Original Investigation | LESS IS MORE

Use of Medications of Questionable Benefit in Advanced Dementia

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IMPORTANCE Advanced dementia is characterized by severe cognitive impairment and complete functional dependence. Patients' goals of care should guide the prescribing of medication during such terminal illness. Medications that do not promote the primary goal of care should be minimized.

OBJECTIVES To estimate the prevalence of medications with questionable benefit used by nursing home residents with advanced dementia, identify resident- and facility-level characteristics associated with such use, and estimate associated medication expenditures.

DESIGN, SETTING, AND PARTICIPANTS Cross-sectional study of medication use by nursing home residents with advanced dementia using a nationwide long-term care pharmacy database linked to the Minimum Data Set (460 facilities) between October 1, 2009, and September 30, 2010.

MAIN OUTCOMES AND MEASURES Use of medication deemed of questionable benefit in advanced dementia based on previously published criteria and mean 90-day expenditures attributable to these medications per resident. Generalized estimating equations using the logit link function were used to identify resident- and facility-related factors independently associated with the likelihood of receiving medications of questionable benefit after accounting for clustering within nursing homes.

RESULTS Of 5406 nursing home residents with advanced dementia, 2911 (53.9%) received at least 1 medication with questionable benefit (range, 44.7% in the Mid-Atlantic census region to 65.0% in the West South Central census region). Cholinesterase inhibitors (36.4%), memantine hydrochloride (25.2%), and lipid-lowering agents (22.4%) were the most commonly prescribed. In adjusted analyses, having eating problems (adjusted odds ratio [AOR], 0.68; 95% CI, 0.59-0.78), a feeding tube (AOR, 0.58; 95% CI, 0.48-0.70), or a do-not-resuscitate order (AOR, 0.65; 95% CI, 0.57-0.75), and enrolling in hospice (AOR, 0.69; 95% CI, 0.58-0.82) lowered the likelihood of receiving these medications. High facility-level use of feeding tubes increased the likelihood of receiving these medications (AOR, 1.45; 95% CI, 1.12-1.87). The mean (SD) 90-day expenditure for medications with questionable benefit was $816 ($553), accounting for 35.2% of the total average 90-day medication expenditures for residents with advanced dementia who were prescribed these medications.

CONCLUSIONS AND RELEVANCE Most nursing home residents with advanced dementia receive medications with questionable benefit that incur substantial associated costs.

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Invited Commentary

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Advanced dementia is a terminal illness characterized by severe cognitive (eg, no longer recognizes family members) and functional impairment, inability to ambulate independently (ie, bedridden), and minimal verbal ability (speech fewer than 5 words).[1] Nursing home residents with advanced dementia also have frequent problems with dysphagia and aspiration, yet most receive an average of 5 to 15 medications daily.[2-4] Furthermore, prior studies[1,5] report that more than 90% of proxies of nursing home residents with advanced dementia state that their goal of care is comfort. For patients with life-limiting illness, the Institute of Medicine recommends that clinical care professionals minimize interventions that are senseless and burdensome and instead focus on interventions to optimize quality of life.[6]

To address this issue for patients with advanced dementia, a panel of expert geriatricians and palliative medicine physicians defined a list of medications that are of questionable benefit when the patient's goal of care is comfort (eg, statins and cytotoxic chemotherapy).[7,8] Investigators from the panel reported that 29% of their patients enrolled in palliative care were prescribed at least 1 of these medications,[7] and a prior nursing home cohort study[2] showed that 38% of residents with advanced dementia were prescribed 1 of these medications.

Few studies examine the patterns of chronic disease medication use in advanced dementia[2,3,9,10] or terminal illness,[4] and none address the costs associated with such use. Most prior studies[2-4,9] were small and drew from geographically limited populations or focused on medications for a single indication.[10] We sought to characterize the use and costs of questionably beneficial medications for residents with advanced dementia using data from more than half of the nursing homes in the United States.[11]

Methods

Data Source

The institutional review board of the University of Massachusetts Medical School exempted this study from review and patient consent was not required. Data for this cross-sectional study were collected from the prescription-dispensing database of a national long-term care pharmacy that operates in 47 states. The pharmacy serves approximately half of the 1.3 million residents of long-term care facilities in the United States (14 511 facilities).[11] These pharmacy data cover a geographic distribution similar to the 2006 Centers for Medicare & Medicaid Services Online Survey Certification and Reporting[12] data (Northeast, 24% vs 23%; Midwest, 36% vs 29%; South, 28% vs 34%; and West, 11% vs 14%). Pharmacy data elements include facility identification number, state, unique resident identifiers, resident demographic data (sex, age, facility enrollment date), and National Drug Code for all dispensed drugs.

Study Sample

To identify the study sample, we used a subset of the aforementioned prescription-dispensing database which linked to resident-level assessments from the Minimum Data Set (MDS) 2.0.[13] This subset comprises residents living in facilities with enhanced service contracts to process MDS records and represents approximately 10% of the residents in the pharmacy database (111 165 residents in 460 facilities). The regional distribution of this 10% sample is similar to the distribution in the entire pharmacy database, and the linked prescription-dispensing MDS database has been used in prior articles[10,11,14,15] about prescribing patterns among nursing home residents.

The MDS is a standardized, clinically based, resident instrument that is mandated for use in all federally funded US nursing homes. It includes information on the demographic, functional, medical, psychological, and cognitive statuses of residents.[13,16] Full MDS assessments are conducted on all residents at the time of nursing home admission, after each year of residence, and whenever there is a significant change in clinical status.

To construct the study sample, we identified residents with prescription medication files and a full MDS assessment conducted between October 1, 2009, and September 30, 2010 (n = 92 336) and used the first full MDS during that time to limit the sample to residents 65 years or older (n = 78 580) with a diagnosis of advanced dementia (n = 7537). Advanced dementia was defined in previous research by a cognitive performance score of 5 or 6 and an MDS diagnosis of dementia (Alzheimer or other).[17,18] A cognitive performance score of 5 corresponds with a mean Mini-Mental State Examination score of 5.1, and a cognitive performance score of 6 with a mean Mini-Mental State Examination score of 0.4. We excluded residents with a length of stay less than 90 days because these residents differ significantly from long-stay residents with respect to burden of illness and functional status (n = 1550).[19] We also excluded residents living in facilities with fewer than 5 eligible residents (n = 259) because estimates of facility-level measures from small facilities would be unreliable. We used listwise deletion to remove 322 observations with missing data, resulting in a final analytic sample of 5406 residents.

Medication Use

We defined medications of questionable benefit as medications deemed "never appropriate" for use in advanced dementia, according to a previously published list[7] developed using a Delphi consensus process that was designed to apply to adults with dementia and a palliative orientation to care. While the panel also defined medications deemed "sometimes appropriate" and "always appropriate" for use by patients with advanced dementia, we did not include the "sometimes appropriate" list in order to increase the specificity of the definition of questionable benefit. The drugs in our analysis included cholinesterase inhibitors, memantine hydrochloride, antiplatelets agents (except aspirin), lipid-lowering agents, sex hormones, hormone antagonists, leukotriene inhibitors, cytotoxic chemotherapy, and immunomodulators. We determined whether any of these medications were dispensed to eligible residents during the 90-day period after their first full MDS assessment in the study period.

Resident Characteristics

Resident characteristics that were potentially associated with medication use[2,3,20] were ascertained from the residents' full

MDS assessments, including age; sex; race or ethnicity; a do-not-resuscitate (DNR) order; hospice enrollment; whether Medicaid was the primary payor; residence in a dementia special care unit; hospitalization in the past 90 days; having had a physician visit in the past 14 days; diagnosis of diabetes mellitus, heart failure, hypertension, stroke, osteoporosis, or depression; nutritional problems (≥25% of meals uneaten, complaints of hunger, or complaints of taste); oral problems (defined as chewing problems, swallowing problems, or mouth pain); presence of a feeding tube; behavioral problems identified using the Behavioral Index (range, 0-2, with higher scores indicating more severe behaviors)[21,22]; and functional status based on the sum of the activities of daily living scores. Scores for activities of daily living are obtained by summing the resident's self-performance ratings on the MDS for the following 7 functional activities: bed mobility, dressing, toileting, transfer, eating, grooming, and locomotion. In the MDS, functional ability is rated on a 5-point scale for each activity (0 indicates independent; 1, supervision; 2, limited assistance; 3, extensive assistance; and 4, total dependence). A total score of 28 represents complete functional dependence. Scores were dichotomized at 28 vs less than 28 because this value represents complete functional dependence and represented the 75th percentile in the distribution of activities of daily living scores in a prior study of nursing home residents with advanced dementia.[23] Race and ethnicity were categorized as black, non-Hispanic, Hispanic, other (including American Indian or Alaskan Native and Asian Pacific Islander), and white.

Facility Characteristics

The MDS portion of the linked database was used to create several facility-level variables based on aggregated characteristics of all residents in nursing homes with 5 or more residents (ie, not just the study sample; n = 98 849). These variables included the presence of a special care unit for dementia, the proportion of residents with DNR orders (grouped as terciles: ≤33%, 33.1%-66%, and >66%), the proportion of residents with advance directives (defined as documentation in the medical record of a living will or any feeding, treatment, or medication restrictions in the MDS, grouped as terciles: ≤33%, 33.1%-66%, and >66%), and the proportion of residents with feeding tubes (grouped as ≤5%, 5.1%-10%, and >10%, based on the distribution across facilities). The pharmacy-dispensing data were used to describe other facility-level variables, including location (geographic census region), size (dichotomized at 100 beds), and the proportion of residents prescribed an antipsychotic medication (including all typical and atypical antipsychotics).

Statistical Analysis

The dependent variable was whether a resident with advanced dementia received at least 1 questionably beneficial medication. The resident was the unit of analysis. The independent variables included resident characteristics and facility variables. Descriptive statistics were used to present the proportion of patients prescribed a questionably beneficial medication. The unadjusted and adjusted associations between each independent variable and the use of questionably beneficial medications were estimated using generalized estimating equations with a logit link function to account for clustering at the level of the nursing home. Variables with $P < .20$ in unadjusted analysis were included in the multivariable analysis, with statistical significance set at $P < .05$. Unadjusted and adjusted odds ratios and 95% CIs were generated from these analyses.

To estimate medication expenditures, we used National Drug Codes to link to 2010 Red Book Average Wholesale Prices[24] to identify the average prices charged to wholesalers before rebates or discounts. We deflated these prices by 10% to approximate Medicaid payment rates.[25] For each resident, we calculated 90-day expenditures for all medications and the study medications. We used STATA, version 10.0, software (StataCorp) to conduct all statistical analyses

Results

Study Sample

Of the 5406 residents who met eligibility criteria, more than half were aged 85 years or older, and most were female and white (**Table 1**). Comorbid conditions were common, with many residents having diabetes (28.5%), hypertension (70.4%), and/or depression (46.7%); 74.3% had oral problems and 71.3% had a Behavioral Index score greater than 0 (indicating the presence of behavioral problems). Overall, 13.4% lived in a special dementia care unit and 69.9% had a DNR order.

Medication Use

A total of 2911 (53.9%) residents with advanced dementia were prescribed at least 1 questionably beneficial medication during the 90-day observation period. Use of at least 1 questionably beneficial medication varies by age, sex, race or ethnicity, activity of daily living score, presence of diabetes or hypertension, and hospice enrollment (Table 1). We also observed geographic variation in use ranging from 44.7% by residents in the Mid-Atlantic census region to 65.0% in residents of the West South Central census region (**Table 2**). **Table 3** lists the medications in order of prevalence. The most common questionably beneficial medications used were cholinesterase inhibitors (36.4%), memantine hydrochloride (25.2%), and lipid-lowering agents (22.4%).

Factors Associated With Questionably Beneficial Medication Use

Adjusted analysis identified several modifiable resident and facility characteristics that were independently associated with the outcome. Residents with oral problems (adjusted odds ratio [AOR], 0.68; 95% CI, 0.59-0.78), a feeding tube (AOR, 0.58; 95% CI, 0.48-0.70), a DNR order (AOR, 0.65; 95% CI, 0.57-0.75), and who were enrolled in hospice (AOR, 0.69; 95% CI, 0.58-0.82) had a lower likelihood of being prescribed a questionably beneficial medication (**Figure 1**). Residing in a facility with a high prevalence of feeding tubes (>10% of facility residents) was associated with a greater likelihood of being given questionably beneficial medications (AOR, 1.45; 95% CI, 1.12-1.87) compared with residents in nursing homes where the

Table 1. Resident Characteristics of 5406 Nursing Home Residents With Advanced Dementia Using Questionably Beneficial Medications in 2009-2010

Characteristic	Residents, No. (%)	
	Advanced Dementia	Receiving Questionably Beneficial Medications
Age, y		
65-74	597 (11.0)	367/597 (61.5)
75-84	2044 (37.8)	1191/2044 (58.3)
≥85	2765 (51.2)	1353/2765 (48.9)
Sex		
Male	1166 (21.6)	720/1166 (61.8)
Female	4240 (78.4)	2191/4240 (51.7)
Medicaid beneficiary		
Yes	4034 (74.6)	2162/4034 (53.6)
No	1372 (25.4)	749/1372 (54.6)
Race/ethnicity		
Other[a]	160 (3.0)	80/160 (50.0)
Black, not Hispanic	781 (14.5)	413/781 (52.9)
Hispanic	515 (9.5)	351/515 (68.2)
White, not Hispanic	3950 (73.1)	2067/3950 (52.3)
Activities of daily living score[b]		
28	1727 (32.0)	754/1727 (43.6)
<28	3679 (68.0)	2157/3679 (58.6)
Diabetes mellitus		
Yes	1540 (28.5)	913/1540 (59.3)
No	3866 (71.5)	1998/3866 (51.7)
Heart failure		
Yes	871 (16.1)	484/871 (55.6)
No	4535 (83.9)	2552/4535 (56.3)
Hypertension		
Yes	3803 (70.4)	2146/3803 (56.4)
No	1603 (29.6)	765/1603 (47.7)
Stroke		
Yes	1174 (21.7)	640/1174 (54.5)
No	4232 (78.3)	2271/4232 (53.7)
Osteoporosis		
Yes	1354 (25.0)	682/1354 (50.4)
No	4052 (75.0)	2229/4052 (55.0)
Depression		
Yes	2526 (46.7)	1472/2526 (58.3)
No	2880 (53.3)	1439/2880 (50.0)
Nutritional problems		
Yes	2113 (39.1)	1107/2113 (53.4)
No	3292 (60.9)	1804/3292 (54.8)
Oral problems		
Yes	4014 (74.3)	2021/4014 (50.4)
No	1392 (25.7)	890/1392 (63.9)
Feeding tube		
Yes	830 (15.4)	391/830 (47.1)
No	4576 (85.6)	2520/4576 (55.1)
Behavioral Index score		
1-2	3853 (71.3)	1993/3853 (51.7)
0	1553 (28.7)	918/1553 (59.1)
Resides in special care unit		
Yes	726 (13.4)	446/726 (61.4)
No	4680 (86.6)	2465/4680 (52.7)
Hospitalization in past 90 days		
Yes	1211 (22.4)	759/1211 (62.7)
No	4195 (77.6)	2152/4195 (51.3)
Physician visits in last 14 days		
≥1	2487 (46.0)	1270/2487 (51.1)
None	2919 (54.0)	1641/2919 (56.2)
Do-not-resuscitate order		
Yes	3777 (69.9)	1871/3777 (49.5)
No	1629 (30.1)	1040/1629 (63.8)
Hospice care		
Yes	691 (12.8)	303/691 (43.9)
No	4715 (87.2)	2608/4715 (55.3)

[a] Other includes American Indian, Alaskan Native, and Asian Pacific Islander.

[b] Calculation of the activities of daily living score is explained in the Resident Characteristics subsection of the Methods section.

prevalence of feeding tubes was 0% to 5% (**Figure 2**). Other factors, such as residing in a facility located in the Pacific (AOR, 1.70; 95% CI, 1.19-2.45), West South Central (AOR, 1.83; 95% CI, 1.31-2.57), and East South Central (AOR, 2.00; 95% CI, 1.17-3.43) census regions, were also associated with greater questionable medication use relative to the Mid-Atlantic region, which had the lowest level of use.

Medication Expenditures

On the basis of the discounted average wholesale price of medications, the 90-day mean (SD) spending for all medications was $1815 ($1384) (interquartile range [IQR], $795-$2514) among all residents, including those who did and did not use questionable medications. Of only those residents who used at least 1 questionably beneficial medication, the mean (SD) 90-day drug expenditure was higher ($2317 [$1357]; IQR, $1377-$2968), of which 35.2% was attributable to medications of questionable benefit (mean [SD], $816 [$553]; IQR, $404-$1188).

Discussion

This nationwide study demonstrates that more than half of long-term nursing home residents with advanced dementia use at least 1 questionably beneficial medication. For such residents, questionably beneficial medications account for more than one-third of their medication expenditures. Lower use

Table 2. Facility Characteristics of 5406 Nursing Home Residents With Advanced Dementia Using Questionably Beneficial Medications in 2009-2010

Characteristic	Residents, No. (%)	
	Advanced Dementia	Receiving Questionably Beneficial Medications
Unit with >100 beds		
Yes	4986 (92.2)	2693/4986 (54.0)
No	420 (7.8)	218/420 (51.9)
Residents receiving antipsychotics, %		
Highest tercile, >20%	1904 (35.2)	1072/1904 (56.4)
Second tercile, 15.1% to ≤20%	1971 (36.5)	1092/1971 (55.4)
Lowest tercile, 0% to ≤15%	1531 (28.3)	745/1531 (48.7)
Residents with feeding tubes, %		
Highest tercile, >10%	1924 (35.6)	1132/1924 (58.8)
Second tercile, 5.1% to ≤10%	1706 (31.6)	908/1706 (53.2)
Lowest tercile, 0% to ≤5%	1776 (32.8)	871/1776 (49.0)
Residents with do-not-resuscitate order, %		
Highest tercile, >66%	2032 (37.6)	1007/2015 (50.0)
Second tercile, 33.1% to ≤66%	1765 (32.6)	972/1759 (55.3)
Lowest tercile, 0% to ≤33%	1609 (29.8)	932/1632 (57.1)
Residents with advance directives, %[a]		
Highest tercile, >66%	1953 (36.0)	958/1953 (59.1)
Second tercile, 33.1% to ≤66%	1770 (32.7)	1000/1770 (56.5)
Lowest tercile, 0% to ≤33%	1683 (31.3)	953/1683 (56.6)
Dementia special care unit		
Yes	2911 (53.9)	1174/2176 (54.0)
No	2495 (46.2)	1737/3230 (53.8)
Census region		
East North Central	996 (18.4)	518/996 (52.1)
East South Central	130 (2.4)	80/130 (61.5)
Mid-Atlantic	591 (10.9)	264/591 (44.7)
Mountain	452 (8.4)	208/452 (46.0)
New England	300 (5.6)	143/300 (47.7)
Pacific	598 (11.1)	318/598 (53.2)
West North Central	202 (3.7)	101/202 (50.0)
West South Central	1191 (22.0)	774/1191 (65.0)
South Atlantic	946 (17.5)	505/946 (53.4)

[a] Defined as documentation in the medical record of a living will, or any feeding, treatment, or medication restrictions in the Minimum Data Set.

of questionably beneficial medications was found among residents with advance directives who were enrolled in the hospice setting.

Our current estimate of questionably beneficial medication use (59%) is higher than a prior estimate[2] of 38% in a sample of 323 nursing home residents with advanced dementia drawn from 22 Boston-area nursing homes, and higher than the reported 29% among 34 residents in a Chicago-area palliative care program.[7] These discrepancies may be explained by temporal and geographic differences, as well as differences in prescribing practices between these prior studies and the more regionally diverse nursing homes in the present study.[2,7] However, all 3 of these studies taken together, along with the likely underestimation of use in this study based on limiting our definition of questionably beneficial medications to the "never use" category of medications from the panel's list,[7] suggest that the burden of questionably beneficial medication use is high among this terminally ill population whose goal of care is comfort.[1,5]

Despite standards of care that call for minimizing interventions that are unnecessary or provide little benefit in order to focus on interventions that optimize quality of life,[6] polypharmacy remains common in this population.[2-4] Several factors suggest that polypharmacy in this population should be minimized. First, swallowing and eating difficulties make giving medication burdensome and difficult for the residents and the nursing home staff.[26] Second, adverse drug effects (ADEs) are common in patients with dementia,[27-30] yet ADEs are difficult to detect by clinicians because these patients have difficulty expressing the symptoms they feel.[31,32] Third, this population has frequent clinical complications associated with a high risk of 6-month mortality, and the time to benefit from many medications exceeds this life expectancy.

The most common questionably beneficial medications used in this cohort of residents with advanced dementia were cholinesterase inhibitors and memantine hydrochloride. Typically prescribed during earlier stages of dementia, a major goal of using these medications is delaying institutional placement.[33] However, the clinical value of these medications, even in early-stage disease, has also recently come into question by the US Preventive Services Task Force.[34] While use in late-stage dementia is common, even in the hospice setting where most hospice medical directors believe that antidementia medications are ineffective,[35] clinical trial data show minimal cognitive and functional benefits for advanced disease.[36-38] While proponents of continued antidementia medication use argue that discontinuation leads to cognitive and behavioral declines,[39-41] data are inconclusive. One clinical trial[39] of a sample of patients with moderate to severe dementia, but not end-stage disease as defined in our study, reported only minimal declines following discontinuation and no quality-of-life or psychological benefits to caregivers with medication continuation. Furthermore, continued use of antidementia medication without benefit places patients at excess risk of well-known ADEs, including syncope, hip fracture, arrhythmia,[42] and urinary retention.[43] One national study[27] showed that antidementia medications were the drugs most often implicated in ADEs in patients with dementia, accounting for almost one-third of all ADEs.

Table 3. Prevalence of Questionably Beneficial Medication Use Among 5406 Nursing Home Residents With Advanced Dementia During First 90 Days of Observation, 2009

Drug Class	No. (%)
Cholinesterase inhibitor	1966 (36.4)
Memantine hydrochloride	1362 (25.2)
Lipid-lowering agent	1213 (22.4)
Antiplatelet agent[a]	389 (7.2)
Hormone antagonist	62 (1.1)
Leukotriene inhibitor	61 (1.1)
Sex hormone	65 (1.2)
Cytotoxic chemotherapy	29 (0.5)
Immunomodulator	4 (0.007)

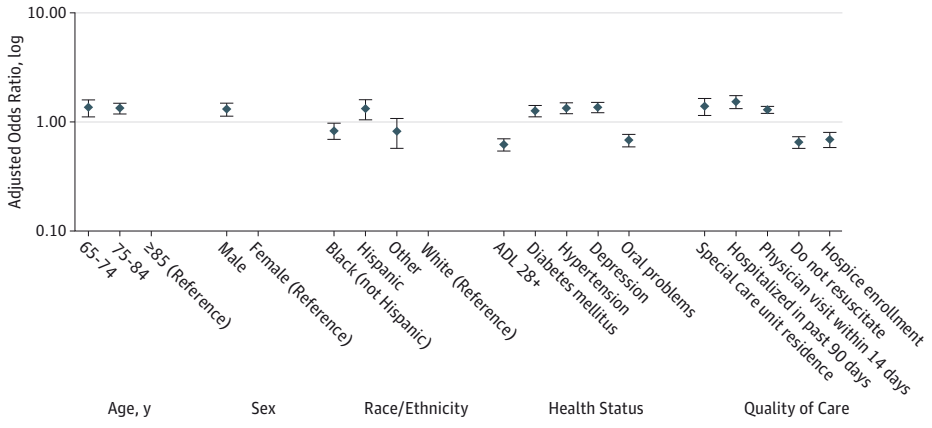
[a] Excluding aspirin.

Less controversial, but also commonly prescribed in this study, were statins. Once generally considered safe, concerns about statins for older adults have escalated. A recent study[44] describes statin-induced myopathy occurring more frequently than previously believed and approaching 20% in some populations. In addition, the Food and Drug Administration changed statin labeling to highlight risks of associated memory loss and confusion, as well as increases in blood glucose levels and risk of type 2 diabetes mellitus.[45] The accumulating evidence of risk in frail older adults should prompt thoughtful reconsideration of statin use in the face of the daily medication burden of many residents with advanced dementia.

Interestingly, we found that having oral problems or a feeding tube were associated with a lower likelihood of questionable medication use, while residing in a facility with high feeding tube use increased the risk of questionable medication use. Because the prevalence of eating and feeding problems in the population with advanced dementia is high and associated with medication administration difficulties,[1,26] the finding of decreased questionable medication use in these clinical circumstances provide some reassurance that medication prescribing practices correlate with the resident's clinical state. More concerning, however, is the finding that residing in a facility with high feeding tube use is associated with greater questionable medication use. This finding is analogous to and consistent with the reported finding that residing in a nursing facility with high levels of antipsychotic use is an independent risk factor for antipsychotic use by residents, regardless of other clinical indications.[14]

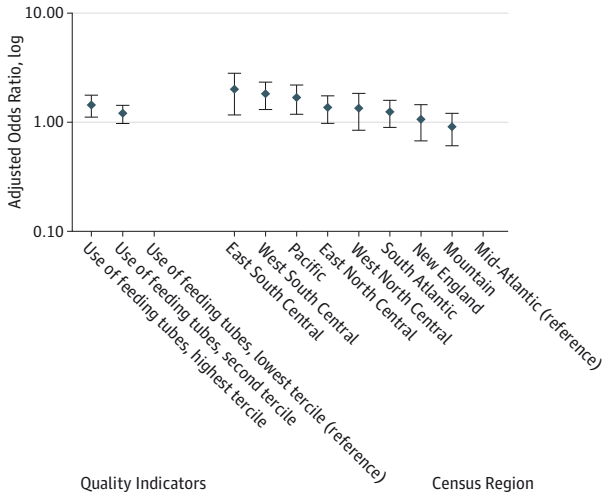
Important modifiable factors at the resident level that were associated with lower use of questionably beneficial medication included the presence of DNR orders and hospice enrollment, while recent hospitalization was associated with greater questionably beneficial medication use. These findings highlight the importance of careful medication review in residents with advanced dementia, particularly in the context of discussions about the risks and benefits of rehospitalization and the role of DNR orders and hospice. While it can be diffi-

Figure 1. Resident-Level Risk Factors and Receipt of Questionably Beneficial Medications



Adjusted odds ratios for resident-level factors associated with questionably beneficial medication use among nursing home residents with advanced dementia. Odds ratios were estimated with a generalized estimating equation and a logit link function. Bars represent 95% CIs. ADL indicates activities of daily living.

Figure 2. Facility-Level Risk Factors and Receipt of Questionably Beneficial Medications



Adjusted odds ratios for facility-level factors associated with questionably beneficial medication use among nursing home residents with advanced dementia. Odds ratios were estimated with a generalized estimating equation and a logit link function. Bars represent 95% CIs.

cult for family decision-makers to discontinue medications that treat the chronic diseases of their loved ones as they transition toward comfort care, minimizing questionably beneficial interventions is an important therapeutic option consistent with recommendations by the Institute of Medicine about care quality at the end of life.[6] As such, it is an important option for clinicians, families, and patients to consider.

We did not observe a facility-level association with residing in a facility with a dementia special care unit, greater number of beds, or a higher proportion of residents with a DNR order. We did observe evidence of geographic variation in medication prescribing patterns that suggests the presence of discretionary prescribing. This finding is similar to other studies that report geographic variation in end-of-life care, including burdensome transitions,[46] feeding tube use,[47] discontinuation of dialysis,[48] and spending.[49] Research is needed to understand the multiple factors that contribute to the observed regional variation in rates of questionable medication use.

This study has several limitations. First, in this cross-sectional study, we were unable to determine causality between resident and facility-level variables and the outcome of questionable medication use. Second, we were unable to measure facility market characteristics, quality, or staff time and composition; these may affect questionable medication use. Third, the sample was limited to a single pharmacy provider. While previous studies[10,11] have found that this sample is comparable with the US nursing home sample distribution of age, sex, and geography, this may limit the generalizability of our findings. Fourth, the use of discounted average wholesale price to calculate costs may overestimate annual medication costs because pharmacies obtain medications at negotiated discount prices. This limitation mainly affects interpretation of the magnitude of expenditures per patient but has little effect on the proportion of cost attributable to questionably beneficial medications because the misspecification nondifferentially applies to both the numerator and denominator. Fifth, while we report AORs resulting from the generalized estimating equation analysis, we recognize that these may inflate the effect of the risk factors because the outcome is common. Finally, we used a single explicit criteria[7] to define the outcome measurement, specific to the terminally ill population of study. While these criteria were based on the expert opinion of national leaders in palliative care, further study is necessary to validate and update the criteria for determining medication appropriateness in this population. Furthermore, while there are other well-accepted definitions and criteria, such as the Beers list,[50] these are not specific to prescribing in situations of limited life expectancy and are therefore not applicable to our analysis.

Conclusions

Our findings have important implications because the use of prescription medications in patients with advanced illness presents a burden to the health care system and to patients.[51] At an economic level, the use of questionably beneficial medications accounts for a significant proportion of the average resident's annual medication expenditure. Medications, which have long been recognized as an important target for improvement from the perspective of federal regulators, were estimated to cost nearly $3.5 billion for long-term care in 2001.[52] While no recent estimates of nursing home medication expenditures are currently available, overall nursing home costs are rising almost 8% per year[53] and represent a serious concern to state and federal policy makers. Our findings have important implications at the policy level, and show that little progress has been made with respect to meeting the intent of the F329 section of the Nursing Home Reform Act, which calls for all nursing home residents to be free of unnecessary medications.[54] While recent efforts such as the Choosing Wisely campaign (http://www.choosingwisely.org) have focused attention on improving the informed decision making of health care professionals and consumers regarding many common health care decisions, nursing home residents with advanced dementia need further efforts on their behalf to address how to reduce the use of unnecessary medications and medications that fail to align with the resident's goals of care.

ARTICLE INFORMATION

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Study concept and design: Tjia, Briesacher, Liu, Mitchell.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Tjia, Liu, Mitchell.
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