectiveness at doses studied; G = significant central nervous system side effects; H = causes orthostatic hypotension; I = potential bradycardia and/or exacerbation of depression.

Sources: References 5, 6 for all medications except clonazepam (reference 12).

## RESULTS

### DEMOGRAPHICS

Our analysis included a total of 588 residents of 163 different ALHs or ALCs. Of those 588 residents, 395 (67.2%) were living in ALHs licensed for 10 beds, and 193 (32.8%) were living in ALCs with 11 or more licensed beds. The average number of residents reviewed per ALH was 2.8 (range 1–13). The average number of residents reviewed per ALC was 8.0 (range 1–56). There was an overall majority of women living in both the ALHs (76.7%) and ALCs (72.5%). The age of the residents varied greatly (Table 2); however, 73.1% of residents in the ALHs and 78.7% of the residents in ALCs were 81 years of age or older.

### MEDICATION USE

The mean numbers of routine and p.r.n. medication orders per resident were  $7.8 \pm 4.6$  standard deviation (SD) and  $1.9 \pm 1.9$  SD, respectively, for a total mean number of  $9.7 \pm 4.6$  SD orders per resident. Based on facility size, the ALH group had a mean number of  $7.6 \pm 4.5$  SD routine orders and  $1.9 \pm 2.0$  SD p.r.n. orders per resident. The ALC group had a mean number of  $8.3 \pm 4.8$  SD routine orders and  $1.9 \pm 1.8$  SD p.r.n. orders per resident (Table 3). There was a statistically significant difference when comparing the mean average of routine orders per resident in the ALH versus ALC subgroups ( $P = 0.026$ ). There was no significant difference in the mean number of p.r.n. orders per resident in either group.

It was found that 169 (28.8%) of the total number of residents were using one or more medications that are considered potentially inappropriate (Table 4). Of this group, 98 (16.6%) of the residents had one or more routine orders, 60 (10.3%) had one or more p.r.n. orders, and 11 (1.9%)

**TABLE 2. AGE DISTRIBUTION OF STUDY POPULATION, BY FACILITY TYPE**

Age Category	ALH n (%)	ALC n (%)	Total n (%)
66–70	6 (1.5)	5 (2.6)	11 (1.9)
71–75	37 (9.4)	15 (7.8)	52 (8.8)
76–80	48 (12.2)	18 (9.3)	66 (11.2)
81–85	91 (23.0)	41 (21.2)	132 (22.5)
86–90	81 (20.5)	58 (30.1)	140 (23.8)
91–95	81 (20.5)	46 (23.8)	127 (21.6)
96–100	28 (7.1)	1 (0.5)	29 (4.9)
Over 100	8 (2.0)	6 (3.1)	14 (2.4)
Unknown Age	15 (3.8)	3 (1.6)	17 (2.9)
TOTAL	395	193	588

ALH = assisted living home; ALC = assisted living center.

**TABLE 3. MEAN NUMBER OF ALL ROUTINE AND P.R.N. ORDERS PER RESIDENT, BY FACILITY TYPE**

Facility Type	Mean Number of Routine Orders per Resident ( $\pm$ SD)	Mean Number of p.r.n. Orders per Resident ( $\pm$ SD)	Mean Number of All Orders per Resident ( $\pm$ SD)
ALH	7.6 $\pm$ 4.5	1.9 $\pm$ 2	9.4 $\pm$ 4.5
ALC	8.3 $\pm$ 4.8	1.9 $\pm$ 1.8	10.2 $\pm$ 4.9
TOTAL	7.8 $\pm$ 4.6	1.9 $\pm$ 1.9	9.7 $\pm$ 4.6

ALH = assisted living home; ALC = assisted living center.

had a combination of both types of orders. When looking at facility type, as defined by state regulations, 18.7% of ALH residents and 10.1% of ALC residents were prescribed at least one medication considered potentially inappropriate. No resident had more than three orders considered potentially inappropriate. Regarding rate of occurrence, 122 (2.1%) of all routine orders and 79 (1.4%) of all p.r.n. orders were classified as potentially inappropriate.

**INAPPROPRIATE MEDICATION PROBLEM CODE**

Table 5 summarizes the medication orders identified in this study as potentially inappropriate, the potential severity, and the problem code. When looking at all potentially inappropriate medication orders, 122 (60.7%) of the orders were routine and 79 (39.3%) were p.r.n. Of these numbers, 44 (36.1%) of the routine orders had a high potential severity rating, and 78 (63.9%) of the routine orders had a low potential severity rating. Nine (11.4%) of the p.r.n. orders had a high potential severity rating, and 70 (88.6%) of the p.r.n. orders had a low potential severity rating. With regards to the problem code, 142 (70.6%) of all medications considered potentially inappropriate have anticholinergic properties, and 38 (18.9%) have significant central nervous system side effects.

**DISCUSSION**

The results of this study demonstrate that medications generally considered potentially inappropriate for use in the elderly population were ordered for residents living in ALHs or ALCs serviced by one pharmacy. ALHs are typically smaller than ALCs, with fewer licensed beds. In the state in which the facilities are located, ALHs have 10 or fewer licensed beds, and ALCs have more than 10 licensed beds. In both groups, more than 70% of the residents were women, with the majority greater than 81 years of age.

This study identified that 169 (28.8%) of all residents in the ALHs and ALCs had at least one routine or p.r.n. medication order that is considered potentially inappropriate based on the Beers criteria. Additionally, 98 (16.6%) of the residents had one or more routine orders, 60 (10.3%) had one or more p.r.n. orders, and 11 (1.9%) had a combination of both types of orders.

The Beers criteria were originally

**TABLE 4. PROPORTION OF RESIDENTS WITH ONE OR MORE ROUTINE, P.R.N., OR COMBINATION MEDICATION ORDERS CONSIDERED POTENTIALLY INAPPROPRIATE (N = 588)**

Facility Type	Residents with No Inappropriate Orders	Medication Orders Considered Potentially Inappropriate									% of All Residents with One or More Inappropriate Orders
		One Routine	Two Routine	Three Routine	One p.r.n.	Two p.r.n.	Three p.r.n.	One Routine, One p.r.n.	Two Routine, One p.r.n.	One Routine, Two p.r.n.	
ALH	48.4%	9.5%	0.5%	0%	6.6%	0.9%	0%	0.7%	0.2%	0.3%	18.7%
ALC	22.8%	5.6%	0.5%	0.5%	2.6%	0.2%	0%	0.7%	0%	0%	10.1%
TOTAL	71.2%	15.1%	1.0%	0.5%	9.2%	1.1%	0%	1.4%	0.2%	0.3%	28.8%

ALH = assisted living home; ALC = assisted living center.

established in 1991 through a survey that was completed by a panel of nationally recognized experts in psychopharmacology, long-term care, clinical geriatric pharmacology, and related fields. Beers developed these criteria to include two considerations when prescribing to nursing home residents: “(1) individual medications or categories of medications that should be avoided except under unusual clinical circumstances, and (2) doses, frequencies, or durations of medication prescription that generally should not be exceeded.”<sup>5</sup> In the 1997 update of this study, it was suggested that these criteria be considered when prescribing to the elderly population in general.<sup>6</sup>

Since the development of the Beers criteria, studies have evaluated the prevalence, extent, and nature of inappropriate drug use in various settings, ranging from highly regulated health care environments such as nursing facilities to unregulated community dwellings. According to a meta-analysis of eight studies evaluating the potential inappropriateness of drug use based on the Beers criteria or a modified list of drugs drawn

from the Beers criteria, 14%–23.5% of patients evaluated were receiving an inappropriate medication.<sup>11</sup> Furthermore, a recent study published after the completion of that meta-analysis suggested that 21.3% of community-dwelling U.S. elderly were receiving at least one potentially inappropriate medication.<sup>7</sup> Similarly, our study found that the prevalence of potentially inappropriate medications ordered was high (28.8%) among the elderly. Unlike the study by Zhan et al. and the aforementioned meta-analysis, however, our study looked only at ALHs and ALCs.

In our study, the most commonly ordered potentially inappropriate medications, based on the Beers criteria, were those with anticholinergic properties. In the elderly, anticholinergic medications can create mental disturbances such as sedation and mental confusion, increase the risk of falls and associated fractures, and result in cardiovascular adverse reactions such as hypotension and cardiac arrhythmias. These medications also produce ongoing symptoms such as constipation, blurred vision, and difficulty urinating.

**TABLE 5. ORDERS OF POTENTIALLY INAPPROPRIATE MEDICATIONS, SORTED BY PROBLEM CODE**

Inappropriate Medication	Potential Problem Code	Potential Severity	Number of Routine Orders	Number of p.r.n. Orders	Total Number of Orders
Amitriptyline	A	High	15	2	17
Belladonna alkaloids	A	High	0	1	1
Clidinium/ chlordiazepoxide	A	High	0	1	1
Dicyclomine	A	High	0	1	1
Diphenhydramine	A	Low	9	15	24
Doxepin	A	High	14	0	14
Hydroxyzine	A	Low	5	4	9
Hyoscyamine	A	High	6	1	7
Oxybutynin	A	Low	46	3	49
Promethazine	A	Low	3	16	19
Barbiturates	B	High	1	0	1
Carisoprodol	C	Low	0	1	1
Cyclobenzaprine	C	Low	1	0	1
Methocarbamol	C	Low	1	0	1
Ticlopidine	C	High	1	0	1
Clonazepam	D	High	7	2	9
Diazepam	D	High	0	1	1
Dipyridamole	F	Low	5	0	5
Trimethobenzamide	F	Low	0	1	1
Indomethacin	G	Low	1	1	2
Propoxyphene	G	Low	7	29	36
TOTAL (% of all inappropriate orders)			122 (60.7%)	79 (39.3%)	201 (100%)

Potential problem code key: A = anticholinergic side effects; B = addictive; C = minimally effective as compared to other agents, and possibly toxic; D = increases risk of falls and fractures, short half-life benzodiazepines preferred; E = excessive risk of hypoglycemia due to long half-life; F = lack of evidence of effectiveness at doses studied; G = significant central nervous system side effects; H = causes orthostatic hypotension; I = potential bradycardia and/or exacerbation of depression.

Of all medications possessing anticholinergic properties, oxybutynin was the most commonly ordered agent in this study. The second most commonly ordered potentially inappropriate medication was propoxyphene, which is considered no more effective than acetaminophen and has sedative effects that may lead to falls. The relatively long half-life of propoxyphene's active metabolite contributes to the risk of falls associated with the drug's use. Interestingly, oxybutynin and propoxyphene were also identified as the most frequently prescribed potentially inappropriate medications in the aforementioned meta-analysis.<sup>11</sup>

Orders for muscle relaxants such as carisoprodol, cyclobenzaprine, and methocarbamol were also found. These agents may cause central nervous system side effects such as mental confusion and sedation, resulting in an increased risk of falls. Other agents identified included barbiturates, indomethacin, ticlopidine, dipyridamole, and trimethobenzamide.

A previous survey of medication orders focusing on the same geographic area of the United States as our study found that 23.7% of residents of the ALFs reviewed were using nine or more medications.<sup>10</sup> Additionally, the study suggested that even though ALFs are considered "lower-acuity" facilities, ALF residents may be receiving more medications than those residents in "higher-acuity" nursing facilities.<sup>10</sup> The results of this study were limited in that they were based on medication orders in one pharmacy patient profile database and were not derived from doses actually administered.

Routine medication usage reviews by consultant pharmacists in ALHs or ALCs are not mandated in many states. Likewise, consultant pharmacists' medication management services are not routinely provided in the

majority of the ALHs or ALCs served by the single pharmacy provider involved in this study. However, regulations do require a quarterly drug regimen review by a physician, pharmacist, or nurse in the state in which this study was conducted.

There are important limitations to the present study. All data were generated by a large pharmacy provider located in a single metropolitan area of the southwestern United States. Additionally, only routine and p.r.n. medication orders on file at the pharmacy were reviewed. MARs of actual doses administered were not reviewed. Likewise, a medication considered inappropriate in this study may have a legitimate use if other alternatives were considered or unsuccessfully tried, or if the expected benefit(s) of use in an individual patient was deemed to outweigh the risk(s). This information may not be generalizable to other communities or facilities. Drug-disease interactions, dosing, and duration of therapy were not reviewed. Further, it was beyond the scope of this study to determine if negative outcomes and adverse reactions had occurred. As two different types of facilities were compared, specific characteristics of the participating ALHs and ALCs may have influenced the outcomes of the data. While it is true that this study identified rates of potentially inappropriate medication orders for those residing in ALHs

or ALCs, further studies are needed to better delineate rates of occurrence on a more global scale and to determine if facility-specific characteristics influence these rates.

### CONCLUSION

As the mean age of the U.S. population continues to rise, the use of ALH or ALC services will likely increase. Data from this study and previous studies suggests that medication orders and usage rates are significant in such facilities. With the vast numbers of medications prescribed for residents of ALHs and ALCs, the potential for inappropriate medication use and DRPs does exist. Monitoring for potentially inappropriate medication usage and utilization of safer and more effective alternatives can decrease the risk of DRPs. As drug regimen review is not provided in many ALHs and ALCs at this time, the residents of those facilities would benefit from the services of a consultant pharmacist-driven medication usage review. The consultant pharmacist can assist in determining true benefit versus risk and offer alternatives for more appropriate medications to decrease the overall risk of DRPs. The potential for DRPs due to the use of medications considered inappropriate in the elderly population demonstrates the need for consultant pharmacist-driven medication usage review in the ALH and ALC settings.

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