Medication Undertreatment in Assisted Living Settings

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**Background:** Residential care/assisted living (RC/AL) is a rapidly growing, long-term care setting, where medication use has not been carefully examined. We sought to determine the prevalence and predictors of nonprescribing of selected medications whose value in decreasing morbidity has been established in clinical trials.

**Methods:** As part of a survey of a stratified random sample of 193 RC/AL facilities in Florida, Maryland, New Jersey, and North Carolina, data were gathered on 2014 residents 65 years and older. Patient characteristics and diagnoses were recorded based on medical record reviews and in-person patient assessments; all medications administered at least 4 of the previous 7 days were recorded. Data on facility characteristics were obtained by interviewing facility administrators. Bivariate and multivariate logistic regression was performed to identify associations between medication nonprescribing and facility characteristics, physician visitation, and patient age, sex, race, comorbidity, functional dependency, and cognition.

**Results:** Of 328 subjects with congestive heart failure, 204 (62.2%) were not receiving an angiotensin-converting enzyme inhibitor; of 172 subjects with prior myocardial infarction, 60.5% were not receiving aspirin and 76.2% were not receiving β-blockers; of 435 patients with history of stroke, 37.5% were not receiving an anticoagulant or antiplatelet agent; and of 315 patients with osteoporosis, 61.0% were not receiving calcium supplementation and 51.1% were not receiving any treatment for the condition. Resident age, race, sex, comorbidity, cognitive status, and dependency in activities of daily living were rarely associated with nonprescribing; in contrast, facility factors—particularly facility type and the frequency of physician visits—were somewhat more frequently associated with nonprescribing.

**Conclusions:** Undertreatment appears to be prevalent in RC/AL facilities. Since preserving independence is often a primary goal of care in these settings, more attention may need to be paid to the use of treatments that have been shown to reduce long-term morbidity.

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**Geriatric Practitioners** have long been concerned about medication overuse among older persons. High rates of prescription drug use, adverse drug events, and drug interactions have led to this widespread concern. Drug-related problems have been reported to be common among older persons in outpatient,1,2 hospital,3 and long-term care settings.4,5 During the 1990s, much attention focused on “potentially inappropriate” prescribing of drugs whose use was no longer recommended because safer and/or more effective alternatives were available.6,7 Investigators have demonstrated significant rates of “potentially inappropriate” medication use among older persons who lived independently in the community,8 were homebound,9 lived in nursing homes,10 and lived in assisted-living facilities.11 In 2000, “potentially inappropriate medications” were added to nursing home survey criteria.12 All of these efforts have increased the awareness of health care providers, regulators, and consumers to the dangers of medication overuse and misuse in elderly patients.

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During the past few years, however, it has become increasingly clear that medication undertreatment of older persons is a problem of equivalent magnitude to that of overuse.13 Undertreatment occurs when a patient has a problem for which the value of drug therapy is substantiated by the medical literature, does not have a contraindication, and yet fails to be prescribed the indicated medication. Increasing age has been identified as a significant predictor of undertreatment with β-blockers.
Residential care/assisted living (RC/AL) is a setting where medication use among older persons has not been carefully examined or well described. This heterogeneous group of long-term care facilities, regulated largely by the states, has been growing rapidly, to the point that assisted living has been projected to soon house more persons than nursing homes. Twenty years ago, RC/AL facilities primarily served deinstitutionalized mentally ill adults and older persons who were largely independent in activities of daily living; however, these facilities increasingly serve persons who are 80 years and older, have multiple chronic illnesses, are receiving multiple medications, and/or have cognitive impairment. Currently, the facilities serve a distinct niche in the long-term care continuum by providing care and housing to individuals who have a higher prevalence of chronic illness, dementia, and disability than do older persons living in the community, yet who are on average less impaired than nursing home populations.

Residents of RC/AL settings receive on average between 5.1 and 6.1 prescription medications daily, rates that are similar to those observed in skilled nursing facilities. However, RC/AL facilities vary widely in the degree to which medical, nursing, and pharmacy professionals are involved in provision and oversight of care, and overall these facilities employ fewer professionals than nursing homes. Therefore, RC/AL settings are likely to be particularly fertile areas for the occurrence of drug-related problems, including overdose, misuse, and underuse of medications. In a previous report, we examined medication misuse in these facilities and found that 16.0% of patients were receiving potentially inappropriate medications.

This article describes the degree to which undertreatment of common geriatric conditions may exist among a sample of 2014 residents from 193 RC/AL facilities in 4 states. Within this sample, the prevalence of undertreatment for 4 chronic conditions was evaluated. The conditions studied—congestive heart failure (CHF), MI, stroke, and osteoporosis—result in significant morbidity and mortality and have effective therapies available to reduce these risks. Also, resident and facility factors that may be associated with nonscribing of these medications were explored.

Data for these analyses were obtained as part of the Collaborative Studies of Long-Term Care (CS-LTC), a study of 2078 residents of 193 RC/AL facilities in 4 states. The 4 states are Florida, Maryland, New Jersey, and North Carolina; they were selected for study because each has a well-developed RC/AL industry, and they represent a range of regulatory responses to “assisted living.” The study defined RC/AL as any licensed facility that is not a nursing home and provides room and board, 24-hour supervision, and assistance with activities of daily living. Within each state, a representative geographic region was selected, and within that region a stratified random sample of RC/AL facilities was selected, with the 3 facility strata being defined as follows: small homes (<16 beds); new-model facilities (>15 beds, built after January 1987, and having ≥1 feature suggesting the ability to allow residents to age in-place); and traditional facilities (>15 beds and not meeting the new-model definition). To maximize efficiency in enrolling elderly residents, facilities that primarily served persons with mental retardation and/or developmental disabilities were excluded, as were facilities with fewer than 16 beds that housed fewer than 4 persons 65 years and older and facilities with 16 or more beds that housed fewer than 10 residents 65 years and older.

A total of 113 small facilities, 40 new-model facilities, and 40 traditional facilities were enrolled. Among eligible facilities, the overall recruitment rate was 59%. Facilities that did not participate in the study did not differ from participating facilities in age, size, profit/nonprofit status, occupancy rate, affiliation with other long-term care facilities, and the average age, ethnic distribution, and racial composition of their residents. Nonparticipating facilities differed in 4 areas: owners on average worked more hours in the facility; occupancy rates were higher; they had more rate levels; and they housed a slightly less impaired resident population. Within the study facilities, 2078 residents provided consent, enrolled, and completed data collection—665 from small facilities, 765 from new-model facilities, and 648 from traditional facilities. Among eligible residents, the overall recruitment rate was 92%. Resident enrollment and data collection procedures were approved by the institutional review boards of both the University of North Carolina at Chapel Hill and the University of Maryland, Baltimore. Further details about the sample and data collection methods of the CS-LTC are published elsewhere.

On-site data collection was conducted between October 1997 and November 1998 by trained research staff. Questionnaires on the structure and process of care were administered to facility staff, and resident data were gathered by a combination of record review, patient or proxy interview, and direct observation and/or testing. As part of study data collection, diagnoses were abstracted from on-site medical records, and the names of all prescription and nonprescription medications that had been administered at least 4 of the previous 7 days were copied verbatim from the medication administration record.

Data were coded, entered, and cleaned by staff of the Cecil G. Sheps Center for Health Services Research. Drug names were entered into data entry fields, and the lists were cleaned and coded using an existing computer program to correct misspellings and code for recognized drugs using the American Hospital Formulary Service system. Drugs not coded by the program were reviewed by a pharmacy student and geriatrician to determine what medication was represented and to assign a code. Of the residents in the study sample, 64 (3.1%) had data containing one or more medications that could not be coded because of illegibility or misspellings. This article reports on the 2014 residents for whom complete medication data were available.

To study potential undertreatment in this data set, the following medications and conditions were selected based on available evidence and standards of practice at the time of data collection:

- ACE inhibitors in persons with a diagnosis of CHF
- Aspirin in persons with prior MI
- β-Blockers in persons with prior MI
- Aspirin or other anticoagulants in persons with a history of stroke
- Alendronate, risedronate, raloxifene, and/or calcitonin.

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To identify factors associated with nonprescription of a given medication for a given condition, we performed bivariate and multivariate logistic regressions for each diagnosis and drug category, with each analysis restricted to subjects who had the diagnosis of interest and had no contraindications to the medication reported by facility staff. The contraindications that were accounted for in these analyses were chronic renal disease for ACE inhibitors, peptic disease for aspirin, and chronic obstructive pulmonary disease for β-blockers; analyses were limited to these contraindications because other nondiagnosis-based contraindications were not recorded in the study data.

We studied the following facility factors for their possible association with undertreatment: facility type (small facilities were the reference group), location in a rural or urban county, presence of a licensed nurse (registered or practical nurse) on staff, and whether a physician made regular visits at least weekly to the facility. We studied the following resident factors to determine whether they were associated with undertreatment: age (dichotomized at age 85 years), sex, race (white/nonwhite), number of comorbid conditions (from a list of 30 common diagnoses), dependency in 1 or more of 3 activities of daily living (transfer, locomotion, and feeding), and cognitive status using the Minimum Data Set Cognition Scale. Each multivariate odds ratio was adjusted for all other resident and facility characteristics being considered (age, sex, race, comorbidity, dependency in activities of daily living, cognitive impairment, facility type, rural/urban location, presence of a registered or licensed practical nurse, and/or frequency of physician visits). Although there are inferential issues regarding the large number of statistical tests involved, because of the exploratory nature of this study, we chose not to make multiple comparison adjustments.

### RESULTS

Table 1 displays characteristics of the 2014 RC/AL residents in the study sample and of the facilities in which they resided. Approximately one half were cognitively impaired. By design, study participants were relatively evenly distributed across the 3 subtypes of RC/AL facilities sampled. Most subjects were elderly, female, and white. Multiple chronic conditions were common, but most residents were independent in transfer, ambulation, and feeding. Among the facilities studied, approximately one third did not have a nurse on staff, and approximately two thirds did not report physician visits at least once a week. Most subjects (83.9%) were in urban counties.

| Characteristic                              | No. (%)
|---------------------------------------------|--------
| Age, y                                      |        |
| 65-84                                       | 966 (48.0) |
| ≥85                                         | 1048 (52.0) |
| Sex                                         |        |
| Male                                        | 489 (24.3) |
| Female                                      | 1526 (75.7) |
| Race                                        |        |
| White, non-Hispanic                         | 1832 (91.0) |
| Other                                       | 182 (9.0) |
| No. of chronic conditions                   |        |
| 0-3                                         | 1085 (54.0) |
| ≥4                                          | 926 (46.0) |
| Dependency in transfer, locomotion, and/or feeding | |
| 0 Dependent                                 | 1555 (79.0) |
| 1-2 Dependent                               | 316 (16.0) |
| 3 Dependent                                 | 98 (5.0) |
| Cognitive status*                           |        |
| Intact (0-1)                                | 909 (46.3) |
| Mild/moderate impairment (2-4)              | 567 (28.9) |
| Severe (≥5)                                 | 487 (24.8) |
| Characteristics of the RC/AL facilities in which the study participants resided† |       |
| Facility type                               |        |
| <16 beds                                    | 632 (31.4) |
| Large, traditional                          | 634 (31.5) |
| Large, new model                            | 749 (37.2) |
| Location                                    |        |
| Urban                                       | 1691 (83.9) |
| Rural                                       | 324 (16.1) |
| Presence of licensed nurse on facility staff‡ |        |
| Yes                                         | 1101 (68.1) |
| No                                          | 515 (31.9) |
| Weekly physician visits                     |        |
| Yes                                         | 661 (33.4) |
| No                                          | 1321 (66.6) |

*Evaluated using the Minimum Data Set Cognition Scale.
†The facilities in this study consisted of a stratified random sample of 113 small (<16 beds), 40 traditional, and 40 new-model facilities in 4 states.
‡Licensed nurse indicates registered or licensed practical nurse.

Table 1. Characteristics of the Study Participants and Facilities

Among the resident factors, age and race were not significant predictors in any of the multivariate models. Among subjects with CHF, severe cognitive impairment was associated with nonreceipt of an ACE inhibitor (adjusted P=.01). Among subjects with a history of MI, none of the resident factors studied was significantly associated with aspirin nonuse, but having fewer chronic conditions was associated with nonreceipt of a β-blocker (adjusted P=.04). Among persons with a history of stroke, none of the resident factors studied was associated with nonuse of a platelet inhibitor or warfarin. Among persons with a diagnosis of osteoporosis, male sex was associated with nonreceipt of calcium supplementation (adjusted P=.046) and other active treatments (ie, men with osteoporosis tended not to be treated) (adjusted P=.05).

Some associations were noted between facility characteristics and prescribing patterns (Table 3). Residents of rural facilities were more likely to receive aspirin (adjusted P=.02) and β-blockers (adjusted P=.03). Weekly physician visits were protective against underprescribing of ACE inhibitors for CHF (adjusted P=.02). Neither facility type nor the presence/absence of licensed nursing staff was associated in multivariate models with nonprescribing of the medications of interest.
Despite strong scientific evidence supporting the effectiveness of certain medications in preventing disease progression, preserving function, and reducing mortality, older persons who would likely benefit often do not receive them. This study demonstrates that older persons residing in RC/AL facilities have high rates of undertreatment, adding to existing reports from community, hospital, and nursing home settings. Among 328 RC/AL residents with CHF, 62.2% were not receiving an ACE inhibitor; of 172 persons with a history of MI, 60.5% were not receiving aspirin, and 76.2% were not receiving a β-blocker; of 435 persons with a history of stroke, 37.5% were not receiving any anticoagulant or antiplatelet agent; and of 315 with an established diagnosis of osteoporosis, 51.1% were not receiving treatment. Furthermore, the observed pattern of nonprescribing was not explained by age, race, or functional status of the residents. This gap in translating evidence-based medical treatment into practice may have a considerable adverse impact on the health of older persons.

While the rates of nonprescribing demonstrated in this study seem high, it should be noted that the ranges observed are similar to those detected in community studies. For example, the prevalence of ACE inhibitor nonprescribing in this sample (62.2%) is slightly below the reported range of 64% to 90% among community-dwelling patients with CHF. Similarly, the observed rate of nonuse of β-blockers in persons with prior MI (76.2%) is remarkably similar to the 73% rate found among older patients with prior MI or coronary artery disease in an academic hospital-based primary care geriatric practice, and the findings in this study are consistent with current literature regarding the undertreatment of osteoporosis in both men and women.

Residential care/assisted-living facilities are assuming an increasingly large role in the housing of impaired older persons. Approximately two thirds of RC/AL residents are older than 75 years; most have impairment in 1 or more activities of daily living; more than 40% have high blood pressure and arthritis; and between 20% and 40% (depending on facility type) have chronic heart disease, a recent fracture, mental or psychiatric illness, and/or dementia. However, three quarters can feed themselves, transfer independently, and locomote independently around the facility or unit, making RC/AL residents intermediate in functional dependency between community-dwelling elderly and nursing home residents. Thus, RC/AL facilities provide a setting with a particularly high concentration of older persons who may benefit from appropriate pharmacotherapy to prevent illness progression and additional loss of function. Given these results, efforts seem warranted to increase the rate of prescribing within RC/AL facilities medications that have proven benefit.

The fact that hospital-based studies have demonstrated higher rates of adherence to prescribing guidelines suggests that improvement is achievable. Hospital-based studies have, for example, identified far higher prescribing rates for aspirin and β-blockers after MI and for aspirin and warfarin in patients who have had a stroke. These differences are likely the result of a combination of factors, one of which is targeted efforts in some hospitalized settings to increase adherence to treatment guidelines.

Educational efforts aimed at RC/AL settings could benefit from knowledge of the factors that promote and impair optimal prescribing. The present study provides some clues. Among these, the association between regular physician visits and lower rates of nonprescribing is particularly intriguing and deserves further study, hav-
ing not been previously described in the long-term care literature, to our knowledge. While this association was statistically significant in only one of the multivariate models (ACE inhibitors and CHF), every one of the models demonstrated a trend toward regular physician visits being associated with higher prescribing rates. A similar but less pronounced, nonsignificant trend can be noted between the presence of a licensed nurse and prescribing of recommended drugs (Table 3). These trends would suggest that better physician oversight and possibly intensified physician involvement in these settings could be to institute organized quality assurance activities, like those now common in hospitals and group practice settings; another approach to increasing pharmacists may improved outcomes.

One approach to increasing professional involvement in these settings could be to institute organized quality assurance activities, like those now common in hospitals and group practice settings; another might be to mandate more intensified physician oversight of RC/AL patients.

The other consistent trend observed across diagnoses and drugs studied is the association between high levels of cognitive impairment and nonprescribing (Table 3). Again, the relationship reached statistical significance in only one of the models (ACE inhibitors and CHF); however, all multivariate models studied had positive odds ratios, and one other (β-blockers after MI) approached statistical significance (adjusted $P = .08$). The nonprescribing of medication and other treatments to persons with cognitive impairment has been demonstrated in contexts ranging from pain control to health screening. Such a pattern may be reasonable for those RC/AL residents receiving palliative care for late-stage dementia. However, decisions to withhold medication in persons with dementia must take into account potential benefits in quality of life and reduction of disease progression. This is especially true in the case of ACE inhibitors and other antihypertensive medications, which have been demonstrated to inhibit dementia progression in older persons with systolic hypertension.

Other factors undoubtedly contribute to prescribing decisions beyond those studied in these analyses, and the lack of inclusion of some key potential factors in the data set is a limitation of this study. Previous reports in hospital and community settings have identified physician subspecialty and disease severity to be significant predictors of prescribing. Perhaps more important in explaining medical decisions are factors that affect individual prescribing decisions and yet are often not captured by broad epidemiological studies. Such factors include cost of the medications, concern about the potential for adverse effects, unique patient and family preferences, suspicion that the evidence supporting recommendations may some day be overturned, and the need to set therapeutic

### Table 3. Relationship Between Resident and Facility Characteristics and Nonprescribing*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Resident</th>
<th>Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥85 y</td>
<td>Bivariate</td>
<td>Multi-variate</td>
</tr>
<tr>
<td>Male sex</td>
<td>1.22</td>
<td>1.30</td>
</tr>
<tr>
<td>White race</td>
<td>1.15</td>
<td>1.23</td>
</tr>
<tr>
<td>Chronic conditions ≥4</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Dependency in transfer nutrition, and/or eating</td>
<td>2.03†</td>
<td>1.66</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>3.65†</td>
<td>3.05†</td>
</tr>
</tbody>
</table>

*Results of bivariate and multivariate analyses (logistic regressions). Data are given as odds ratio for nonprescribing. Each analysis excluded persons who had a known contraindication to the drug being evaluated. Multivariate odds ratios were adjusted for all the other resident and facility characteristics included in the table.

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and the results in need of confirmation and further study. Finally, no data were gathered on the physicians who prescribed these medications, and therefore the study was unable to explore physician-specific prescribing patterns that might inform future interventions.

**CONCLUSIONS**

This study found that most older persons residing in RC/AL facilities who have chronic conditions do not receive medications for which strong evidence of favorable impact on morbidity, function, and mortality exists. Given the growing prominence of RC/AL in the care of older persons nationwide, additional studies in these settings are recommended to better understand the extent and causes of the observed patterns of undertreatment. To the extent that underprescribing represents a failure of dissemination of research results into practice, efforts should be encouraged to improve these rates through education and the fostering of system changes (eg, Medicare payment for prescription drugs) that may facilitate guideline compliance.

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**REFERENCES**


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