
Prescription Drug Use in the Elderly: A Descriptive Analysis

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In the current policy debate, pharmaceutical use in the elderly has been characterized largely by its economic impact, with little discussion of what drugs the elderly are taking. Based on data from the Medicare Current Beneficiary Survey (MCBS), this study defines subgroups of the community-dwelling elderly using health and functional status, and provides a comprehensive description of the composition of prescription drug use in this population. Drugs are classified into 16 primary therapeutic classes, with further breakdown into secondary classes and characterization by chronic versus acute use. Utilization is reported by age and health status categories.

BACKGROUND

Payment for pharmaceutical therapy in the elderly has become a central policy debate but has been poorly informed by data on actual drug use in this population. The research literature has focused almost exclusively on cost and payment issues, essentially ignoring patterns of demographic and clinical factors that determine differences in utilization and, ultimately, spending. To date, no national comprehensive descriptive data have been made available

on the composition of prescription drug use in the elderly in total or in its subgroups. One study provides an overview of utilization of the five most common classes of drugs in the elderly with stratification by age and sex (Waldron and Poisal, 1999). Other studies have been conducted in targeted populations that may not be representative, or are limited by collection methodologies, e.g., one time collection, or have been conducted in very small samples (Schmader et al., 1998; Lassila, Stoehr, and Ganguli, 1996; Chrischilles, Foley, and Wallace, 1992; Stewart et al., 1991; Helling et al., 1987; Darnell et al. 1986). Few studies have examined subgroups of the population.

The elderly, however, are not homogeneous and will be differentially affected by any of the currently proposed prescription drug benefit policies. Analysis of socioeconomic characteristics and health and functional status of beneficiaries to help policymakers understand gaps in coverage and craft options for reform is needed (Davis et al., 1999). One study used data from a pharmacy benefit management (PBM) organization for a population with continuous prescription drug coverage and no annual cap to assess drug use differences by subgroups defined by comorbid conditions (Steinberg et al., 2000). Many studies have examined drug use and adherence in subpopulations with specific diseases. A recent study examined the use of inappropriate medications in the elderly (Zhan et al., 2001). To date, however, no study has surveyed the entire population.

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This study provides a comprehensive description of the composition of prescription drug use in the community-dwelling elderly, and health and functional status subgroups to inform policymakers of the potential impact of benefit designs on them. Using a nationally representative sample of Medicare beneficiaries, we describe overall drug utilization for a 1-year period in terms of the number of broad therapeutic classes and the number of more specific drug subclasses.

STUDY METHODOLOGY

Data Source

The 1996 MCBS Cost and Use Data Files were used for this study. The MCBS is a nationally-representative longitudinal panel survey of Medicare beneficiaries that is intended for use in policy studies. Data collected include use of health services, medical care expenditures, health insurance coverage, sources of payment, health status and functioning, and a variety of demographic and behavioral information, such as income, assets, living arrangements, family supports, and access to medical care. Data are collected from each survey participant or a proxy three times a year using computer assisted personal interviews.

Study Sample

We used the 1996 MCBS data files for the study. There were 11,884 Medicare beneficiaries participating in the MCBS sample in calendar year 1996, representing approximately 39 million persons. While the MCBS includes in its sample the disabled and facility-dwelling elderly, our analysis is focused on the community-

dwelling elderly only. Data collection methodologies for those who are institutionalized do not support detailed analysis of pharmaceutical use, and the characteristics of the disabled population warrant a separate analysis. Subjects were included who: (1) were community dwelling (i.e., those who spent no time in a long-term care facility during the study year), (2) were at least age 65 or over, and (3) completed the entire survey year to ensure that we had a complete year of prescription drug use. The final study sample had 7,798 subjects.

The study sample of 7,798 Medicare beneficiaries represents 27,285,988 Medicare community-dwelling elderly. In Table 1, we present basic demographic data associated with the study population, including age, sex, race, educational status, income distribution, marital status, percent residing in a metropolitan area, and number of comorbidities.

All health care-related events and expenditures are collected in the MCBS survey, including prescription drug use. To minimize underreporting of prescription medicine use, survey participants are asked to save bottles, tubes, and prescription receipts for each 4-month period and to provide them to the interviewer at the time of survey. Data elements in the MCBS prescription drug data files include drug name, therapeutic class, form, strength, units, and expenditures. Fill date and days supply are not collected in the survey.

Approximately 12 percent of the study sample had no recorded drug utilization. The MCBS data files do not differentiate between prescription drug data which could not be collected for an individual and no drug use for that individual in the survey year. Analysis showed that the beneficiaries for whom no drug data were reported

Table 1
Demographic Characteristics of Community Dwelling Elderly: 1996

| Demographic | Total ¹ | Male ² | Female ² |
|-----------------------------|--------------------|-------------------|---------------------|
| | | Percent | |
| Age | | | |
| 65-69 Years | 21.2 | 25.2 | 18.4 |
| 70-74 Years | 30.0 | 30.9 | 29.4 |
| 75-79 Years | 23.4 | 22.1 | 24.3 |
| 80-84 Years | 15.3 | 13.9 | 16.3 |
| 85 Years or Over | 10.0 | 7.7 | 11.7 |
| Race | | | |
| White | 87.6 | 88.1 | 87.2 |
| Black | 7.8 | 7.1 | 8.4 |
| Other | 4.3 | 4.8 | 4.4 |
| Educational Status | | | |
| Less than High School | 37.7 | 37.6 | 37.7 |
| High School | 32.8 | 29.2 | 35.4 |
| College or Higher | 28.9 | 32.5 | 26.3 |
| Income | | | |
| \$10,000 or Less | 23.2 | 13.6 | 30.1 |
| \$10,001-\$25,000 | 45.2 | 45.9 | 44.7 |
| \$25,001-\$50,000 | 23.9 | 30.0 | 19.5 |
| \$50,001 or More | 7.7 | 10.6 | 5.6 |
| Marital Status | | | |
| Married | 54.5 | 75.2 | 39.6 |
| Widowed | 35.2 | 15.1 | 49.6 |
| Other | 10.3 | 9.7 | 10.8 |
| Reside in Metropolitan Area | 73.1 | 72.2 | 73.7 |
| Comorbidities | | | |
| 0 | 14.3 | 16.1 | 13.0 |
| 1 | 25.7 | 28.4 | 23.7 |
| 2 | 28.6 | 27.1 | 29.7 |
| 3 | 18.6 | 17.5 | 19.3 |
| 4 or More | 12.9 | 10.9 | 14.2 |

¹ The study sample of 7,798 Medicare beneficiaries represents 27,285,988 Medicare community-dwelling elderly.

² Forty-two percent (11,384,636) represents the male participation in the study sample and 58 percent (15,901,352) represents the female participation.

SOURCE: Medicare Current Beneficiary Survey Cost and Use Data Files, 1996.

were younger, reported less comorbidities (almost 50 percent reporting zero comorbidities), reported less difficulty with activities of daily living (ADLs) (90 percent reporting no difficulty), and had better health perception (71 percent reporting excellent or very good health). In addition, overall medical expenditures were lower in this group. Based on this analysis, we assumed that beneficiaries for whom drug data were not reported had no drug utilization in the study year. This approach tends to underestimate utilization.

Data Analysis

Reporting Classes

Although the MCBS provides a therapeutic class for each drug name on the drug file, we found that the classification provided was not sufficiently descriptive. Drug names were, therefore, remapped to a proprietary drug classification system developed by Multum Information Services, Inc. (1999). Multum provides three levels of classification: primary (loosely based on body system, e.g., central

nervous system), secondary (e.g., analgesics within central nervous system), and subcategory (e.g., narcotic analgesics). This classification system does not allow sufficient differentiation of common conditions in the elderly and is too detailed for easy comprehension. Therefore, we developed a two-level, clinically-meaningful category scheme appropriate to the geriatric population by modifying and condensing the Multum classification system.

Sixteen primary reporting classes were developed based on either body system (e.g., cardiovascular agents) or clinical condition (e.g., diabetic agents). A total of 50 subclasses were defined based on a clinical breakdown of the primary classes. In development of the primary reporting classes, biologicals (which consists of anti-toxins and colony stimulating factors, both infrequently used by patients) and alternative medicines (not prescription drugs) were dropped from the primary classification grouping, while analgesics and anti-diabetic agents (commonly used medications not easily identifiable under their respective Multum classification of central nervous system drugs and hormones) were added. The Multum primary class, nutritional products, which consists of vitamins, iron, and electrolyte supplements was reclassified as vitamin/mineral/electrolyte to better reflect the subclasses. The subclasses were developed by condensing the secondary and tertiary classes from Multum to reflect the drug categories most commonly used by Medicare beneficiaries and to be clinically meaningful. The subclass “other” within each class subsumes all subclasses not specifically mentioned due primarily to extremely low prevalence of use in the population. For example, anti-Parkinson agents would be found under the central nervous system agents subclass “other.” Lastly, one consideration in

development of the drug classification system was to reflect medications with high utilization patterns in the geriatric population. Because this was based on 1996 data, the classification scheme does not include medications that were not widely used in 1996 such as acetylcholinesterase inhibitors for Alzheimer’s disease or newer diabetic agents. The primary classes and subclasses are shown in Table 2.

The subclasses were developed to be used as an indicator of how many different medications an individual takes in a year without actually counting each individual brand name or prescription fill. This approach is intended to yield an estimate of the number of different types (i.e., subclasses) of medications a beneficiary takes within a year. If an individual is taking more than one drug within a subclass, the subclass is only counted once. For example, if an individual is chronically taking an antihyperlipidemic agent, a proton pump inhibitor, and was treated several times with two different anti-infectives, the count of subclasses for the year would be three.

Drug name was not available for approximately 10 percent of fills on the drug file. Estimating expenditures is the primary purpose of the MCBS survey; therefore, CMS captures these fills and associated expenditures and categorizes them as “untranslatable”. Since these drugs could not be classified, they were necessarily excluded from our analysis.

Acute Versus Chronic Classification

In addition to estimating the total number of drugs a beneficiary is taking during a year, we also wished to estimate of the number of drugs that the beneficiary is taking chronically. Since there are no standard criteria to determine chronic versus acute drug use we used clinical judgment

Table 2
Drug Reporting Classes and Subclasses for Categorization of Utilization

| Class | Subclass | Chronic | |
|------------------------------|---|------------------|---|
| Analgesics | Narcotic Analgesics | — | |
| | Non-steroidal Anti-inflammatory Agents | — | |
| | Other | — | |
| Antihyperlipidemic Agents | HMG CoA Reductase Inhibitors | x | |
| | Other | x | |
| Anti-infective Agents | | | |
| Antineoplastic Agents | | | |
| Cardiovascular Agents | ACE Inhibitors | x | |
| | Anti-anginal Agents | x | |
| | Anti-arrhythmic Agents | x | |
| | Beta Blockers | x | |
| | Calcium Channel Blockers | x | |
| | Inotropic Agents | x | |
| | Loop Diuretics | x | |
| | Miscellaneous Antihypertensives | x | |
| | Non-loop Diuretics | x | |
| | Other | x | |
| | Central Nervous System Agents | Anticonvulsants | x |
| | | Antiemetics | — |
| | | Muscle Relaxants | — |
| Other | | — | |
| Coagulation Modifiers | Coumarins and Indandiones | — | |
| | Other | — | |
| Diabetic Agents | Insulin | x | |
| | Sulfonylureas | x | |
| Gastrointestinal Agents | H2 Antagonists | — | |
| | Proton Pump Inhibitors | — | |
| | Other | — | |
| Hormones | Adrenal Cortical Steroids | — | |
| | Estrogens/Progestins | x | |
| | Thyroid Drugs | x | |
| | Other | x | |
| Immunologic Agents | | | |
| Miscellaneous Agents | Antigout Agents | x | |
| | Bisphosphonates | x | |
| | Erythropoietin | — | |
| | Other | — | |
| Psychotherapeutic Agents | Benzodiazepines | — | |
| | Miscellaneous Anxiolytics, Sedatives, Hypnotics | — | |
| | SSRI Antidepressants | x | |
| | Tricyclic Antidepressants | x | |
| | Other Antidepressants | x | |
| Respiratory Agents | Other | — | |
| | Antihistamines | — | |
| | Inhalants | — | |
| | Methylxanthines | x | |
| | Nasal Steroids | — | |
| | Other | — | |
| Topical Agents | Dermatologic Agents | — | |
| | Ophthalmic Preparations | — | |
| | Other | — | |
| Vitamin/Mineral/Electrolytes | Potassium | x | |
| | Other | — | |

NOTES: These 16 primary reporting classes were developed based on either body system (e.g., cardiovascular) or clinical condition (diabetic). The 50 subclasses were defined based on a clinical breakdown of the primary classes and developed as an indicator of the different medications an individual takes in a year without actually counting each individual brand name or prescription fill.

SOURCES: Moxey, E.D., Thomas Jefferson University Hospital, Nash, D.B., Novielli, K.D., Thomas Jefferson University, O'Connor, J.P., The Baldwin School, 2002.

to determine which subclasses would be used chronically. The designation of a subclass as chronic was extremely conservative, and focused on classes that are almost

invariably used chronically such as antihyperlipidemic agents (Table 2). Drugs that can be used either short or long term were classified as acute.

Comorbidities

We used comorbidities to classify beneficiaries by current health status. The MCBS survey asks each beneficiary a series of questions about a limited number of health conditions they may have. Questions are posed in the following manner: “Have you ever been told you have...?” The comorbid conditions that we included in our study are hypertension, coronary heart disease (including acute myocardial infarction and angina), stroke, diabetes, arthritis, osteoporosis, emphysema/chronic obstructive pulmonary disease/asthma, Alzheimers, and Parkinsons. All chronic diseases most prevalent in the elderly are included—with the exception of peptic ulcer disease/gastro-esophageal reflux disease (GERD), and depression, because neither of these are asked about in the survey. Neoplastic disease data are collected in the survey, but because time of diagnosis is not provided we were unable to relate the data to current health status. For this reason, neoplasms were not counted as a comorbidity. Population estimates for health status categories II and III may be underestimated as a result of the exclusion of these comorbidities from the survey/analysis. While peptic ulcer/GERD, depression, and neoplasms are not counted in this study as comorbidities, drug use data associated with the conditions are included in both estimates of prevalence of use and of cost.

Development of Health Status Categories

One of the primary study objectives was to describe drug use in the elderly in relation to health status. Based on the number of reported comorbidities and the number of ADLs with which difficulty was reported, we defined three broad categories of health status in the elderly:

- Category I: Zero comorbidities, no ADL difficulty.
- Category II: One–two comorbidities, no ADL difficulty.
- Category III: Three or more comorbidities and/or any difficulty with an ADL.

Category III, the least healthy, comprised 43.3 percent of the population, with mean annual drug expenditures of \$2,275. The more healthy elderly consisted of category II (43.6 percent of the population) with mean drug expenditures of \$1,099, and category I, the most healthy, (13.1 percent of the population) had mean drug expenditures of \$345.

Extrapolation of Results to Medicare Population

The MCBS provides weights for extrapolation to the entire Medicare population. Weights for extrapolation are applied to individual observations and allow projection from sample means and frequencies to the population. These weights reflect the probabilities of selection for each observation, adjusted for undercoverage and non-response. All frequencies and means presented in the tables were produced using these weights.

STUDY RESULTS

Utilization

Table 3 shows three different views of drug utilization in the community dwelling elderly. The number of primary classes of drugs that an individual takes in a year gives us a view of utilization across broad categories, while subclasses and chronic use provide more detail. The subclasses were developed to be used as an indicator of how many different medications an individual takes in a year. Using this approach, we estimate that 58 percent of the community

Table 3**Drug Utilization¹ in the Community Dwelling Elderly, by Reporting Class and Subclass: 1996**

| Number of Primary Classes of Drugs | Percent Beneficiaries | Number of SubClasses ² | Percent of Beneficiaries | Number of Chronic Subclasses | Percent of Beneficiaries |
|------------------------------------|-----------------------|-----------------------------------|--------------------------|------------------------------|--------------------------|
| 0 | 12.1 | 0 | 12.1 | 0 | 27.2 |
| 1 | 16.4 | 1 | 12.9 | 1 | 22.3 |
| 2 | 19.5 | 2 | 14.7 | 2 | 19.0 |
| 3 | 16.6 | 3 | 13.7 | 3 | 12.9 |
| 4 | 13.7 | 4 | 11.7 | 4 | 8.0 |
| 5 | 8.6 | 5 | 10.0 | 5 | 4.3 |
| 6 | 5.4 | 6 | 7.1 | 6 | 2.4 |
| 7 | 3.3 | 7 | 5.2 | 7 | 1.0 |
| 8 | 1.6 | 8 | 3.6 | 8 | 0.6 |
| 9 or More | 0.8 | 9 or More | 7 | 9 or More | 0.3 |

¹ Usage in a 1-year period.

² Indicator of how many different medications an individual takes. We estimate that 58 percent of the elderly take 3 or more different medications in a year.

NOTE: All frequencies represent unbiased estimates, however, caution should be noted that frequencies less than 10 percent may have coefficient of variation more than 30 percent.

SOURCE: Medicare Current Beneficiary Survey Cost and Use Data Files, 1996.

dwelling elderly are taking three or more different medications in a year. Given the complexity of prescribing and titrating medications in the elderly, we also examined the number of chronic medications taken in a year (Table 3). Although this estimate is conservative, we still observe that 70 percent of the population are taking at least one chronic medication, and almost 30 percent are taking three or more chronic drugs annually. The large numbers of elderly patients taking multiple medications concurrently raises safety issues since many of the documented patient safety issues are directly related to medication errors (Institute of Medicine, 1999). Pharmaceutical management in elderly patients is more complex than in younger patients and each added medication increases the potential for interactions and adverse events.

Characteristics

Table 4 shows that while there is significant variation in medication use by health status category, use within category does not vary by age group. In Category I,

approximately 14 percent of those under age 75, and 22 percent of both the 75–84 and 85 or over age groups are using three or more medications in a year, with 5 percent in both groups taking three or more chronically. In Category II, between 51 and 54 percent use three or more medications, and between 21 and 23 percent chronically take three or more, an increase of 100 and 300 percent respectively from Category I to Category II. In Category III, between 73 and 77 percent use three or more medications, and between 43 and 46 percent chronically use three or more, a 50 and 100 percent increase respectively from Category II to Category III.

While the number of medications and the number of chronic medications varies little by age group within a health status category, expenditures vary significantly, particularly between the age groups 75–84 and 85 or over. The cost increase is 72 percent in Category I, 77 percent in Category II, and 31 percent in Category III. Since the number of medications taken among the age groups is similar, that the expenditures vary can be attributed to several possible causes including differences in

Table 4
Descriptive Statistics, by Health Status and Age Strata¹ in Community Dwelling Elderly: 1996

| Statistic | Category I ² | | | Age Group Category II ³ | | | Category III ⁴ | | |
|-------------------------------------|-------------------------|-----------|------------|---------------------------------------|-----------|------------|---------------------------|-----------|------------|
| | 65 - 74 | 75 - 84 | 85 or Over | 65 - 74 | 75 - 84 | 85 or Over | 65 - 74 | 75 - 84 | 85 or Over |
| Population | 2,221,448 | 1,161,651 | 194,980 | 6,872,828 | 4,257,538 | 761,696 | 4,889,094 | 5,144,626 | 1,782,128 |
| | Percent | | | | | | | | |
| Beneficiaries | 8.1 | 4.3 | 0.7 | 25.2 | 15.6 | 2.8 | 17.2 | 18.9 | 6.5 |
| Age | 62.1 | 32.5 | 5.4 | 57.8 | 35.8 | 6.4 | 41.4 | 43.5 | 15.1 |
| Health Perception | | | | | | | | | |
| Excellent | 39.8 | 37.2 | 37.7 | 23.7 | 19.1 | 21.6 | 5.9 | 7.8 | 12.5 |
| Very Good | 39.2 | 36.6 | 34.8 | 37.3 | 34.9 | 36.8 | 21.1 | 21.1 | 20.3 |
| Good | 19.1 | 22.1 | 21.1 | 30.0 | 33.2 | 27.6 | 33.8 | 34.7 | 33.6 |
| Fair | 1.7 | 3.4 | 6.4 | 7.4 | 10.9 | 12.8 | 25.3 | 25.3 | 24.4 |
| Poor | 0.2 | 0.7 | 0.0 | 1.5 | 1.8 | 1.1 | 13.8 | 11.0 | 8.3 |
| IADL Deficits | | | | | | | | | |
| 0 | 88.9 | 77.1 | 54.5 | 78.7 | 69.2 | 49.2 | 38.3 | 29.5 | 13.2 |
| 1 | 7.9 | 13.5 | 19.1 | 15.0 | 22.2 | 27.0 | 31.0 | 29.3 | 21.9 |
| 2 | 1.8 | 5.4 | 14.6 | 3.1 | 4.7 | 9.3 | 11.0 | 12.8 | 13.7 |
| 3 or More | 1.4 | 3.9 | 11.8 | 3.2 | 3.8 | 14.5 | 19.7 | 28.4 | 51.3 |
| Income | | | | | | | | | |
| \$10,000 or Less | 13.4 | 16.9 | 26.9 | 15.9 | 21.4 | 31.4 | 25.4 | 28.7 | 45.8 |
| \$10,001–\$25,000 | 38.8 | 55.2 | 46.0 | 41.0 | 47.3 | 49.1 | 47.9 | 48.7 | 38.8 |
| \$25,001–\$50,000 | 33.0 | 21.1 | 20.1 | 31.5 | 24.9 | 15.6 | 21.0 | 17.7 | 12.4 |
| \$50,001 or More | 14.7 | 6.8 | 7.0 | 11.6 | 6.3 | 3.9 | 5.7 | 5.0 | 3.0 |
| | Annual Per Capita Cost | | | | | | | | |
| Total Health Care Cost ⁴ | \$3,530 | \$5,370 | \$10,233 | \$6,822 | \$11,059 | \$13,719 | \$16,981 | \$21,707 | \$33,329 |
| Prescription Drugs | 288 | 396 | 682 | 962 | 1,152 | 2,039 | 1,985 | 2,297 | 3,007 |
| Total Health Care Cost ⁴ | 1,142 | 1,971 | 3,149 | 1,716 | 3,583 | 7,132 | 1,592 | 6,399 | 18,786 |
| | Percent | | | | | | | | |
| No Drug Consumption ⁵ | 45.6 | 40.1 | 33.4 | 12.3 | 8.9 | 9.7 | 3.3 | 3.7 | 5.6 |
| Subclasses⁶ | | | | | | | | | |
| 0 | 45.6 | 40.1 | 33.4 | 12.3 | 8.9 | 9.7 | 3.3 | 3.7 | 5.6 |
| 1 | 22.2 | 17.7 | 20.5 | 15.7 | 16.3 | 14.5 | 7.5 | 7.1 | 9.0 |
| 2 | 13.7 | 16.0 | 19.3 | 18.4 | 17.7 | 21.6 | 11.7 | 10.2 | 11.0 |
| 3 | 7.5 | 6.6 | 9.2 | 16.4 | 17.4 | 15.2 | 10.5 | 14.0 | 14.6 |

Refer to footnotes at end of table.

Table 4—Continued
Descriptive Statistics, by Health Status and Age Strata¹ in Community Dwelling Elderly: 1996

| Statistic | Category I ² | | | Age Group Category II ³ | | | Category III ⁴ | | |
|---------------------------------------|-------------------------|---------|------------|---------------------------------------|---------|------------|---------------------------|---------|------------|
| | 65 - 74 | 75 - 84 | 85 or Over | 65 - 74 | 75 - 84 | 85 or Over | 65 - 74 | 75 - 84 | 85 or Over |
| | Percent | | | | | | | | |
| 4 | 3.4 | 6.7 | 7.2 | 12.6 | 12.1 | 12.3 | 12.9 | 13.4 | 13.2 |
| 5 | 1.9 | 4.0 | 0.9 | 9.2 | 10.0 | 10.6 | 12.3 | 12.4 | 13.6 |
| 6 | 0.7 | 0.9 | 1.2 | 5.6 | 5.7 | 6.6 | 11.1 | 10.4 | 9.0 |
| 7 | 0.5 | 2.5 | 1.5 | 3.3 | 4.4 | 2.9 | 7.8 | 8.2 | 8.2 |
| 8 | 0.2 | 0.3 | 2.2 | 1.8 | 2.2 | 1.9 | 6.3 | 6.6 | 5.5 |
| 9 or More | 0.2 | 0.7 | 0.0 | 2.3 | 2.5 | 2.5 | 16.0 | 13.0 | 9.2 |
| Chronic Subclasses⁶ | | | | | | | | | |
| 0 | 71.4 | 61.3 | 59.5 | 29.7 | 27.3 | 24.7 | 14.3 | 12.6 | 15.5 |
| 1 | 18.2 | 17.8 | 14.9 | 26.6 | 27.3 | 23.7 | 19.6 | 18.9 | 19.9 |
| 2 | 4.9 | 11.1 | 16.3 | 20.6 | 20.5 | 26.6 | 19.2 | 21.9 | 20.3 |
| 3 | 1.0 | 4.0 | 0.0 | 12.1 | 12.8 | 12.0 | 16.6 | 17.4 | 14.9 |
| 4 | 0.2 | 0.8 | 4.2 | 5.0 | 6.0 | 5.0 | 13.0 | 12.9 | 12.2 |
| 5 | 0.0 | 0.2 | 0.0 | 2.0 | 2.0 | 4.2 | 7.6 | 7.9 | 8.3 |
| 6 | 0.0 | 0.0 | 0.6 | 1.3 | 0.7 | 0.8 | 4.5 | 4.4 | 4.6 |
| 7 | 0.0 | 0.3 | 0.0 | 0.1 | 0.5 | 0.2 | 2.3 | 1.7 | 2.5 |
| 8 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.4 | 1.6 | 1.0 | 0.7 |
| 9 or More | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.3 | 0.9 | 0.4 | 0.0 |

¹ Individuals with no drug expenditures for 1996 as recorded in the Medicare Current Beneficiary Survey.

² Zero comorbidities, no ADL difficulty.

³ One-two comorbidities, no ADL difficulty.

⁴ Three or more comorbidities and/or no ADL difficulty.

⁵ Dollars spent in a 1-year period.

⁶ May not total 100 percent due to untranslatables.

NOTES: All frequencies represent unbiased estimates, however, caution should be noted that frequencies less than 10 percent may have coefficient of variation more than 30 percent. ADLS is activities of daily living. IADL is instrumental activities of daily living.

SOURCE: Medicare Current Beneficiary Survey Cost and Use Data Files, 1996.

brands taken and duration of use. Factors influencing these differences may include prescription coverage and income.

Since health status/age strata were defined a priori, the patterns observed in income are striking. Income decreases with age and with declining health status. This is consistent with a large body of literature on the linkage between income and health, including two recently published studies (Deaton, 2002; Marmot, 2002).

Drug Class Use

Table 5 shows prescription drug utilization in the community-dwelling elderly and stratified by health status and age. The percentages represent the percent of beneficiaries in each health status/age stratum who reported taking a drug in each primary class/subclass at least one time during the year. Note that the total of the subclass percentages will generally exceed the class percentage because individuals are taking drugs in multiple subclasses.

Two general observations can be made from the table. First, the use of all classes increases across health status categories. Since the health status categories were developed based on comorbid conditions and difficulty with ADLs, the increase would be expected in drug classes associated with chronic conditions such as diabetic agents and cardiovascular medications. But this increase is also observed in classes such as gastro-intestinal (GI) agents—though GERD nor peptic ulcer disease were used for classification—as well as anti-infectives, narcotic analgesics, and sedatives. This suggests that chronic illness increases overall medication utilization, not just use of medications associated with specific chronic conditions, and that the increase parallels the number of chronic conditions and disabilities. Second, age-

related patterns are more variable than those observed in Table 4. In Table 5, however, we see that prevalence of treatment in the age 85 or over group tends to be less than that of other age groups within a health status category.

Several interesting observations can be made specific to certain classes of drugs. Use of anti-hyperlipidemic agents appears to be low, given the prevalence of hyperlipidemia in the population. The marked decline in use of anti-hyperlipidemics in the age 85 or over group is notable and suggests a reluctance to treat in the oldest old. Likewise, relative to the prevalence of diabetes and depression respectively, the use of diabetic agents and antidepressants appears to be low. The use of calcium channel blockers and non-loop diuretics compared with beta blockers or angiotensin-converting enzyme (ACE) inhibitors is greatest in Category III, suggesting overuse of channel blockers and underuse of beta blockers and ACE inhibitors. Similar concerns exist for benzodiazepines compared with antidepressants. Finally, the prevalence of use of digoxin (inotropic agents), an agent with a very narrow therapeutic window and the potential for toxicity, suggests overuse.

DISCUSSION

This study presents comprehensive descriptive data on the composition of prescription drug use in the community dwelling elderly. Drug use is described for the overall population and among subgroups defined by health status and age. The study quantifies total utilization in terms of number of broad therapeutic classes and the number of more specific drug subclasses. It also indicates variation in utilization across the subgroups. The study addresses the basic questions of how

**Table 5
Drug Class Use, by Health Status and Age Strata in Community Dwelling Elderly: 1996**

| Class/Subclass ¹ | Age Group | | | | | | | | | | | |
|--|------------|-----------|------------|---------|-----------|-------------|---------|-----------|------------|-----------|--------------|------------|
| | Category I | | | | | Category II | | | | | Category III | |
| | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over |
| Population | 27,285,988 | 2,221,448 | 1,161,651 | 194,980 | 6,872,828 | 4,257,538 | 761,696 | 4,889,094 | 5,144,626 | 1,782,128 | | |
| | | | | | | Percent | | | | | | |
| Analgesics | 28.3 | 9.4 | 9.4 | 7.0 | 24.7 | 25.1 | 15.8 | 43.0 | 36.0 | 30.6 | | |
| Narcotic Analgesics | 14.5 | 5.0 | 4.0 | 3.1 | 10.9 | 12.1 | 8.0 | 23.2 | 20.7 | 15.2 | | |
| Non-steroidal Anti-inflammatory Agents | 17.5 | 5.6 | 5.1 | 3.9 | 16.3 | 15.4 | 8.9 | 27.2 | 20.9 | 19.1 | | |
| Other | 1.5 | 0.4 | 1.3 | 0.0 | 0.7 | 1.0 | 0.7 | 3.1 | 2.0 | 1.7 | | |
| Anti-hyperlipidemic Agents | 9.4 | 5.9 | 3.8 | 2.2 | 11.4 | 7.9 | 3.6 | 14.5 | 9.2 | 3.2 | | |
| HMG CoA Reductase Inhibitors | 7.7 | 5.0 | 2.9 | 1.0 | 9.9 | 5.3 | 2.7 | 12.2 | 7.4 | 2.6 | | |
| Other | 2.3 | 1.2 | 1.1 | 1.2 | 2.4 | 2.9 | 0.8 | 3.2 | 2.3 | 0.9 | | |
| Anti-infective Agents | 33.9 | 20.8 | 20.1 | 24.6 | 33.0 | 34.5 | 26.5 | 43.2 | 36.8 | 31.4 | | |
| Anti-neoplastic Agents | 1.9 | 0.8 | 0.5 | 0.0 | 1.6 | 2.0 | 2.7 | 2.6 | 2.4 | 1.4 | | |
| Cardiovascular Agents | 58.8 | 8.5 | 18.4 | 27.2 | 52.6 | 58.5 | 65.2 | 74.6 | 77.4 | 75.4 | | |
| ACE Inhibitors | 15.6 | 0.8 | 0.7 | 5.2 | 13.5 | 11.7 | 12.5 | 22.6 | 23.9 | 19.7 | | |
| Antianginal Agents | 8.4 | 0.6 | 2.1 | 1.0 | 3.3 | 5.8 | 9.9 | 14.5 | 13.8 | 16.5 | | |
| Antiarrhythmic Agents | 1.9 | 0.0 | 0.6 | 0.0 | 1.5 | 2.5 | 2.5 | 2.1 | 2.6 | 3.6 | | |
| Beta Blockers | 14.7 | 2.7 | 4.5 | 5.1 | 14.1 | 14.3 | 11.5 | 21.1 | 17.7 | 15.6 | | |
| Calcium Channel Blockers | 21.8 | 1.5 | 3.7 | 4.4 | 19.1 | 18.3 | 23.4 | 30.3 | 31.8 | 26.8 | | |
| Inotropic Agents | 10.0 | 0.7 | 6.6 | 11.4 | 4.7 | 9.8 | 14.6 | 10.8 | 15.9 | 23.6 | | |
| Loop Diuretics | 12.4 | 0.6 | 3.3 | 9.5 | 6.0 | 7.6 | 12.5 | 18.6 | 20.8 | 28.1 | | |
| Miscellaneous Antihypertensives | 10.6 | 2.2 | 2.6 | 2.9 | 9.8 | 10.7 | 11.2 | 14.7 | 13.9 | 9.3 | | |
| Non-loop Diuretics | 16.3 | 0.6 | 4.3 | 8.1 | 13.7 | 18.0 | 17.7 | 21.0 | 21.8 | 21.2 | | |
| Other | 2.4 | 0.2 | 0.2 | 0.0 | 1.2 | 1.4 | 3.4 | 3.9 | 3.7 | 5.2 | | |
| Central Nervous System Agents | 13.1 | 3.6 | 8.2 | 4.2 | 9.7 | 10.5 | 10.3 | 19.9 | 18.3 | 16.6 | | |
| Anticonvulsants | 2.4 | 1.1 | 1.6 | 1.6 | 1.6 | 1.7 | 1.6 | 3.4 | 3.6 | 2.9 | | |
| Antiemetics | 6.4 | 1.2 | 4.6 | 0.9 | 4.2 | 5.9 | 6.3 | 9.7 | 8.5 | 9.3 | | |
| Muscle Relaxants | 2.8 | 0.6 | 0.4 | 1.7 | 2.8 | 1.7 | 1.1 | 5.3 | 3.6 | 2.0 | | |
| Other | 2.8 | 0.8 | 1.9 | 0.0 | 1.6 | 1.8 | 2.1 | 4.0 | 4.9 | 3.9 | | |
| Coagulation Modifiers | 9.9 | 1.6 | 3.1 | 3.1 | 5.4 | 9.0 | 8.8 | 13.3 | 17.6 | 14.0 | | |
| Coumarins and Indandiones | 5.9 | 1.1 | 3.1 | 1.9 | 3.4 | 5.8 | 3.7 | 8.2 | 10.1 | 7.3 | | |
| Other | 4.4 | 0.5 | 0.3 | 1.2 | 2.2 | 3.2 | 5.0 | 6.3 | 8.2 | 7.1 | | |

Refer to footnotes at end of table.

Table 5—Continued
Drug Class Use, by Health Status and Age Strata in Community Dwelling Elderly: 1996

| Class/Subclass ¹ | Age Group | | | | | | | | | | | | |
|--|------------|-------|------------|-------|-------|-------------|-------|-------|------------|-------|--------------|------------|---------|
| | Category I | | | | | Category II | | | | | Category III | | |
| | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | |
| | | | | | | | | | | | | | Percent |
| Diabetic Agents | 8.6 | 0.0 | 0.0 | 5.3 | 3.9 | 3.1 | 17.0 | 15.7 | 8.7 | | | | |
| Insulin | 1.5 | 0.0 | 0.0 | 0.6 | 0.4 | 0.2 | 3.2 | 3.4 | 0.7 | | | | |
| Sulfonylureas | 7.4 | 0.0 | 0.0 | 4.9 | 3.5 | 2.8 | 14.6 | 12.8 | 8.2 | | | | |
| Gastrointestinal Agents | 17.7 | 6.2 | 9.5 | 13.9 | 15.2 | 14.7 | 24.8 | 24.7 | 21.8 | | | | |
| H2 Antagonists | 10.6 | 2.8 | 6.4 | 7.6 | 8.9 | 10.3 | 16.1 | 14.9 | 12.2 | | | | |
| Proton Pump Inhibitors | 4.2 | 1.4 | 0.6 | 3.4 | 4.2 | 2.3 | 6.1 | 5.6 | 4.6 | | | | |
| Other | 7.0 | 3.4 | 3.7 | 5.8 | 4.6 | 4.6 | 9.6 | 10.4 | 8.5 | | | | |
| Hormones | 23.9 | 12.3 | 10.7 | 23.4 | 21.5 | 21.9 | 31.4 | 26.2 | 26.3 | | | | |
| Adrenal Cortical Steroids | 7.8 | 3.1 | 2.8 | 6.1 | 7.0 | 5.9 | 12.3 | 10.0 | 8.1 | | | | |
| Estrogens/Progestins | 9.5 | 7.0 | 1.2 | 12.7 | 7.9 | 4.6 | 12.4 | 7.7 | 5.1 | | | | |
| Thyroid Drugs | 9.7 | 3.9 | 5.7 | 8.2 | 9.9 | 12.0 | 11.0 | 11.2 | 14.2 | | | | |
| Other | 1.5 | 0.2 | 0.9 | 1.0 | 1.4 | 2.4 | 2.0 | 2.1 | 2.9 | | | | |
| Immunologic Agents | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.2 | 0.2 | | | | |
| Miscellaneous Agents | 7.3 | 1.6 | 2.4 | 6.4 | 5.2 | 5.1 | 10.1 | 11.8 | 8.0 | | | | |
| Antigout Agents | 3.0 | 0.2 | 1.2 | 2.9 | 1.9 | 3.1 | 4.0 | 4.7 | 3.2 | | | | |
| Bisphosphonates | 1.5 | 0.0 | 0.0 | 1.0 | 1.8 | 0.6 | 1.9 | 2.7 | 1.4 | | | | |
| Erythropoietin | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.1 | 0.0 | 0.1 | | | | |
| Other | 3.0 | 1.4 | 1.2 | 2.8 | 1.3 | 1.1 | 4.3 | 4.6 | 3.4 | | | | |
| Psychotherapeutic Agents | 18.0 | 6.8 | 9.6 | 14.8 | 14.1 | 13.3 | 26.9 | 26.8 | 24.5 | | | | |
| Benzodiazepines | 10.4 | 4.1 | 3.4 | 7.9 | 7.9 | 6.5 | 15.8 | 13.9 | 14.2 | | | | |
| Miscellaneous Anxiolytics, Sedatives, Hypnotics | 3.0 | 1.4 | 4.4 | 2.0 | 2.6 | 3.3 | 3.8 | 4.4 | 4.4 | | | | |
| SSRI Antidepressants | 3.6 | 0.9 | 0.6 | 2.6 | 2.8 | 4.3 | 5.9 | 4.7 | 5.4 | | | | |
| Tricyclic Antidepressants | 3.9 | 1.2 | 2.2 | 3.0 | 2.6 | 0.8 | 6.2 | 6.0 | 3.4 | | | | |
| Other Antidepressants | 1.4 | 0.5 | 0.0 | 0.9 | 0.8 | 0.3 | 2.3 | 2.4 | 1.4 | | | | |
| Other | 2.0 | 0.9 | 0.0 | 1.5 | 1.5 | 1.7 | 3.0 | 2.9 | 2.9 | | | | |
| Respiratory Agents | 18.0 | 5.7 | 9.8 | 15.7 | 15.6 | 13.9 | 26.3 | 23.7 | 18.3 | | | | |
| Antihistamines | 5.7 | 2.6 | 2.5 | 6.1 | 4.7 | 6.0 | 7.3 | 7.1 | 4.7 | | | | |
| Inhalants | 8.9 | 1.9 | 3.2 | 5.9 | 6.9 | 6.3 | 15.9 | 12.8 | 10.2 | | | | |
| Methylxanthines | 3.1 | 0.0 | 1.0 | 1.5 | 1.5 | 1.5 | 7.7 | 4.9 | 2.5 | | | | |
| Nasal Steroids | 1.0 | 0.2 | 1.0 | 1.0 | 1.2 | 0.8 | 0.8 | 1.5 | 0.8 | | | | |
| Other | 5.0 | 2.4 | 4.1 | 4.7 | 4.5 | 2.7 | 7.2 | 6.0 | 3.9 | | | | |

Refer to footnotes at end of table.

Table 5—Continued
Drug Class Use, by Health Status and Age Strata in Community Dwelling Elderly: 1996

| Class/Subclass ¹ | Age Group | | | | | | | | | |
|------------------------------|------------|-------|------------|-------------|-------|------------|--------------|-------|------------|------------|
| | Category I | | | Category II | | | Category III | | | |
| | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 65-74 | 75-84 | 85 or Over | 85 or Over |
| | | | | | | | | | | Percent |
| Topical Agents | 17.6 | 15.6 | 15.6 | 14.6 | 18.6 | 19.0 | 19.0 | 22.0 | 20.1 | 18.6 |
| Dermatologic Agents | 7.5 | 6.1 | 4.7 | 6.6 | 6.7 | 8.1 | 8.1 | 9.1 | 5.7 | 6.7 |
| Ophthalmic Preparations | 10.2 | 9.2 | 10.8 | 7.9 | 11.9 | 11.3 | 11.3 | 13.6 | 14.4 | 11.9 |
| Other | 1.2 | 1.0 | 1.2 | 1.0 | 1.2 | 1.0 | 1.0 | 1.4 | 1.3 | 1.2 |
| Vitamin/Mineral/Electrolytes | 11.4 | 3.2 | 3.6 | 6.2 | 8.5 | 11.9 | 11.9 | 17.4 | 24.3 | 8.5 |
| Potassium | 8.7 | 1.5 | 3.6 | 4.3 | 6.0 | 8.8 | 8.8 | 13.9 | 21.5 | 6.0 |
| Other | 3.2 | 1.7 | 0.6 | 2.0 | 2.8 | 3.8 | 3.8 | 4.3 | 3.9 | 2.8 |

¹ Total of subclass percentages will generally exceed class percentage because individuals are taking multiple drugs across subclasses.

NOTE: All frequencies represent unbiased estimates, however, the reader is cautioned that frequencies less than 10 percent may have coefficient of variation more than 30 percent.

SOURCE: Medicare Current Beneficiary Survey Cost and Use Data Files, 1996.

heterogeneous the elderly are with respect to health status, how drug utilization differs among health/age strata, what classes of drugs are being taken, and in what quantity.

These data represent use of drugs in 1996 and do not reflect new subclasses of drugs (e.g., cyclooxygenase-2 inhibitor, newer oral agents for diabetes, etc.) which have been introduced more recently. The analyses conducted here, however, can be readily applied to reflect the most recent patterns of use as new data become available.

MCBS relies on self-report which underestimates utilization by 5 percent, compared with 15–20 percent in other survey-collected data sets (Berk, Schur, and Mohr, 1999). It is unlikely with the possible exception of psychiatric drugs that the underreporting would lead to a biased distribution of use among subcategories. Also, that we excluded fills where drug name was not available (approximately 10 percent of fills on the drug file) leads to underestimation of use.

In the development of our drug classification scheme, we made compromises between clinical precision at the level of any individual's drug consumption, and a classification that could be applied across the population. Our approach does not assess use of multiple drugs within a subcategory, and thus, does not give a complete accounting of overall drug use. For example, since we are not able to distinguish between sequential drug switching and concurrent use, we decided that if an individual were taking two seemingly substitutable agents, such as two antihyperlipidemics or two forms of insulin, then at the subclass level these drugs would be counted as one. In the case of antihyperlipidemics, the algorithm is appropriate because the more likely scenario is drug switching. In the case of insulin, however,

an individual may take two agents concurrently. We would, in this case, therefore, underrepresent the number of medications. The direction of bias is consistently that of underestimation.

The primary objective of the study was to define subgroups in the elderly using health and functional status to demonstrate the heterogeneity of the population in its burden of illness and the associated variability in medication use patterns. Population subgroups have grossly different prescription drug utilization. In health status Category III (three or more comorbidities and/or difficulty with any ADL) we estimate conservatively that upwards of 40 percent of the population is taking three or more chronic medications and is spending between \$2,000 and \$3,000 per year on prescription drugs. Additionally, based on prevalence of chronic conditions, chronic medications are underutilized (Table 5). Conversely, 22 percent or less of those in health status Category I (zero comorbidities, no difficulty with ADLs) are taking three medications in a year. Very few take the medications chronically, and they have drug expenditures of less than \$700 per year.

The impact of insurance coverage on prescription drug use is significant. In a study that also used 1996 MCBS data files, it was found that persons without drug coverage had on average five fewer prescriptions and expenditures 40 percent lower than their counterparts with drug coverage (Poisal and Chulis, 2000). The same study found that this gap in use between covered and uncovered beneficiaries widens as functional status declines and poverty increases. Our study builds on these findings by stratifying the population into health status/age categories and describing the differences in expenditures and use within and across the categories.

Medicare drug benefit proposals will have substantially different consequences on individuals depending on their particular health status; as issues of eligibility, caps on annual expenditures, copays, and what will be covered are explored, understanding the variability of drug utilization in the community-dwelling elderly should help policymakers improve the quality of and access to pharmacologic therapy in the elderly.

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