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Pharmacotherapeutic Management of Dementia Across Settings of Care

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Abstract

Objectives—To describe population-based use of cognitive-enhancing and psychopharmacological medications across care settings among Medicare beneficiaries with dementia.

Design—One-year (2008) cross-sectional study

Setting—Medicare administrative claims from a 5% random sample

Participants—52,754 Medicare beneficiaries with dementia aged ≥ 65 years with continuous Medicare Parts A, B, and D coverage and alive throughout 2008. To ascertain dementia, 1 medical claim with a dementia ICD-9-CM code was required prior to 2008 and an additional claim was required in 2008 to confirm active disease.

Measurements—Use of medications commonly prescribed in managing dementia (cognitive enhancers, antidepressants, antipsychotics, and mood stabilizers) was assessed using three separate measures: 1) Annual prevalence of use; 2) Consistency of use; 3) Count of psychopharmacological medication classes. Care setting was determined using the number of months of nursing home (NH) residency: no-NH (zero months), partial-NH (1–11 months), and full-NH (12 months).

Results—Community-dwellers represented 41.3% of the cohort, while 42.4% and 16.3% resided partially and fully in a NH, respectively. Annual prevalence of use was 57.1% for cognitive enhancers, 56.4% for antidepressants, 34.0% for antipsychotics, and 8.8% for mood stabilizers. Cognitive enhancer use was significantly lower among those with any NH-stay [adjusted-

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prevalence-ratio (99% CI) partial-NH vs. no-NH 0.84 (0.83–0.86); full-NH versus no-NH 0.83 (0.81–0.85)]. In contrast, those with any NH residence had significantly higher use for all psychopharmacological medication classes compared with community-dwellers. Over half the cohort had consistent medication regimens during 2008 (64.8%). The number of psychopharmacological medication classes used increased with increasing NH-stay duration.

Conclusion—This population-based study documents significant differences in medication use for managing dementia across care settings and substantial use of psychopharmacological medications among older adults with dementia.

Keywords

Alzheimer's disease; dementia; psychopharmacological medications; care setting; nursing home

INTRODUCTION

Given the increasing prominence of Alzheimer's Disease and related dementias (ADRD) as a public health problem, the National Alzheimer's Project Act (NAPA) has the objectives of forming an integrated national plan to improve early detection techniques, provide disease management and discover effective new treatments for ADRD.¹ Substantial progress in diagnostic techniques and the identification of meaningful biomarkers has resulted in newly published criteria and guidelines for identifying and classifying ADRD. However, less progress has been made in finding effective new treatments for ADRD.^{2,3} Acetylcholine esterase inhibitors (donepezil, rivastigmine, galantamine) and memantine, an N-Methyl-D-Aspartate receptor antagonist, are used to delay cognitive, behavioral and functional loss in ADRD patients across varying stages of disease.^{4,5} While statistically significant differences in cognition have been achieved in placebo-controlled clinical trials using these medications across mild, moderate and more severe stages of ADRD,^{4,6–8} achieving clinically meaningful differences with the use of these agents in practice has been limited.⁹ In addition to these "cognitive enhancers", ADRD patients also are likely to receive psychopharmacological drugs such as antidepressants, antipsychotics, sedative-hypnotics, and anticonvulsants for the management of behavioral and psychological symptoms associated with ADRD.^{10–13}

Despite controversy regarding their effectiveness and safety, use of cognitive enhancers and psychopharmacological medications to treat ADRD symptoms is wide spread.^{4,14–17} Most classes of psychopharmacological medications are associated with an increased risk of falls.¹⁸ Further, acetylcholinesterase inhibitors, antidepressants and antipsychotics have been associated with syncope,¹⁹ increased risk of hip fracture,²⁰ increased mortality,^{21–24} and poorer cognition,²⁵ respectively. Moreover, polypharmacy due to use of multiple classes of these medications that are used to manage ADRD can lead to adverse effects and increased mortality.^{26,27} Adverse effects related to the use of these medications are observed in more than 50% of the patients with dementia and lead to increased length of hospitalizations.^{14,28} Studies focused on identifying variations in antipsychotic prescribing²⁹ and discontinuation rates of cognitive enhancers,³⁰ particularly in long term care settings, highlight the dilemma clinicians currently face in managing ADRD symptoms as the disease progresses.

Objectives of this study

To inform the potential policy effects of NAPA and clinical practice, it is important to benchmark pharmacologic drug use in ADRD patients at a national level. Documenting patterns of use and changes in utilization of these medications across care settings is a necessary step toward identifying patient populations likely to realize the greatest benefit and least harm from medications used to treat ADRD and its symptoms. In this paper, we

describe population-based annual prevalence for cognitive-enhancing and psychopharmacological medication classes during 2008 in a nationally representative sample of Medicare beneficiaries with ADRD across the continuum of community and nursing home settings.

METHODS

Data Source and Study Sample

Using a one-year (2008) cross-sectional design, we identified a cohort of Medicare beneficiaries with ADRD from the Chronic Condition Warehouse (CCW) database, provided by the Centers for Medicare & Medicaid Services for research purposes.³¹ The CCW contains Medicare administrative claims data from a 5% random sample of Medicare beneficiaries and includes 27 predefined chronic condition cohorts, including ADRD.³²

Beneficiaries with evidence of ADRD were identified based on meeting both of the following criteria: 1) the CCW algorithm for Alzheimer's Disease and Related Disorders or Senile Dementia (ADRD), defined as at least one inpatient, skilled nursing facility, home health agency, hospital outpatient, or carrier (physician) claim with a dementia diagnosis code [International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes: 331.0, 331.1x, 331.2, 331.7, 290.0, 290.1x, 290.2x, 290.3, 290.4x, 294.0, 294.1x, 294.8, 797] anytime between 1/1/1999 and 12/31/2007;^{31,32} and 2) to confirm the presence of active disease during the study period, we also required that beneficiaries have at least one claim with an ADRD diagnosis code between 1/1/2008 and 12/31/2008. Of note, those with only a mild cognitive impairment diagnosis code (ICD-9-CM 331.83) were not included in the study sample.

The study sample included beneficiaries aged ≥ 65 years (as of 1/1/2008) with continuous enrollment in fee-for-service coverage for Medicare Parts A, B, and D prescription drug plan (PDP) between 10/1/2007 and 12/31/2008. We excluded individuals with any enrollment in Medicare Advantage (MA) plans during the study period as beneficiary claims pertaining to their Medicare Part A and B coverage were not available. We also excluded individuals who died prior to 1/1/2009.

This study was approved by the University of Maryland Baltimore Institutional Review Board.

Measures

Dependent Variables

Cognitive Enhancer and Psychopharmacological Medication Use: Medications commonly prescribed to treat and manage cognitive and behavioral ADRD symptoms were identified using Medicare prescription drug (Part D) event records. Medications were categorized into the following four broad medication classes: cognitive enhancers [acetylcholinesterase inhibitors (donepezil, rivastigmine, and galantamine) and memantine]; antidepressants (selective-serotonin reuptake inhibitors, serotonin/norepinephrine reuptake inhibitors, trazodone, tricyclics, mirtazapine, bupropion, monoamine oxidase inhibitors); antipsychotics (typical and atypical antipsychotics); and selected anticonvulsants or mood stabilizers (valproic acid, carbamazepine, and oxcarbazepine). Use of sedative-hypnotic medications, such as benzodiazepines, was not examined as these agents were not covered under Medicare Part D plans during the study period.

We created three different measures of medication use throughout 2008: annual prevalence, consistency of use and a count of psychopharmacological medications used. The first

measure, annual prevalence of medication use, was based on presence of at least one prescription claim for a medication within each class during the one-year study period. The estimated annual medication prevalence of use is reported separately for each medication class.

The second measure, consistency of cognitive enhancer and psychopharmacological medication use, was based on quarterly use patterns of all four medication classes. We captured combinations of these medications during each three-month calendar period (January–March; April–June; July–September; October–December). ADRD beneficiaries with repeating patterns in all four quarters (i.e., the beneficiary's medication pattern did not change throughout the year, including consistent non-use of any of these medications) were considered to have consistent medication use (or non-use) throughout 2008.

The third measure was a count of psychopharmacological medication classes used throughout the year, calculated among ADRD beneficiaries who had consistent medication use (including consistent non-use) of the selected medication classes throughout 2008. This count ranged from 0 (no psychopharmacological medication use throughout the year) to 3 (consistent use of antidepressants, antipsychotics and mood-stabilizers throughout the year).

Independent Variables

Care Setting—Nursing home residence was based on the number of months each beneficiary resided in a nursing home (NH) during the one-year study period and was determined using an algorithm based on the Healthcare Common Procedure Coding System (HCPCS) modified from published literature.^{33,34} This measure was operationalized as a categorical variable: no nursing home (zero months in a NH), partial nursing home (1–11 months in a NH) and full nursing home (12 months in a NH). In sensitivity analyses, significant differences in medication utilization were observed while comparing individuals with no NH stay and full NH stay to individuals with 1–3 months and 9–11 months of NH stay, respectively. Further those with partial NH stay were essentially equally distributed across the entire range possible for partial NH stay (1 to 11 months). Consequently, we decided to take the conservative approach of collapsing individuals with evidence of nursing home stays in at least 1 and up to 11 months into a single separate group.

Sociodemographic Characteristics—Sociodemographic characteristics examined in the study included age as of January 1, 2008, sex, race/ethnicity (black, white, Hispanic, Asian, other) and geographic region (South, West, Midwest, Northeast). As proxies for socioeconomic status, we included dual (Medicaid) eligibility status and low-income subsidy (LIS) status.

Comorbidity—General health indicators included evidence of specific comorbid conditions and the Charlson-Comorbidity Index (CCI) to capture the number of comorbid conditions during the study period, excluding dementia.^{35,36} We used the chronic condition indicators provided by CCW or we created indicators based upon ICD-9-CM codes in 2008 claims, depending upon availability of CCW indicators and algorithms based upon published literature. We also included a variable describing a beneficiary's original reason for entitlement to control for disability status.

Since three of the four medication classes we examined are indicated for psychiatric comorbidities, we defined depression, anxiety, and other psychiatric disorders (schizophrenia and other psychoses, bipolar disorder, mood disorder) using specific ICD-9-CM diagnosis codes. Specific definitions and algorithms for each of the comorbid conditions are included in the Appendix.

Statistical Analyses

Univariable and bivariable analyses were used to describe ADRD cohort characteristics and medication use. Bivariable analyses were used to examine the unadjusted relationship between care setting and ADRD medication use.

Multivariable models using generalized estimating equations were used to estimate the adjusted relationships between ADRD medication use and nursing home residence. We used a modified Poisson regression model (Poisson distribution with a log link) to allow estimation of prevalence ratios of ADRD medication use and nursing home residence, rather than prevalence odds ratios.³⁷ Prevalence ratios (PR) of ADRD medication use with 99% confidence intervals are reported.

Among ADRD beneficiaries with a consistent pattern of psychopharmacological medication use in each quarter (i.e., beneficiaries whose medication use did not change throughout the year, including consistent non-use of any of these medications), we examined the number of psychopharmacological medication classes received (ranging from 0 to 3) by care setting using Poisson regression while controlling for cognitive enhancer medication use and covariates. For the Poisson regression models, we report the adjusted differences in the count of psychopharmacological medications. All analyses were performed using SAS^R, version 9.2 (SAS Institute, Inc., Cary, NC).

RESULTS

Cohort Characteristics

A total of 395,131 Medicare beneficiaries met our definition of ADRD; of these, 52,754 met the study inclusion and exclusion criteria. The mean [$\pm$ standard deviation (SD)] age of the cohort was 83.3 ($\pm$ 7.4) years and 79.1% were female (Table 1). Over 80% of beneficiaries in our sample were white and over 60% were receiving low income subsidy (LIS) for their Part D benefit. Over half (51.7%) of the cohort had at least two comorbid conditions, with the most common comorbidities being ischemic heart disease (46.0%), chronic heart failure (37.4%), diabetes (34.2%), osteoporosis (22.0%), and chronic kidney disease (21.9%). Among the study cohort, 41.3% resided the entire year in the community setting, 42.4% resided in both the community and in a nursing home facility (1–11 months) settings, and the remaining 16.3% resided full-time in a nursing home facility (12 months) throughout 2008. There were higher proportions of females and those aged $\geq$ 85 years among those with any nursing home residence compared to those who resided solely in the community setting. Additionally, a higher proportion of black beneficiaries resided full time in the nursing home compared to other care settings. Beneficiaries who had any residence in a nursing home setting (partial or full) were more likely to be LIS-eligible and have more comorbidities compared with beneficiaries who resided in the community setting throughout 2008 (Table 1).

Medication Use

The majority (84.7%) of the cohort received at least one of the four studied medication classes in 2008 (Table 2). Annual drug class prevalence was 57.1% for cognitive enhancers, 56.4% for antidepressants, 34.0% for antipsychotics and 8.8% for mood stabilizers. Annual drug class prevalence among the cohort varied by care setting; beneficiaries residing solely in the community had significantly higher prevalence of cognitive enhancer use compared to all others (65.9% versus 51.7% partial NH versus 48.7% full NH; $p < 0.001$), while beneficiaries residing full time in the nursing home setting had significantly higher prevalence of use of psychopharmacological medications (antidepressants: 65.6% versus 46.5% no NH versus 62.6% partial NH, $p < 0.001$; antipsychotics: 45.2% versus 24.0% no

NH versus 39.2% partial NH, $p < 0.001$; mood stabilizers: 15.1% versus 4.1% no NH versus 10.9% partial NH, $p < 0.001$).

Multivariable models of medication use by care setting adjusted for covariates as previously described are summarized in Table 3. In adjusted models, prevalence ratios (PRs) demonstrated lower use of cognitive enhancers for ADRD beneficiaries who had any NH stay compared to community-dwelling beneficiaries (adjusted-PR, partial NH stay versus no NH stay 0.84, 99% CI 0.83–0.86; adjusted-PR, full NH stay versus no NH stay 0.83, 99% CI 0.81–0.85). In contrast, adjusted models showed significantly higher adjusted-PRs for all three classes of psychopharmacological medications (antidepressants, antipsychotics, mood stabilizers) comparing ADRD beneficiaries with any NH stay to community-dwelling ADRD beneficiaries, with the greatest effect size seen for mood stabilizers (Table 3).

Consistency of cognitive enhancer and psychopharmacological medication use

We found that 34,161 (64.8%) ADRD beneficiaries had consistent medication regimens over the four quarters of 2008. Of these, 8,052 (23.6%) ADRD beneficiaries used none of the four medication classes of interest in any quarter in 2008. More than half (57.3%) of the 34,161 ADRD beneficiaries with consistent medication regimens used one or more psychopharmacological medication classes consistently throughout the year and 19.1% received only a cognitive enhancer without any psychopharmacological medication use consistently throughout 2008.

Counts of Psychopharmacological Medication Use by Setting

The adjusted count of psychopharmacological medication use (antidepressants, antipsychotics, and mood-stabilizers) among ADRD beneficiaries with consistent medication regimens throughout 2008 by care setting was modeled controlling for age, sex, race, region of residence, LIS status, original reason for Medicare entitlement, CCI, and cognitive enhancer use. The number of psychopharmacological medication classes increased with increasing duration of nursing home stay (Table 4). For example, an 80 year old community-dwelling woman of white race with two comorbid conditions would receive medications from 1.65 psychopharmacological classes. A woman with these same characteristics with partial nursing home residence or full time nursing home residence would receive medications from 2.47 or 2.80 psychopharmacological classes, respectively.

DISCUSSION

In our study, we found significant differences in the use of cognitive enhancers and psychopharmacological medications in Medicare beneficiaries with ADRD across care settings. Cognitive enhancer use was highest among those residing in the community setting while psychopharmacological medication use was highest among those residing full-time in the nursing home setting. Moreover, the number of different classes of psychopharmacological medications used concurrently during the year was significantly higher among Medicare beneficiaries with ADRD residing in nursing homes compared with community dwellers. These findings for psychopharmacological medication use are consistent with previous studies.^{10,38,39} In contrast, our findings regarding the use of cognitive enhancers across care setting differ from those previously observed, where use of cognitive enhancers was lower overall (24.7% –26.3%) and did not vary with care setting among Medicare beneficiaries in 2002.¹⁰ This previous study was conducted using 2002 Medicare data, prior to the implementation of Medicare prescription drug coverage (Part D). Therefore, it is not unexpected that access to and use of cognitive enhancers would vary from what we have observed in our study.¹⁰

Further, the benefit of cognitive enhancers has been demonstrated in many clinical trials, which were conducted among dementia patients with mild to severe cognitive impairment and across settings of care.^{5-7,9} A recent systematic review of clinical trials of cognitive enhancers has noted that while statistically significant benefits are achieved with cognitive enhancer use, they may not universally translate to clinically meaningful benefits for ADRD patients.⁴ The decrease we observed in use of cognitive enhancers in full time NH residents compared with community residents is consistent with a recent study in which an approximately 50% discontinuation rate of cognitive enhancers was observed three months post-NH admission in newly admitted dementia patients.³⁰ As well, our finding of decreased cognitive enhancer use in NH settings compared with community dwelling patients is in line with the finding that a higher level of cognitive impairment (where the effectiveness of cognitive enhancers is more limited) is a predictor of nursing home placement for ADRD patients.⁴⁰

The prevalence of psychopharmacological medication use was high and higher than several prior studies. For example, among the community-dwelling participants in this sample 46.5% were taking antidepressants and 24.5% taking antipsychotics, considerably more than the 24.8% taking antidepressants and 4.3% taking antipsychotics in the Cache County Dementia Progression Study⁴¹ or the 29.1% taking antidepressants and 19.1% taking antipsychotics in ADAMS.³⁸ Similarly, among the full-time nursing home residents in this sample 65.6% were taking antidepressants and 45.2% were taking antipsychotics; there were no recent comparable data for antidepressant use but this rate of antipsychotic use was higher than the 35.9% observed in a comparable cohort of Medicare beneficiaries sampled in 2002,²² or 40% observed in a comparable cohort in 2002.¹⁰ It appears that the prevalence of psychopharmacologic medication use in Medicare beneficiaries may be increasing, perhaps as a result of improved access due to Medicare Part D coverage or to increasing perception of the need for these medications among prescribing physicians. Whatever the cause, this trend is of concern due to mixed evidence on efficacy,¹⁴ evidence of mortality from antipsychotic prescribing,²⁴ and recent report⁴¹ of associations with poorer cognitive, functional, and neuropsychiatric outcomes.

Study limitations include those commonly associated with administrative data such as the limitations of information available in this data, including potential measurement and ascertainment errors. Furthermore, medication use and patterns of use were determined using prescription fill and refill patterns; information on actual medication ingestion is not available in administrative data. Nevertheless, medication use and patterns of use as determined using prescription refill patterns has been previously proven to be a valid measure of medication use.⁴²⁻⁴⁴ Additionally, while several common comorbid conditions are well controlled in this study, we did not account for the presence of other indications such as pain, fibromyalgia, seizure/convulsions with regards to psychopharmacological medication use, in particular the use of antidepressants and mood stabilizers. Finally, although we obtained our ADRD study sample from a 5% random sample of Medicare beneficiaries; findings may not be generalizable to all Medicare patients with ADRD due to study exclusion criteria associated with Medicare plan coverage.

Our study has notable strengths. Specifically, our study was conducted using a large nationally representative sample of older adults with probable, prevalent ADRD, given the presence of an ICD-9-CM code on a claim(s) prior to 2008 and the additional requirement of a claim in 2008 with an ADRD diagnosis indicating active management of ADRD. The entire study sample of Medicare beneficiaries had consistent Medicare Part D medication coverage and as such the information on drug use and patterns of drug use by beneficiaries is of interest to clinicians and decision-makers alike. Additionally, prescribing patterns were unlikely to be distorted by changes in insurance coverage during the study period.

Our study adds to the literature by documenting existing differences in use and patterns of treatment with common medication classes used in ADRD symptom management across the continuum of residence settings in the “real-world”. To our knowledge, this is the first study to explore patterns of psychopharmacological medication use across care settings in an older Medicare population with ADRD following the implementation of Medicare Part D prescription drug coverage. Moreover, our study documents both differences in use among ADRD patients across community and nursing home settings as well as the substantial use of psychopharmacological medications overall, many of which are known to be hazardous in older adults with ADRD.^{21,23,24,27,45–50} Documenting population-based medication prevalence is the first step in quantifying the risks and benefits of ADRD symptom treatment and management with currently available medications and provides a basis for evaluating the comparative effectiveness of emerging therapies and changes in treatment practices.

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References

1. US Department of Health & Human Services. [Accessed April, 30, 2012] National Alzheimer's Project Act. <http://aspe.hhs.gov/daltcp/napa/>
2. McKhann GM, Knopman DS, Chertkow H, et al. The diagnosis of dementia due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimers Dement*. 2011; 7:263–269. [PubMed: 21514250]
3. Sperling RA, Aisen PS, Beckett LA, et al. Toward defining the preclinical stages of Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimers Dement*. 2011; 7:280–292. [PubMed: 21514248]
4. Raina P, Santaguida P, Ismaila A, et al. Effectiveness of cholinesterase inhibitors and memantine for treating dementia: Evidence review for a clinical practice guideline. *Ann Intern Med*. 2008; 148:379–397. [PubMed: 18316756]
5. Reisberg B, Doody R, Stoffer A, et al. Memantine in moderate-to-severe Alzheimer's disease. *New Engl J Med*. 2003; 348:1333–1341. [PubMed: 12672860]
6. Black SE, Doody R, Li H, et al. Donepezil preserves cognition and global function in patients with severe Alzheimer disease. *Neurology*. 2007; 69:459–469. [PubMed: 17664405]
7. Feldman H, Gauthier S, Hecker J, et al. A 24-week, randomized, double-blind study of donepezil in moderate to severe Alzheimer's disease. *Neurology*. 2001; 57:613–620. [PubMed: 11524468]
8. Winblad B. Severe Alzheimer's disease: benefits of donepezil therapy. *Int Psychogeriatr*. 2006; 18:S25–S31.
9. Qaseem A, Snow V, Cross JT, et al. Current Pharmacologic treatment of dementia: A clinical practice guideline from the American College of Physicians and the American Academy of Family Physicians. *Ann Intern Med*. 2008; 148:370–8. [PubMed: 18316755]
10. Gruber-Baldini AL, Stuart B, Zuckerman IH, et al. Treatment of dementia in community-dwelling and institutionalized medicare beneficiaries. *J Am Geriatr Soc*. 2007; 55:1508–1516. [PubMed: 17727648]
11. Kamble P, Chen H, Sherer JT, et al. Use of antipsychotics among elderly nursing home residents with dementia in the us an analysis of national survey data. *Drug Aging*. 2009; 26:483–492.
12. Margallo-Lana M, Swann A, O'Brien J, et al. Prevalence and pharmacological management of behavioural and psychological symptoms amongst dementia sufferers living in care environments. *Int J Geriatr Psych*. 2001; 16:39–44.

13. Steinberg M, Shao H, Zandi P, et al. Point and 5-year period prevalence of neuropsychiatric symptoms in dementia: The Cache County Study. *Int J Geriatr Psych*. 2008; 23:170–177.
14. Sink KM, Holden KF, Yaffe K. Pharmacological treatment of neuropsychiatric symptoms of dementia: A review of the evidence. *JAMA*. 2005; 293:596–608. [PubMed: 15687315]
15. Drye LT, Martin BK, Frangakis CE, et al. Do treatment effects vary among differing baseline depression criteria in depression in Alzheimer's disease study +/- 2 (DIADS-2)? *Int J Geriatr Psych*. 2011; 26:573–583.
16. Rosenberg PB, Drye LT, Martin BK, et al. Sertraline for the treatment of depression in Alzheimer disease. *Am J Geriatr Psychiatry*. 2010; 18:136–145. [PubMed: 20087081]
17. Weintraub D, Rosenberg PB, Drye LT, et al. Sertraline for the treatment of depression in Alzheimer disease: Week-24 outcomes. *Am J Geriatr Psychiatry*. 2010; 18:332–340.
18. Woolcott JC, Richardson KJ, Wiens MO, et al. Meta-analysis of the impact of 9 medication classes on falls in elderly persons. *Arch Intern Med*. 2009; 169:1952–1960. [PubMed: 19933955]
19. Gill SS, Anderson GM, Fischer HD, et al. Syncope and its consequences in patients with dementia receiving cholinesterase inhibitors: A population-based cohort study. *Arch Intern Med*. 2009; 169:867–873. [PubMed: 19433698]
20. Ensrud KE, Blackwell T, Mangione CM, et al. Central nervous system active medications and risk for fractures in older women. *Arch Intern Med*. 2003; 163:949–957. [PubMed: 12719205]
21. Gill SS, Bronskill SE, Normand SLT, et al. Antipsychotic drug use and mortality in older adults with dementia. *Ann Intern Med*. 2007; 146:775–786. [PubMed: 17548409]
22. Simoni-Wastila L, Ryder PT, Qian JJ, et al. Association of antipsychotic use with hospital events and mortality among medicare beneficiaries residing in long-term care facilities. *Am J Geriatr Psychiatry*. 2009; 17:417–427.
23. Wang PS, Schneeweiss S, Avorn J, et al. Risk of death in elderly users of conventional vs. atypical antipsychotic medications. *New Engl J Med*. 2005; 353:2335–2341. [PubMed: 16319382]
24. Schneider LS, Dagerman KS, Insel P. Risk of death with atypical antipsychotic drug treatment for dementia - Meta-analysis of randomized placebo-controlled trials. *JAMA*. 2005; 294:1934–1943. [PubMed: 16234500]
25. Vigen CLP, Mack WJ, Keefe RSE, et al. Cognitive effects of atypical antipsychotic medications in patients with alzheimer's disease: Outcomes from CATIE-AD. *Am J Psychiatry*. 2011; 168:831–839. [PubMed: 21572163]
26. Setoguchi S, Wang PS, Brookhart MA, et al. Potential causes of higher mortality in elderly users of conventional and atypical antipsychotic medications. *J Am Geriatr Soc*. 2008; 56:1644–1650. [PubMed: 18691283]
27. Liperoti R, Onder G, Landi F, et al. All-cause mortality associated with atypical and conventional antipsychotics among nursing home residents with dementia: A Retrospective Cohort Study. *J Clin Psychiatry*. 2009; 70:1340–1347. [PubMed: 19906339]
28. Shin IS, Carter M, Masterman D, et al. Neuropsychiatric symptoms and quality of life in Alzheimer disease. *Am J Geriatr Psychiatry*. 2005; 13:469–474. [PubMed: 15956266]
29. Rochon PA, Normand SL, Gomes T, et al. Antipsychotic therapy and short-term serious events in older adults with dementia. *Arch Intern Med*. 2008; 168:1090–1096. [PubMed: 18504337]
30. Parsons C, Briesacher BA, Givens JL, et al. Cholinesterase inhibitor and memantine use in newly admitted nursing home residents with dementia. *J Am Geriatr Soc*. 2011; 59(7):1253–1259. [PubMed: 21668913]
31. Chronic Condition Data Warehouse. [Accessed April, 30, 2012] Chronic Condition Categories. <http://www.ccwdata.org/chronic-conditions/index.htm>
32. Taylor DH Jr, Fillenbaum GG, Ezell ME. The accuracy of medicare claims data in identifying Alzheimer's disease. *J Clin Epidemiol*. 2002; 55:929–937. [PubMed: 12393082]
33. Zuckerman IH, Sato M, Hsu VD, et al. Validation of a method for identifying nursing home admissions using administrative claims. *BMC Health Serv Res*. 2007; 7:202. [PubMed: 18070360]
34. Koroukian SM, Xu F, Murray P. Ability of Medicare claims data to identify nursing home patients: A validation study. *Medical Care*. 2008; 46:1184–1187. [PubMed: 18953230]

35. Deyo RA, Cherkin DC, Ciol MA. Adapting a Clinical Comorbidity Index for Use with Icd-9-Cm Administrative Databases. *J Clin Epidemiol.* 1992; 45:613–619. [PubMed: 1607900]
36. Romano PS, Roos LL, Jollis JG. Adapting a Clinical Comorbidity Index for Use with Icd-9-Cm Administrative Data - Differing Perspectives. *J Clin Epidemiol.* 1993; 46:1075–1079. [PubMed: 8410092]
37. Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol.* 2004; 159:702–706. [PubMed: 15033648]
38. Rhee Y, Csernansky JG, Emanuel LL, et al. Psychotropic medication burden and factors associated with antipsychotic use: An analysis of a population-based sample of community-dwelling older persons with dementia. *J Am Geriatr Soc.* 2011; 59:2100–2107. [PubMed: 22092099]
39. Rochon PA. Exploring the variation in Ontario nursing home prescribing rates for antipsychotics. *Healthc Q.* 2007; 10:20–22. [PubMed: 18027450]
40. Yaffe K, Fox P, Newcomer R, et al. Patient and caregiver characteristics and nursing home placement in patients with dementia. *JAMA.* 2002; 287:2090–2097. [PubMed: 11966383]
41. Rosenberg PB, Mielke MM, Han D, et al. The association of psychotropic medication use with the cognitive, functional, and neuropsychiatric trajectory of Alzheimer's disease. *Int J Geriatr Psychiatry.* 2012; 27:1248–1257. [PubMed: 22374884]
42. Andrade SE, Kahler KH, Frech F, et al. Methods for evaluation of medication adherence and persistence using automated databases. *Pharmacoepidemiol Drug Saf.* 2006; 15:565–574. [PubMed: 16514590]
43. Hess LM, Raebel MA, Conner DA, et al. Measurement of adherence in pharmacy administrative databases: A proposal for standard definitions and preferred measures. *Ann Pharmacother.* 2006; 40:1280–1288. [PubMed: 16868217]
44. Steiner JF, Prochazka AV. The assessment of refill compliance using pharmacy records: Methods, validity, and applications. *J Clin Epidemiol.* 1997; 50:105–116. [PubMed: 9048695]
45. Schneeweiss S, Setoguchi S, Brookhart A. Risk of death associated with the use of conventional versus atypical antipsychotic drugs among elderly patients. *Can Med Assoc J.* 2007; 176:1613–1613.
46. Rossom RC, Rector TS, Lederle FA, et al. Are all commonly prescribed antipsychotics associated with greater mortality in elderly male veterans with dementia? *J Am Geriatr Soc.* 2010; 58:1027–1034. [PubMed: 20487081]
47. Setoguchi S, Wang PS, Alan Brookhart M, et al. Potential causes of higher mortality in elderly users of conventional and atypical antipsychotic medications. *J Am Geriatr Soc.* 2008; 56:1644–1650. [PubMed: 18691283]
48. Kales HC, Kim HM, Zivin K, et al. Risk of mortality among individual antipsychotics in patients with dementia. *Am J Psychiatry.* 2012; 169:71–79. [PubMed: 22193526]
49. Huybrechts KF, Gerhard T, Crystal S, et al. Differential risk of death in older residents in nursing homes prescribed specific antipsychotic drugs: Population based cohort study. *BMJ.* 2012; 344:e977. [PubMed: 22362541]
50. Paterno E, Bohn RL, Wahl PM, et al. Anticonvulsant medications and the risk of suicide, attempted suicide, or violent death. *JAMA.* 2010; 303:1401–1409. [PubMed: 20388896]

Appendix. Description of algorithms for the chronic diseases and conditions used in the study

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
Depression	296.20, 296.21, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.31, 296.32, 296.33, 296.34,	At least one Part A or B claim, using any diagnosis on the claim, OR one MDS assessment for depression AND having depression	CMS Chronic Condition Data Warehouse Condition Categories. http://www.ccwdata.org/cs/groups/public/documents/document/

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
	296.35, 296.36, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 298.0, 300.4, 309.0, 309.1, 309.28, 311.00	rating scale ≥ 3 on the same assessment in 2008.	<p>ccw_conditioncategories.pdf>. Accessed June 6, 2012;</p> <p>Karkare SU et al. Am J Geriatr Pharmacother. 2011 Apr. 9(2):109–19.;</p> <p>Mark TL et al. Am J Geriatr Psychiatry. 2011 Mar. 19(3): 211–21.;</p> <p>Donohoue JM et al. Am J Geriatr Psychiatry. 2011 Dec. 19(12): 989–97.;</p> <p>Chen H et al. J Clin Psychiatry. 2006 Jun. 67(6):972–82.;</p> <p>Crystal S et al. J Am Geriatr Soc. 2003 Dec. 51(12):1718–28.;</p> <p>Kamble P et al. Am J Geriatr Pharmacother. 2008 Oct. 6(4):187–97.;</p> <p>Kamble P et al. Drugs Aging. 2009. 26(6):483–92.;</p> <p>Sclar DA et al. Gen Hosp Psychiatry. 2008 Jan–Feb. 30(1): 73–6.</p>
Anxiety	293.84, 293.89, 300.xx, 301.4, 309.24, 309.28, 309.81	At least 1 Part A or B claim, using any diagnosis on the claim, in 2008.	<p>Karkare SU et al. Am J Geriatr Pharmacother. 2011 Apr. 9(2):109–19.;</p> <p>Mark TL et al. Am J Geriatr Psychiatry. 2011 Mar. 19(3): 211–21.;</p> <p>Donohoue JM et al. Am J Geriatr Psychiatry. 2011 Dec. 19(12):989–97.;</p> <p>Chen H et al. J Clin Psychiatry. 2006 Jun. 67(6):972–82.;</p> <p>Crystal S et al. J Am Geriatr Soc. 2003 Dec. 51(12):1718–28.;</p> <p>Kamble P et al. Am J Geriatr Pharmacother. 2008 Oct. 6(4):187–97.;</p> <p>Kamble P et al. Drugs Aging. 2009. 26(6):483–92.;</p> <p>Sclar DA et al. Gen Hosp Psychiatry. 2008 Jan–Feb. 30(1): 73–6.</p> <p>McLaughlin T et al. Pharmacotherapy. 2003 Oct; 23(10):1251–6.</p> <p>Wu CS et al. Am J Geriatr Psychiatry. 2009 Jul;17(7):614–20.</p> <p>Wu CS et al. Am J Geriatr Psychiatry. 2011 Feb. 19(2): 151–9.</p> <p>Wu CS et al. Am J Psychiatry. 2011 May. 168(5):511–21.</p>

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
Other psychiatric	291.5, 293.81, 295.0x, 295.1x, 295.2x, 295.3x, 295.4x, 295.5x, 295.6x, 295.7x, 295.8x, 295.9x, 296.1x, 296.24, 296.34, 296.4x, 296.5x, 296.6x, 296.7, 296.8x, 297.0, 297.1, 297.2, 297.3, 297.8, 297.9, 298.0, 298.1, 298.2, 298.3, 298.4, 298.8, 298.9, 301.10, 301.12, 780.1	At least one Part A or B claim, using any diagnosis on the claim, OR at least one MDS assessment for anxiety or schizophrenia or delusion or manic depression/bipolar disorder or hallucinations in 2008.	Kamble P et al. Am J GeriatrPharmacother. 2008 Oct. 6(4):187–97.; Kamble P et al. Drugs Aging. 2009. 26(6):483–92.; Kamble P et al. Psychiatr Serv. 2010 Feb. 61(2):130–6.; Briesacher BA et al. Arch Intern Med. 2005 Jun 13. 165(11):1280–5. Stevenson DG et al. Am J Geriatr Psychiatry. 2010 Dec. 18(12):1078–92.; Grabowski DC et al. Factor Substitution and Inappropriate Use of Antipsychotics in Nursing Homes. < http://faculty.fuqua.duke.edu/~dbr1/pharma/Grabowski-Bowblis.pdf >. Accessed June 6, 2012.
Alzheimer's Disease and Related Disorders or Senile Dementia	331.0, 331.1, 331.11, 331.19, 331.2, 331.7, 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 294.0, 294.1, 294.10, 294.11, 294.8, 797	At least 1 inpatient, SNF, HHA, HOP or carrier claim with diagnosis codes during a 3 year period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Atrial Fibrillation	427.31	At least 1 inpatient claim or 2 HOP or Carrier claims with diagnosis code during the 1-yr period, only using the first or second diagnosis in the claims.	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Acute myocardial infarction	410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91	At least 1 inpatient claim with diagnosis codes during the 1-yr period, only using first or second diagnosis codes	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Chronic Kidney Disease	016.00, 016.01, 016.02, 016.03, 016.04, 016.05, 016.06, 095.4, 189.0, 189.9, 223.0, 236.91, 249.40, 249.41, 250.40, 250.41, 250.42, 250.43, 271.4, 274.10, 283.11, 403.01, 403.11, 403.91, 404.02, 404.03,	At least 1 inpatient, SNF or HHA claim or 2 HOP or Carrier claims with DX codes during the 2-yr period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
	404.12, 404.13, 404.92, 404.93, 440.1, 442.1, 572.4, 580.0, 580.4, 580.81, 580.89, 580.9, 581.0, 581.1, 581.2, 581.3, 581.81, 581.89, 581.9, 582.0, 582.1, 582.2, 582.4, 582.81, 582.89, 582.9, 583.0, 583.1, 583.2, 583.4, 583.6, 583.7, 583.81, 583.89, 583.9, 584.5, 584.6, 584.7, 584.8, 584.9, 585, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 585.9, 586, 587, 588.0, 588.1, 588.81, 588.89, 588.9, 591, 753.12, 753.13, 753.14, 753.15, 753.16, 753.17, 753.19, 753.20, 753.21, 753.22, 753.23, 753.29, 794.4		
Chronic Obstructive Pulmonary Disease	491.0, 491.1, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 494.0, 494.1, 496	At least 1 inpatient, SNF, HHA or 2 HOP or Carrier* claims with diagnosis codes during the 1-yr period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Diabetes	249.00, 249.01, 249.10, 249.11, 249.20, 249.21, 249.30, 249.31, 249.40, 249.41, 249.50, 249.51, 249.60, 249.61, 249.70, 249.71, 249.80, 249.81, 249.90, 249.91, 250.00, 250.01, 250.02, 250.03, 250.10, 250.11, 250.12, 250.13, 250.20, 250.21, 250.22, 250.23, 250.30, 250.31, 250.32, 250.33, 250.40, 250.41, 250.42, 250.43, 250.50, 250.51, 250.52, 250.53, 250.60, 250.61, 250.62, 250.63, 250.70, 250.71, 250.72, 250.73, 250.80, 250.81, 250.82, 250.83,	At least 1 inpatient, SNF or HHA claim or 2 HOP or Carrier* claims with diagnosis codes during the 2-yr period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
	250.90, 250.91, 250.92, 250.93, 357.2, 362.01, 362.02, 366.41		
Heart Failure (CHF)	398.91, 402.01, 402.11, 402.91, 404.01, 404.11, 404.91, 404.03, 404.13, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9	At least 1 inpatient, HOP or Carrier * claim with diagnosis codes during the 2-yr period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Hip/Pelvic Fracture	733.98, 808.0, 808.1, 808.2, 808.3, 808.41, 808.42, 808.43, 808.49, 808.51, 808.52, 808.53, 808.59, 808.8, 808.9, 820.00, 820.01, 820.02, 820.03, 820.09, 820.10, 820.11, 820.12, 820.13, 820.19, 820.20, 820.21, 820.22, 820.30, 820.31, 820.32, 820.8, 820.9	At least 1 inpatient claim with diagnosis code during a one-year period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Ischemic heart disease	410.00, 410.01, 410.02, 410.10, 410.11, 410.12, 410.20, 410.21, 410.22, 410.30, 410.31, 410.32, 410.40, 410.41, 410.42, 410.50, 410.51, 410.52, 410.60, 410.61, 410.62, 410.70, 410.71, 410.72, 410.80, 410.81, 410.82, 410.90, 410.91, 410.92, 411.0, 411.1, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07, 414.10, 414.11, 414.12, 414.19, 414.2, 414.3, 414.8, 414.9; ICD-9-CM procedure codes 00.66, 36.01, 36.02, 36.03, 36.04, 36.05, 36.06, 36.07, 36.09, 36.10,	At least 1 inpatient, SNF, HHA, HOP or Carrier claim with diagnosis, procedure or HCPCS codes during a 2-yr period	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.

Disease/ Condition	ICD-9/ CPT4/ HCPCS codes	Number/Type of Claims	Source
	36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.19, 36.2, 36.31, 36.32; HCPCS 33510, 33511, 33512, 33513, 33514, 33515, 33516, 33517, 33518, 33519, 33521, 33522, 33523, 33533, 33534, 33535, 33536, 33542, 33545, 33548, 92975, 92977, 92980, 92982, 92995, 33140, 33141		
Osteoporosis	733.00, 733.01, 733.02, 733.03, 733.09	At least 1 inpatient, HOP or carrier claim with diagnosis code during 1-year, using any diagnosis code on the claim	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Stroke/ Transient Ischemic Attack	430, 431, 434.00, 434.01, 434.10, 434.11, 434.90, 434.91, 435.0, 435.1, 435.3, 435.8, 435.9, 436, 997.02	At least 1 inpatient claim or 2 HOP or Carrier claims* with diagnosis codes during the 1-yr period, excluding patients with head/facial fractures, other head injury	CMS Chronic Condition Data Warehouse Condition Categories. < http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf >. Accessed June 6, 2012.
Chronic liver disease	571.4, 571.40, 571.41, 571.42, 571.49, 571.5, 571.6, 571.8, 571.9	At least one Part A claim or two or more Part B claims at least 30 days apart within a one year period	Liver conditions from the Charlson comorbidity Index using the Deyo and Romano adaptations: Deyo RA et al. J Clin Epidemiol. 1992 Jun;45(6):613–9. Romano PS et al. J Clin Epidemiol. 1993 Oct; 46(10):1075–9.

* Any combination of 2 HOP/Carrier claims at least one day apart; MDS= Minimum Data Set; DX=ICD-9-CM diagnosis code; SNF=Skilled Nursing Facility; HOP= Hospital Outpatient; HHA= Home Health; CMS= Centers for Medicare & Medicaid Services; ICD-9: International Classification of Diseases, 9th Revision; HCPCS:Healthcare Common Procedure Coding System; CPT4: Current Procedural Terminology, 4th Edition.

Table 1
 Characteristics of Medicare Beneficiaries with Alzheimer's Disease and Related Disorders by Care Setting, N= 52,754

Characteristic	Total			No NH ^e			Partial NH ^b			Full NH ^c			p-value
	N	col. %	N= 52,754, 100%	N	col. %	N= 21,790, 41.3%	N	col. %	N= 22,348, 42.4%	N	col. %	N= 8,616, 16.3%	
Age (years)													
65 – 74	6961	13.2	3478	16.0	2346	10.5	1137	13.2					<0.001
75 – 84	21462	40.7	9930	45.6	8392	37.6	3140	36.4					
85 – 94	21444	40.6	7687	35.3	10041	44.9	3716	43.1					
95	2887	5.5	695	3.2	1569	7.0	623	7.2					
Sex													
Male	11051	20.9	5129	23.5	4246	19.0	1676	19.5					<0.001
Female	41703	79.1	16661	76.5	18102	81.0	6940	80.5					
Race													
White	43531	82.5	17536	80.5	19132	85.6	6863	79.7					<0.001
Black	6052	11.5	2329	10.7	2374	10.6	1349	15.7					
Hispanic	1573	3.0	973	4.5	392	1.8	208	2.4					
Asian	840	1.6	542	2.5	201	0.9	97	1.1					
Other	758	1.4	410	1.9	249	1.1	99	1.1					
Region													
South	21392	40.6	9419	43.2	8748	39.1	3225	37.4					<0.001
West	7144	13.5	3788	17.4	2563	11.5	793	9.2					
Northeast	11616	22.0	4248	19.5	4823	21.6	2545	29.5					
Midwest	12602	23.9	4335	19.9	6214	27.8	2053	23.8					
Low Income Subsidy													
None	19142	36.3	12792	58.7	5708	25.5	642	7.5					<0.001
Partial	1865	3.5	372	1.7	1240	5.5	253	2.9					
Full	31747	60.2	8626	39.6	15400	68.9	7721	89.6					
Original reason for Medicare entitlement													
Old age	46749	88.6	19807	90.9	19639	87.9	7303	84.8					<0.001
Disability and/ or ESRD ^d	6005	11.4	1983	9.1	2709	12.1	1313	15.2					

Characteristic	Total N= 52,754, 100%			No NH ^a N=21,790, 41.3%			Partial NH ^b N=22,348, 42.4%			Full NH ^c N=8,616, 16.3%			p-value
	N	col. %		N	col. %		N	col. %		N	col. %		
CCI ^e													<0.001
0	13002	24.6		7392	33.9		4422	19.8		1188	13.8		
1	12480	23.7		5364	24.6		5228	23.4		1888	21.9		
2	9911	18.8		3732	17.1		4378	19.6		1801	20.9		
3	17361	32.9		5302	24.3		8320	37.2		3739	43.4		
Selected Comorbidities													
Depression	6853	13		2618	12.0		3151	14.1		1084	12.6		<0.001
Anxiety	4811	9.1		1736	8.0		2288	10.2		787	9.1		<0.001
Other psychiatric disorder ^f	6615	12.5		2015	9.3		3458	15.5		1142	13.3		<0.001
Acute Myocardial Infarction	769	1.5		241	1.1		401	1.8		127	1.5		<0.001
Atrial Fibrillation	6486	12.3		2123	9.7		3172	14.2		1191	13.8		<0.001
CHF ^g	19723	37.4		6043	27.7		9533	42.7		4147	48.1		<0.001
Chronic Kidney Disease	11528	21.9		3611	16.6		5547	24.8		2370	27.5		<0.001
COPD ^h	9297	17.6		2845	13.1		4458	20.0		1994	23.1		<0.001
Diabetes	18047	34.2		6458	29.6		7966	35.7		3623	42.1		<0.001
Hip/Pelvic Fracture	1632	3.1		150	0.7		1258	5.6		224	2.6		<0.001
Ischemic Heart Disease	24267	46.0		9363	43.0		10485	46.9		4419	51.3		<0.001
Osteoporosis	11611	22.0		4369	20.1		5392	24.1		1850	21.5		<0.001
Stroke/TIA ⁱ	7173	13.6		1924	8.8		3636	16.3		1613	18.7		<0.001

^aNo nursing home: Medicare beneficiaries living in community throughout 2008;

^bPartial nursing home: Medicare beneficiaries who lived in skilled nursing facility for 1–11 months in 2008

^cFull nursing home: Medicare beneficiaries who lived in skilled nursing facility for 12 months in 2008;

^dESRD: End Stage Renal Disease;

^eCCI: Charlson comorbidity index;

^fOther psychiatric disorders include schizophrenia and other psychoses, bipolar disorder, mood disorder;

^gCHF: Chronic Heart Failure;

h COPD: Chronic obstructive pulmonary disease;

i TIA: Transient ischemic attack

Annual Medication Use Prevalence Among Medicare Beneficiaries with Alzheimer’s Disease and Related Disorders by Care Setting, N= 52,754

Table 2

	Total		No NH ^a		Partial NH ^b		Full NH ^c		p-value
	N	%	N	%	N	%	N	%	
Medication									
Cognitive Enhancers ^d	30,108	57.1	14,368	65.9	11,544	51.7	4,196	48.7	<0.001
Antidepressants	29,763	56.4	10,129	46.5	13,984	62.6	5,650	65.6	<0.001
Antipsychotics	17,892	34.0	5,230	24.0	8,767	39.2	3,895	45.2	<0.001
Mood stabilizers ^e	4,621	8.8	884	4.1	2,435	10.9	1,302	15.1	<0.001
None	8,052	15.3	3,605	16.5	3,317	14.8	1,130	13.1	<0.001

^aNo nursing home: Medicare beneficiaries living in community throughout 2008;

^bPartial nursing home: Medicare beneficiaries who lived nursing home facility for 1–11 months in 2008;

^cFull nursing home: Medicare beneficiaries who lived in nursing home facility for 12 months in 2008;

^dCognitive enhancers include acetylcholinesterase inhibitors (donepezil, rivastigmine, galantamine) or memantine;

^eMood stabilizers include valproic acid, carbamazepine, oxcarbazepine

Adjusted Prevalence Ratios (APR)^{*} of Medication Use among Medicare Beneficiaries with Alzheimer’s disease and Related Disorders, N= 52,754

Table 3

Characteristic	Cognitive Enhancers ^a		Antidepressants		Antipsychotics		Mood Stabilizers ^b	
	APR	99% CI	APR	99% CI	APR	99% CI	APR	99% CI
NH residence ^c								
None (0 month)	1	Ref.	1	Ref.	1	Ref.	1	Ref.
Partial (1–11 months)	0.84	(0.83,0.86)	1.31	(1.29,1.34)	1.56	(1.51,1.61)	2.70	(2.49, 2.92)
Full (12 months)	0.83	(0.81,0.85)	1.38	(1.35,1.41)	1.72	(1.66,1.79)	3.48	(3.18, 3.81)

^{*} Multivariable models were adjusted for age, sex, race, U.S. region of residence, low income subsidy status, original reason for Medicare entitlement, Charlson comorbidity index;

^a Cognitive enhancers include acetylcholinesterase inhibitors (donepezil, rivastigmine, galantamine) or memantine;

^b Mood stabilizers include valproic acid, carbamazepine, oxcarbazepine;

^c No nursing home: Medicare beneficiaries living in community throughout 2008, Partial nursing home: Medicare beneficiaries who lived in nursing home for 1–11 months in 2008, Full nursing home: Medicare beneficiaries who lived in nursing home for 12 months in 2008

Table 4

Adjusted Count and Adjusted Count Difference of Psychopharmacological^a Medication Use among Medicare Beneficiaries with Alzheimer's Disease and Related Disorders and with a Consistent^b Pattern of Medication Use throughout 2008, N=34,161

Characteristic	Adjusted Count	99% CI	Adjusted Count Difference	99% CI
Nursing Home Residence^c				
None (0 month)	1	Ref.	0	Ref.
Partial (1–11 months)	1.50	(1.45, 1.55)	0.31	(0.27, 0.34)
Full (12 months)	1.70	(1.63, 1.76)	0.46	(0.41, 0.51)

Multivariable models were adjusted for cognitive enhancer medication use, age, sex, race, U.S. region of residence, low income subsidy status, original reason for Medicare entitlement, and Charlson comorbidity index;

^aPsychopharmacological medications include antipsychotics, antidepressants, and mood stabilizers;

^bConsistent pattern of medication use also includes individuals who did not use any cognitive enhancers or any of the three classes of psychopharmacological medications studied ("non-users") throughout 2008;

^cNo nursing home: Medicare beneficiaries living in community throughout 2008, Partial nursing home: Medicare beneficiaries who lived in nursing home for 1–11 months in 2008, Full nursing home: Medicare beneficiaries who lived in nursing home for 12 months in 2008