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# Applying the 2003 Beers Update to Elderly Medicare Enrollees in the Part D Program

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**Background:** Inappropriate prescribing of certain medications known as Beers drugs may be harmful to the elderly, because the potential risk for an adverse outcome outweighs the potential benefit.
**Objectives:** (1) To assess Beers drug use in dual enrollees compared to non-duals; (2) to explore the association between dual enrollment status and Beers use, controlling for the effects of age, gender, race/ethnicity, census region, and health status; (3) to assess which medication therapeutic category had the highest Beers use.
**Design:** Cross sectional retrospective review of 2007 Centers for Medicare & Medicaid Service Part D data. Potentially inappropriate medication use was assessed, independent of diagnosis, using the 2003 update by Fick et al.
**Findings:** The likelihood of Beers drug use among duals approximates that of non-duals (OR 1.023, 95% CI 1.020–1.026). Characteristics associated with the receipt of a Beers medication include Hispanic origin, younger age, female gender, poor health status, and residence outside of the U.S.' Northeast region. Genitourinary products had the highest Beers use within medication therapeutic categories among both dual and non-dual enrollees (21.1% and 19.9%, respectively).
**Conclusions:** Part D data can be successfully used to monitor Beers drug use. With adjustments for several important and easily measured demographic, health, and prescription drug use covariates, Beers drug use appears to be as common among non-dual enrollees as it is among dual enrollees in the Part D program. New Part D drug utilization policies that apply to all beneficiaries may need to be enacted to reduce Beers drug use.

**Keywords:** Medicare, Part D, Elderly, Beers, Prescribing

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## Introduction

Inappropriate prescription medication use in the elderly can result in intense medical and safety problems. Elderly patients are more susceptible to medication-induced health complications, such as depression, falls, hip fractures, and confusion, because of their poorer health status, a greater potential to receive multiple medications, and differences in how the body absorbs, metabolizes, and eliminates a medication (Bootman, Harrison, & Cox, 1997; Hanlon et al., 1997; Shrank, Polinski, & Avorn, 2007) The Beers Criteria for potentially inappropriate medication use in older adults have been used widely to identify medications that may be inappropriately prescribed for older adults (Beers, 1997; Fick et al., 2003; Blackwell, Ciborowski, Baugh, & Montgomery, 2008). Several studies indicate that medications meeting the Beers Criteria, known as Beers drugs, are particularly harmful to the elderly (U.S. General Accounting Office 1995; Blackwell, Ciborowski, Baugh, & Montgomery, 2008). Blackwell *et al* (2008) estimated that approximately 47% of elderly Medicare enrollees who were dually enrolled in Medicare and Medicaid received a potentially inappropriate medication.[1]

In 2006, all Medicare beneficiaries were given the opportunity to participate in Medicare Part D, while the low income, elderly and disabled dual enrollees were automatically placed in Part D (The Henry J. Kaiser Family Foundation, 2011). Medicare is administered directly by the federal government, using a uniform set of national guidelines and rules that apply to enrollees regardless of residence. This uniformity allows the Centers for Medicare & Medicaid Services (CMS) to monitor, on a continual basis, the use of Beers drugs in the Part D program. Conversely, prior to implementation of the Part D program, prescription drug coverage for elderly dual enrollees was a states-administered conglomeration of programs that, by its very nature, made it difficult to rule out differences in one state's drug coverage rules compared to another state. The Medicare Part D program presents an opportunity to examine the use of Beers drugs among both dual enrollees and non-dual enrollees.

Previous studies addressing Medicare elderly enrollees have relied on Medicaid data, which was limited to dual enrollees—a population comprised of many individuals who are sick and frail, with substantial health needs (The Henry J. Kaiser Family Foundation, 2004). Thus, findings from these prior studies may have disproportionately represented Beers drug use among the elderly. The results of this study can be compared to those of previous studies to determine whether non-dual Medicare enrollees have Beers drug utilization similar to dual enrollees.

By examining Medicare's national enrollment and claims data, following implementation of the Part D program, policy makers will have more information at their disposal to assess the impact of continued Beers drugs use among all Medicare—dual and non-

[1]Prior to 2006, duals received drug coverage through Medicaid. Blackwell *et al*'s (2008) findings were based on analysis of pre-2006 Medicaid data.

dual—Part D medication recipients. They can use our findings about Beers drug utilization, within and between the two groups, to formulate improved policies in the Part D program. Part D plans may use the information to take a more active role in assisting practitioners with patient safety through improved medication therapy decisions.

Our primary research question was to assess Beers drug use in the dual enrollee population compared to the non-dual enrollee population. Our second question was to assess which medication therapeutic category had the highest percentage of Beers drug use. Our third question was to explore the association between dual/non-dual enrollment status and Beers drug use in the elderly, controlling for the effects of age, gender, race/ethnicity, census region, and health status.

## Methodology

### Data

Calendar year 2007 data were obtained from the Medicare Enhanced Denominator file (or simply, Denominator file), which provided dual eligibility status, age, gender, and race/ethnicity data. The Medicare Part D prescription drug event (PDE) files provided the National Drug Code (NDC) for each prescription fill. The NDC was linked using the Medi-Span® therapeutic classification system to identify Beers medications and medication therapeutic categories (Wolters Kluwer Health, 2010). Lastly, CMS' Hierarchical Condition Category (CMS-HCC) prospective risk score model (i.e., the health risk adjuster) provided beneficiary risk scores.

### Methods

We employed a cross-sectional design. Using the Denominator file, we selected beneficiaries (irrespective of medication use) who would have attained age 65 as of December 31, 2007, and who were enrolled in Medicare Part D for the entire 2007 calendar year, and identified those who were dual enrollees and those who were non-dual enrollees (Exhibit 1). Enrollees who did not have a full twelve months of participation in Medicare Part D in 2007 were not selected in order to more accurately measure the effects of dual eligibility. From the selected population, dual/non-dual enrollees having at least one medication fill within calendar year 2007 were retained, and comprised our study population for subsequent analysis.

**Exhibit 1. Number (%) of Medicare Part D Enrollees[1], Part D Medication Recipients[2], and Part D Beers Medication Recipients[3] by Dual Eligibility Status, Gender, Age Group, Race/Origin, and Recipient Disease/Prescription Burden, 2007, Age 65 and Over**

| | Medicare Part D Enrollees | | Medicare Part D Medication Recipients | | Medicare Part D Beers Medication Recipients | |
|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[4] | Non-Dual[5] | Dual[4] | Non-Dual[5] | Dual[4] | Non-Dual[5] |
| *Total Enrollees* | 4,087,132 | 13,640,634 | 3,842,987 | 12,711,537 | 1,641,024 | 4,237,056 |
| Dual + Non-Dual | 17,727,766 | | 16,554,524 | | 5,878,080 | |
| *Characteristic* | | | | | | |
| Gender | | | | | | |
| Female | 2,896,156 | 8,231,834 | 2,773,385 | 7,782,019 | 1,233,222 | 2,867,030 |
| | 71% | 60% | 72% | 61% | 75% | 68% |
| Male | 1,190,976 | 5,408,800 | 1,069,602 | 4,929,518 | 407,802 | 1,370,026 |
| | 29% | 40% | 28% | 39% | 25% | 32% |
| Age Group | | | | | | |
| 65–74 | 1,712,519 | 6,689,743 | 1,589,583 | 6,135,394 | 722,766 | 2,069,865 |
| | 42% | 49% | 41% | 48% | 44% | 49% |
| 75–84 | 1,535,344 | 5,063,791 | 1,447,053 | 4,776,125 | 609,035 | 1,595,984 |
| | 38% | 37% | 38% | 38% | 37% | 38% |
| 85+ | 839,269 | 1,887,100 | 806,351 | 1,800,018 | 309,223 | 571,207 |
| | 21% | 14% | 21% | 14% | 19% | 13% |
| Race/Ethnic Origin | | | | | | |
| Black | 739,692 | 838,651 | 692,531 | 748,908 | 297,600 | 256,796 |
| | 18% | 6% | 18% | 6% | 18% | 6% |
| Hispanic | 349,581 | 208,963 | 323,349 | 187,500 | 140,500 | 78,236 |
| | 9% | 2% | 8% | 1% | 9% | 2% |
| Other | 476,511 | 409,429 | 447,666 | 365,682 | 171,045 | 96,665 |
| | 12% | 3% | 12% | 3% | 10% | 2% |
| White | 2,521,348 | 12,183,591 | 2,379,441 | 11,409,447 | 1,031,879 | 3,805,359 |
| | 62% | 89% | 62% | 90% | 63% | 90% |
| Region | | | | | | |
| Midwest | 715,288 | 3,136,893 | 672,029 | 2,915,818 | 266,321 | 896,928 |
| | 18% | 23% | 17% | 23% | 16% | 21% |
| Northeast | 834,093 | 2,462,599 | 786,330 | 2,290,672 | 275,215 | 595,704 |
| | 20% | 18% | 20% | 18% | 17% | 14% |
| South | 1,586,864 | 4,571,109 | 1,501,861 | 4,306,873 | 723,836 | 1,643,208 |
| | 39% | 34% | 39% | 34% | 44% | 39% |
| West | 948,002 | 3,183,830 | 877,734 | 2,935,617 | 373,637 | 965,582 |
| | 23% | 23% | 23% | 23% | 23% | 23% |
| Other | 2,885 | 286,203 | 5,033 | 262,557 | 2,015 | 135,634 |
| | 0% | 2% | 0% | 2% | 0% | 3% |

| Exhibit 1 (cont.) | Medicare Part D Enrollees | | Medicare Part D Medication Recipients | | Medicare Part D Beers Medication Recipients | |
|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[4] | Non-Dual[5] | Dual[4] | Non-Dual[5] | Dual[4] | Non-Dual[5] |
| Disease Burden[6] | | | | | | |
| High | . | . | 1,581,353 | 2,535,709 | 754,683 | 1,020,108 |
| | | | 41% | 20% | 46% | 24% |
| Medium–High | . | . | 1,280,618 | 3,001,627 | 528,711 | 1,046,342 |
| | | | 33% | 24% | 32% | 25% |
| Medium–Low | . | . | 809,137 | 3,161,885 | 296,085 | 980,086 |
| | | | 21% | 25% | 18% | 23% |
| Low | . | . | 171,836 | 4,008,857 | 61,527 | 1,188,915 |
| | | | 5% | 32% | 4% | 28% |
| Missing | . | . | 43 | 3459 | 18 | 1,605 |
| | | | 0% | 0% | 0% | 0% |
| Prescription Burden[7] | | | | | | |
| High | . | . | 1,920,713 | 2,136,493 | 1,011,792 | 1,094,577 |
| | | | 50% | 17% | 62% | 26% |
| Medium–High | . | . | 904,573 | 3,178,394 | 357,443 | 1,294,605 |
| | | | 24% | 25% | 22% | 31% |
| Medium–Low | . | . | 568,285 | 3,641,130 | 180,503 | 1,153,533 |
| | | | 15% | 29% | 11% | 27% |
| Low | . | . | 449,416 | 3,755,520 | 91,286 | 694,341 |
| | | | 12% | 30% | 6% | 16% |

[1]A Medicare Part D enrollee is a beneficiary enrolled for the entire 12 months in a Medicare Part D program and who is eligible to receive Medicare Part D prescription benefits, whether or not the individual received a prescription in 2007.
[2]A Medicare Part D recipient is a beneficiary enrolled for the entire 12 months in a Medicare Part D program and received at least one medication in 2007.
[3]A Medicare Part D Beers medication recipient is a Part D enrollee who received at least one Beers drug in 2007, based on the Fick update (Fick et al., 2003). Legend drugs considered inappropriate based on dose were excluded from this analysis.
[4]Beneficiaries enrolled in Part D for the entire twelve months as dual enrollees for calendar year 2007.
[5]Beneficiaries enrolled in Part D for the entire twelve months as non-dual enrollees for calendar year 2007.
[6]Disease burden based on hierarchical condition category risk scores acquired from the Centers for Medicare & Medicaid Services. Derivation based on quartiles.
[7]Prescription burden based on total number of prescriptions filled per enrollee during calendar year 2007. Derivation based on quartiles.
SOURCE: Medicare Denominator file.

We initially report the population characteristics of dual status in addition to census region, gender, age group, race/ethnicity, and health status (i.e., as disease burden and prescription burden). Regional assignment was based on United States Census regions (U.S. Department of Economics and Statistics Administration, U.S. Census Bureau, 2010) using the Social Security Administration's (SSA) state code of residence of the beneficiary (ResDAC, 2009). State codes identifying beneficiary residence outside of the continental United States were classified as "other."

Race/ethnicity assignment was made using race code designations (ResDAC, 2009). We divided race/ethnicity into the groups of Black, Hispanic, White, and Other. Due to small numbers of beneficiaries in the categories coded in the Denominator file as Asian/Pacific

Islander, American Indian/Alaska Native, Unknown, and Other, these beneficiaries were combined into our Other category.

To evaluate health status, we employed the two variables of disease burden and prescription burden. Disease burden was assigned to the study population using the CMS-HCC prospective risk score model for calendar year 2007 (U.S. Department of Health and Human Services, 2011). The model is a risk adjustment model used for Medicare Part C reimbursement. The CMS-HCC model, updated yearly, uses demographics and a diagnosis-based medical profile, captured during all inpatient and outpatient clinician encounters the previous year, to produce a health-based measure of future medical expenditures. The HCC score is normalized to the extent that 1.0 means a beneficiary is expected to have expenditures of the average Fee-for-Service Medicare beneficiary. The model is used to predict cost of care for an individual in a given year, even though it does not explicitly reflect how sick an individual may be in a given year. For the study, we use the model as a proxy for disease burden with the realization of this limitation. We divided disease burden into the quartile groups, having scores of low (0–0.543), medium-low (0.544–0.842), medium-high (0.843–1.452), and high (1.453 and over).

We defined prescription burden as the calculated total number of original and refill prescriptions filled—a definition we use throughout this paper—per enrollee during calendar year 2007. We divided prescription burden into the quartile groups of low (0–17), medium-low (18–35), medium-high (36–64), and high (65 and over).

Beers drug identification was based on the criteria addressed by the Fick et al. (2003) update. Beneficiaries who received any medication defined by Fick et al. (2003) as being potentially inappropriate, independent of diagnoses or conditions, were classified as having potentially inappropriate use. Because we did not capture dosing information from our data, dose limited medications identified by Fick et al. (2003) were not included in the analysis.

## Analysis

Population characteristics were initially assessed followed by an individual-level logistic regression analysis. We then assessed the percentage of Beers prescription fills against all prescription fills based on medication therapeutic category. Population characteristics for the calendar year 2007 study population are reported as follows:

1) Enrollees are the unique Part D beneficiaries (with or without medication use).
2) Medication Recipients are unique Part D enrollees who received at least one prescription medication.
3) Beers Medication Recipients are unique Part D enrollees who received at least one Beers drug.

The logistic regression analyses were limited to medication recipients having a risk score in order to more accurately measure the effects of disease burden. To perform the logistic regression analyses, we first constructed an outcome variable that identifies whether or not an

enrollee was a Beers medication recipient. Enrollee demographics (viewed as risk factors) were used as predictor variables. In conducting each logistic regression analysis, the null hypothesis for a common odds ratio analysis applied—there is no statistically significant difference among the groups under study in terms of receiving a Beers medication. Results for the odds ratio analyses were reported as odds ratios (OR) along with *p* values and 95% confidence intervals (CIs). Analyses of the data were performed using SAS® software (SAS Institute Inc., 2010). The SAS® PROC LOGISTIC procedure was utilized to perform the logistic regression analyses.

To assess the percentage of Beers prescription fills to all prescription fills by medication therapeutic category, we retained any prescription fill for all Beers and non-Beers medications belonging to one of the nine medication categories previously addressed by Blackwell *et al* (2008) as Beers categories. These nine categories were analgesics and anesthetics, cardiovascular agents, central nervous system drugs, endocrine and metabolic drugs, gastrointestinal agents, genitourinary products, hematological agents, neuromuscular drugs, and respiratory agents. We compared the number of Beers prescription fills to all prescription fills in each of the nine therapeutic drug categories to demonstrate which category had the highest Beers drug utilization.

## Results

### Population Characteristics

As shown in Exhibit 1, 17.7 million elderly Medicare Part D enrollees were in the program through calendar year 2007 as either a dual enrollee for the entire twelve months or a non-dual enrollee for the entire twelve months. These enrollees comprised beneficiaries with or without medication use during calendar year 2007. The largest proportion of enrollees were White (83%) females (63%), aged 65–74 years old (47%), who lived in the South region (35%). The 13.6 million non-dual enrollees (77% of total enrollees) outnumbered the dual enrollees (4.0 million) more than three to one.

Of the 17.7 million elderly enrollees (Exhibit 1), approximately 16.6 million or 93% received at least one medication in calendar year 2007. The largest percentage of recipients were White (83%) females (64%), aged 65–74 years old (47%), who lived in the South region (35%), who were of medium-high disease burden (26%) and medium-low prescription burden (25%). Three times as many non-dual beneficiaries received medications compared to dual beneficiaries who received medications (12.7 million and 3.8 million, respectively). Dual beneficiaries were approximately equal to non-dual beneficiaries regarding the percentage of medication recipients to enrollees (94% and 93%, respectively).

Of the 16.6 million elderly medication recipients in calendar year 2007, 5.9 million or 35.5% received Beers medication (Exhibit 1). The Northeast region had the lowest percentage of Beers recipients (15%) whereas the South region had the highest (40%). Two and one-half times as many non-dual beneficiaries as dual beneficiaries received a Beers medication (72% and 28%,

respectively). Female gender, elderly age (i.e., 65 to 74 year old elderly), White race/ethnic origin, high disease burden, and high prescription burden were characteristics found associated with Beers use.

## Logistic Regression Analysis

Exhibit 2 presents the results of the individual-level odds ratio analysis to assess the likelihood of a medication recipient to receive a Beers drug based on dual enrollment status, controlling for the effects of age, gender, race/ethnicity, census region, and health status. We found that dual enrollee medication recipients were just slightly more likely to receive a Beers medication compared to non-dual enrollee recipients (OR 1.023, 95% CI 1.020–1.026), holding all other independent variables constant. Medication recipients residing in any of the remaining regions were more likely to be a Beers medication recipient compared to the Northeast region. Female gender, high disease burden, and high prescription burden were also associated with a higher likelihood of receiving a Beers medication compared to their respective counterparts. Counter to our population characteristic findings, we found that increased elderly age (i.e., 75 to 84 age group and 85+ age group) had a decreased likelihood of receiving a Beers medication compared to the younger elderly (i.e., the 65–74 age group). Hispanics were found to be more likely compared to Whites (OR 1.100, 95% CI 1.093–1.107) to receive a Beers medication, whereas Blacks were slightly less likely to receive a Beers medication compared to White beneficiaries (OR 0.960, 95% CI 0.956–0.963).

**Exhibit 2: Individual-Level Multivariate Logistic Regression Model Predicting Beers[1] Drug Use for Medicare Part D Medication Recipients[2] Age 65 and Over, 2007**

| Characteristic | | Odds Ratio[3,4] Point Estimate | Wald Chi-Square | *p* value | 95% Wald Confidence Limits | |
|---|---|---|---|---|---|---|
| Region | | | | | | |
| | Midwest | 1.217 | 12408.699 | <0.0001 | 1.213 | 1.221 |
| | South | 1.685 | 108646.680 | <0.0001 | 1.680 | 1.690 |
| | West | 1.582 | 69182.337 | <0.0001 | 1.577 | 1.588 |
| | Other | 2.857 | 58786.921 | <0.0001 | 2.833 | 2.882 |
| | Northeast | 1.0— | | | | |
| Dual Enrollee Status | | | | | | |
| | Dual Enrollee | 1.023 | 255.526 | <0.0001 | 1.020 | 1.026 |
| | Non-Dual Enrollee | 1.0— | | | | |
| Age | | | | | | |
| | 85+ | 0.647 | 66689.701 | <0.0001 | 0.644 | 0.649 |
| | 75–84 | 0.834 | 21911.636 | <0.0001 | 0.832 | 0.836 |
| | 65–74 | 1.0— | | | | |

| Exhibit 2 (cont.) Characteristic | | Odds Ratio[3,4] Point Estimate | Wald Chi-Square | *p* value | 95% Wald Confidence Limits | |
|---|---|---|---|---|---|---|
| Race/Ethnic Origin | | | | | | |
| | Black | 0.960 | 447.149 | <0.0001 | 0.956 | 0.963 |
| | Hispanic | 1.100 | 923.360 | <0.0001 | 1.093 | 1.107 |
| | Other | 0.835 | 4639.998 | <0.0001 | 0.831 | 0.840 |
| | White | 1.0— | | | | |
| Gender | | | | | | |
| | Female | 1.349 | 65217.890 | <0.0001 | 1.346 | 1.352 |
| | Male | 1.0— | | | | |
| Disease Burden[5] | | | | | | |
| | High | 1.147 | 5872.231 | <0.0001 | 1.143 | 1.151 |
| | Medium–High | 1.030 | 310.365 | <0.0001 | 1.027 | 1.034 |
| | Medium–Low | 0.954 | 809.500 | <0.0001 | 0.951 | 0.957 |
| | Low | 1.0— | | | | |
| Prescription Burden[6] | | | | | | |
| | High | 4.531 | 691353.773 | <0.0001 | 4.515 | 4.547 |
| | Medium–High | 2.909 | 339165.765 | <0.0001 | 2.899 | 2.918 |
| | Medium–Low | 2.013 | 176669.525 | <0.0001 | 2.007 | 2.020 |
| | Low | 1.0— | | | | |

[1]Legend drugs considered inappropriate based on dose were excluded from this analysis (Fick et al., 2003).
[2]A Medicare Part D medication recipient is a Part D enrollee who received at least one medication in 2007.
[3]Max-rescaled $R^2 = 0.1125$. c = 0.673.
[4]Higher ratio (>1) = greater odds for receiving a Beers medication.
[5]Disease burden based on hierarchical condition category risk scores acquired from the Centers for Medicare & Medicaid Services. Derivation based on quartiles.
[6]Prescription burden based on total number of prescriptions filled per enrollee during calendar year 2007. Derivation based on quartiles.
SOURCE: Medicare Part D Prescription Drug Event and Medicare Denominator files.

## Beers Prescriptions

There were 36.2 million Beers prescriptions filled for our study population (Exhibit 3). Non-dual beneficiaries received a larger number of Beers prescriptions compared to dual beneficiaries (22.8 million and 13.4 million, respectively). Within group, non-dual enrollees also received a higher percentage of Beers prescriptions compared to dual enrollees (5.2% and 4.8%, respectively). Genitourinary products had the highest Beers use within medication therapeutic category among both dual and non-dual enrollees (21.1% and 19.9%, respectively).

**Exhibit 3. Beers[1] Filled Prescriptions as a Percentage of All Filled Prescriptions[2] by Therapeutic Category[3], 2007.**
**Based on Dual Enrollee Status for Part D Medication Recipients[4] Age 65 and Over**

| | Dual Enrollee Medication Recipients | | Non-Dual Enrollee Medication Recipients | |
|---|---|---|---|---|
| Therapeutic Category [5] | Total Number of Prescriptions Filled | Percentage of Total Filled that were Beers Prescriptions | Total Number of Prescriptions Filled | Percentage of Total Filled that were Beers Prescriptions |
| Analgesics and Anesthetics | 23,501,291 | 6.4% | 32,354,985 | 6.7% |
| Cardiovascular Agents | 110,069,016 | 2.9% | 209,670,439 | 2.6% |
| Central Nervous Syst. Drugs | 33,450,681 | 10.5% | 37,154,453 | 15.2% |
| Endocrine & Metabolic Drugs | 41,369,345 | 1.8% | 71,454,498 | 4.0% |
| Gastrointestinal Agents | 24,397,356 | 2.5% | 25,551,378 | 3.6% |
| Genitourinary Products | 6,791,797 | 21.1% | 12,115,859 | 19.9% |
| Hematological Agents | 12,047,463 | 1.0% | 18,478,252 | 1.9% |
| Neuromuscular Drugs | 11,231,617 | 11.3% | 12,483,831 | 16.2% |
| Respiratory Agents | 15,662,217 | 6.5% | 19,504,294 | 4.8% |
| All Categories | 278,520,783 | 4.8% | 438,767,989 | 5.2% |

[1]Legend drugs considered inappropriate based on dose were excluded from this analysis (Fick et al., 2003).
[2]Filled prescriptions include both original prescriptions and refills.
[3]Medi-Span® is a product of Wolters Kluwer Health. See http://www.wkhealth.com for details.
[4]A Medicare Part D medication recipient is a Part D enrollee who received at least one medication in 2007.
[5]All Beers drugs included in this analysis were classified into one of these nine categories (Blackwell et al., 2008).
SOURCE: Medicare Part D Prescription Drug Event and Medicare Denominator files.

## Discussion

Our findings can be grouped into three areas. First, the likelihood of Beers medication use among non-duals approximates that of duals for our study population. Second, characteristics associated with the receipt of a Beers medication in our study population include Hispanic origin, younger age, female gender, poor health status, and residence outside of the U.S.' Northeast region. Third, our findings support previous findings regarding genitourinary products having the highest within therapeutic category use.

When modeling the probability of receiving a Beers medication in our regression model, based on *a priori* independent variables, we found that duals had only a slightly greater likelihood of receiving a Beers medication compared to non-duals for our study population. This finding adds to the literature by suggesting that Beers medication use among non-duals approximates that of duals for our study population. This finding is important in that it suggests that Part D plans can use similar tools/techniques to reduce Beers use among non-duals and duals.

Our findings also indicate an association between some demographic variables and the likelihood of receiving a potentially inappropriate medication. Such variables include Hispanic origin, female gender, residence in the South region, advanced age, and poor health status.

Literature addressing the prescribing of Beers medications based on racial/ethnic origin has been inconclusive. Piecoro, Browning, Prince, Ranz, and Scutchfield (2000) and Zhan *et al.* (2001) suggest that Black beneficiaries are at a lower risk for receiving a potentially inappropriate medication compared to other ethnic groups. Blackwell *et al.* (2008) suggests that inappropriate medication prescribing in Blacks more closely approximates that of Whites. Differences among these findings may be attributed to the different versions of the Beers list used when conducting the analysis. The Piecoro *et al.* (2000) and Zhan *et al.* (2001) studies were conducted prior to the release of the Fick *et al* (2003) update to the previous Beers list, whereas the Blackwell *et al.* (2008) study used the Fick *et al* (2003) update. Our current findings agree with the Blackwell *et al*'s (2008) findings. Using the Fick *et al* (2003) update, we found that Blacks were slightly less likely to receive a Beers medication compared to Whites. We also found Hispanics to be more likely to receive a Beers medication compared to Whites, which also agrees with Blackwell *et al.*'s (2008) previous finding. Thus, the gap may be closing regarding the differential use of Beers medications based on race/ethnic origin between Whites and Blacks, when comparisons are made using the Fick *et al* (2003) update, but continues to exist between Whites and Hispanics.

We also found that female gender is associated with an increased likelihood of potentially inappropriate prescribing relative to males for our study population. This finding agrees with previous studies performed prior to the Fick update (Zhan *et al.,* 2001; Piecoro *et al.,* 2000; Meredith *et al.,* 2001; Fick *et al.,* 2001) as well as following the Fick update (Blackwell *et al.,* 2008).

Regarding region of residence, previous research addressing characteristics associated with a *decreased* likelihood of receiving inappropriate medications may include living in the Northeast, whereas an *increased* likelihood of receiving inappropriate medications may include living in the South (Mort & Aparasu, 2000; Rothberg *et al.,* 2008). Our findings agree. Prescribing practices by region do not appear to have changed since earlier studies. Prescribing behavior in the Northeast region continues to remain less problematic, for which further exploration may prove most fruitful.

Studies addressing the impact of age on Beers medication use have been inconclusive. One study found the odds of inappropriate prescribing increased with age when assessing only psychotropics (Mort & Aparasu, 2000); others have found the odds decreased with age when assessing total medication use (Piecoro *et al.*, 2000; Rothberg et al., 2008). By assessing total medication use, we also found that as age increased, the likelihood of receiving a Beers medication decreased. This finding suggests that prescribers continue to avoid prescribing potentially inappropriate medications to the eldest of the elderly.

Health status has been assessed in previous studies and is considered to be a potential risk factor for inappropriate prescribing—as health status decreases, the risk of inappropriate prescribing may increase (Chin *et al.,* 1999; Zhan *et al.,* 2001; Gallagher, Barry, Ryan, Hartigan, & O'Mahony, 2008). When assessing health status based on disease burden and prescription burden, we also found a potential difference between the use of Beers medication among those with poor health status compared to those with better health status.

Regarding the mix of Beers medications by therapeutic category, we found that for both duals and non-duals, genitourinary agents had the highest percentage of Beers prescriptions filled to total prescriptions by therapeutic category. In a similar study using 2003 state Medicaid data for dual eligibles, a pre-Part D study, Blackwell *et al* (2008) reported genitourinary products as having the highest percentage. Thus, our finding suggests that prescribing practices for genitourinary products have not changed since the previously reported work.

## Limitations

First, Part D event data do not capture all medications provided to elderly enrollees, thereby possibly resulting in undercounts of numbers of prescriptions and payments. For example, prescription medications provided to enrollees during a hospital stay are not captured, because they are specifically excluded by statute. Also, prescription medications paid for by other payers (for example, the Department of Veterans Affairs) or the enrollee are not captured. Furthermore, variation in coverage determinations by Part D sponsors exists.

Second, findings based on our study population may not be representative of the population as a whole. We cannot generalize our findings to the Medicare population as a whole, since we studied only elderly medication recipients in 2007 having either twelve months of dual coverage or twelve months of non-dual coverage.

Third, medications believed to be problematic in our study population may be considered appropriate by the prescribing practitioner for a particular patient on a case-by-case basis. In this instance, prescribing the Beers medication is not indicative of lesser quality care.

Fourth, we construed the CMS-HCC risk scores as a proxy for patient disease burden, although they were originally developed as a measure of capitated payment prediction in Medicare Part C. However, these scores have been used previously as a measure of disease burden (Blackwell, Baugh, Montgomery, Ciborowski, & Levy, 2011) and compare favorably with the Charlson and Elixhauser methods as risk adjusters for mortality (Li, Kim, & Doshi, 2010).

## Conclusion

The Part D program offers an opportunity for incorporation of the Beers criteria into current tools, such as formularies, utilization tools (e.g., prior authorization), and medication therapy management programs that may be further developed to assist in ensuring appropriate

prescribing for older patients. Following the program's implementation, CMS has been monitoring the use of Beers medications in the Part D program (C. Tudor, Ph.D., Director, Medicare Drug Benefit and C & D Data Group, Center for Medicare & Medicaid Services, personal communication, October 5, 2010). With uniformity in program administration, a better understanding of risk factors associated with the prescribing of Beers medications in the Part D population can now be acquired. Our finding that poor health status is associated with a higher likelihood of Beers use is problematic. Future studies assessing this phenomenon, particularly focusing on a specific disease state/clinical condition, appear warranted in order to provide policymakers and Part D plans with additional information. Given that there are medication alternatives for most patients, our study findings should provide additional information for policy makers as they continue to monitor the Part D program.

With adjustment for several important and easily measured demographic, health, and prescription drug use covariates, Beers drug use appears to be as common among non-dual enrollees as it is among dual enrollees in the Part D program. New Part D drug utilization policies that apply to all beneficiaries might be enacted to reduce Beers drug use. With this knowledge, Part D plans may be able to take a more active role in assisting practitioners with patient safety through improved medication therapy decisions.

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## Appendix

**Exhibit 4. Number of Medicare Part D Enrollees[1] and Percent by Dual Eligibility Status, Gender, Age Group, Origin, and Region, 2007. Age 65 and Over**

| *Region* | Midwest | | Northeast | | South | | West | | Other | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | All |
| *Total Enrollees* | 715,288 | 3,136,893 | 834,093 | 2,462,599 | 1,586,864 | 4,571,109 | 948,002 | 3,183,830 | 2,885 | 286,203 | 4,087,132 | 13,640,634 | 17,727,766 |
| Dual + Non-dual | 3,852,181 | | 3,296,692 | | 6,157,973 | | 4,131,832 | | 289,088 | | 17,727,766 | | |
| *Characteristic* | | | | | | | | | | | | | |
| Gender % | | | | | | | | | | | | | |
| Female | 73.6 | 62.0 | 71.7 | 61.9 | 72.1 | 60.1 | 66.0 | 58.1 | 60.4 | 57.9 | 70.9 | 60.4 | 62.8 |
| Male | 26.4 | 38.0 | 28.3 | 38.2 | 27.9 | 39.9 | 34.0 | 41.9 | 39.6 | 42.1 | 29.1 | 39.7 | 37.2 |
| Age Group % | | | | | | | | | | | | | |
| 65–74 | 37.7 | 48.2 | 40.3 | 45.4 | 43.3 | 51.7 | 44.2 | 48.4 | 50.4 | 54.5 | 41.9 | 49.0 | 47.4 |
| 75–84 | 37.4 | 37.4 | 36.9 | 39.4 | 37.4 | 35.9 | 38.6 | 37.3 | 38.4 | 33.3 | 37.6 | 37.1 | 37.2 |
| 85+ | 24.9 | 14.5 | 22.9 | 15.3 | 19.4 | 12.5 | 17.2 | 14.2 | 11.2 | 12.2 | 20.5 | 13.8 | 15.4 |
| Race/Ethnic Origin % | | | | | | | | | | | | | |
| Black | 15.3 | 4.0 | 15.5 | 6.5 | 27.9 | 9.6 | 6.1 | 3.1 | 9.3 | 6.8 | 18.1 | 6.2 | 8.9 |
| Hispanic | 1.7 | 0.2 | 8.0 | 0.7 | 8.5 | 1.3 | 14.3 | 1.9 | 24.0 | 22.1 | 8.6 | 1.5 | 3.2 |
| Other | 5.0 | 1.0 | 11.3 | 2.1 | 4.4 | 1.5 | 29.2 | 7.7 | 19.1 | 4.4 | 11.7 | 3.0 | 5.0 |
| White | 77.9 | 94.8 | 65.2 | 90.7 | 59.2 | 87.7 | 50.5 | 87.3 | 47.6 | 66.7 | 61.7 | 89.3 | 83.0 |

[1]A Medicare Part D enrollee is a beneficiary enrolled for the entire 12 months in a Medicare Part D program and who is eligible to receive Medicare Part D prescription benefits whether or not the individual received a prescription in 2007.

[2]Beneficiaries enrolled in Part D for the entire twelve months as dual enrollees for calendar year 2007.

[3]Beneficiaries enrolled in Part D for the entire twelve months as non-dual enrollees for calendar year 2007.

SOURCE: Medicare Part D Prescription Drug Event files, Medicare Denominator file, and US Census Bureau.

**Exhibit 5. Number of Medicare Part D Medication Recipients[1] and Percent by Dual Eligibility Status, Gender, Age Group, Origin, and Region, 2007. Age 65 and Over**

| *Region* | Midwest | | Northeast | | South | | West | | Other | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | All |
| *Total Recipients* | 672,029 | 2,915,818 | 786,330 | 2,290,672 | 1,501,861 | 4,306,873 | 877,734 | 2,935,617 | 5,033 | 262,557 | 3,842,987 | 12,711,537 | 16,554,524 |
| Dual + Non-dual | 3,587,847 | | 3,077,002 | | 5,808,734 | | 3,813,351 | | 267,590 | | 16,554,524 | | |
| *Characteristic* | | | | | | | | | | | | | |
| Gender % | | | | | | | | | | | | | |
| Female | 74.8 | 62.9 | 72.7 | 62.6 | 73.5 | 60.9 | 67.5 | 59.0 | 60.8 | 59.3 | 72.2 | 61.2 | 63.8 |
| Male | 25.2 | 37.1 | 27.4 | 37.4 | 26.5 | 39.1 | 32.5 | 41.0 | 39.2 | 40.7 | 27.8 | 38.8 | 36.2 |
| Age Group % | | | | | | | | | | | | | |
| 65–74 | 37.1 | 47.2 | 39.7 | 44.5 | 42.8 | 51.2 | 43.6 | 47.5 | 51.1 | 54.5 | 41.4 | 48.3 | 46.7 |
| 75–84 | 37.5 | 37.9 | 36.9 | 39.9 | 37.5 | 36.2 | 38.8 | 37.9 | 38.5 | 33.3 | 37.7 | 37.6 | 37.6 |
| 85+ | 25.5 | 14.9 | 23.4 | 15.6 | 19.7 | 12.7 | 17.6 | 14.6 | 10.4 | 12.2 | 21.0 | 14.2 | 15.7 |
| Race/Ethnic Origin % | | | | | | | | | | | | | |
| Black | 15.1 | 3.7 | 15.2 | 6.1 | 27.8 | 9.2 | 6.0 | 3.0 | 7.8 | 6.5 | 18.0 | 5.9 | 8.7 |
| Hispanic | 1.7 | 0.2 | 8.0 | 0.7 | 8.4 | 1.3 | 13.8 | 1.8 | 25.7 | 22.3 | 8.4 | 1.5 | 3.1 |
| Other | 4.9 | 1.0 | 11.3 | 2.0 | 4.3 | 1.4 | 29.6 | 7.5 | 21.0 | 4.1 | 11.7 | 2.9 | 4.9 |
| White | 78.3 | 95.1 | 65.5 | 91.2 | 59.4 | 88.2 | 50.5 | 87.7 | 45.5 | 67.1 | 61.9 | 89.8 | 83.3 |
| Disease Burden[4] % | | | | | | | | | | | | | |
| High | 42.9 | 18.7 | 44.1 | 21.7 | 42.2 | 20.2 | 35.4 | 18.5 | 32.5 | 31.2 | 41.2 | 20.0 | 24.9 |
| Medium–High | 31.9 | 22.8 | 32.7 | 25.0 | 33.7 | 23.5 | 34.4 | 22.7 | 34.4 | 31.6 | 33.3 | 23.6 | 25.9 |
| Medium–Low | 19.5 | 25.6 | 19.0 | 24.7 | 20.5 | 24.5 | 25.0 | 25.1 | 27.0 | 20.9 | 21.1 | 24.9 | 24.0 |
| Low | 5.8 | 32.8 | 4.2 | 28.5 | 3.6 | 31.8 | 5.2 | 33.7 | 6.1 | 16.2 | 4.5 | 31.5 | 25.3 |
| Missing | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |

**Exhibit 5 (cont.)**

| *Region* | Midwest | | Northeast | | South | | West | | Other | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | Dual[2] | Non-dual[3] | All |
| Prescription Burden[5] % | | | | | | | | | | | | | |
| High | 55.4 | 18.3 | 52.8 | 15.5 | 49.9 | 19.6 | 43.5 | 11.8 | 32.0 | 21.4 | 50.0 | 16.8 | 24.5 |
| Medium–High | 22.3 | 25.5 | 22.7 | 24.0 | 24.4 | 27.7 | 23.8 | 21.2 | 24.5 | 27.4 | 23.5 | 25.0 | 24.7 |
| Medium–Low | 12.7 | 28.0 | 13.9 | 29.5 | 14.8 | 27.7 | 17.2 | 30.3 | 21.3 | 24.6 | 14.8 | 28.6 | 25.4 |
| Low | 9.6 | 28.1 | 10.6 | 31.0 | 11.0 | 25.1 | 15.5 | 36.7 | 22.2 | 26.6 | 11.7 | 29.5 | 25.4 |

[1]A Medicare Part D recipient is a beneficiary enrolled for the entire 12 months in a Medicare Part D program and received at least one medication in 2007.

[2]Beneficairies enrolled in Part D for the entire twelve months as dual enrollees for calendar year 2007.

[3]Beneficiaries enrolled in Part D for the entire twelve months as non-dual enrollees for calendar year 2007.

[4]Disease burden based on hierarchical condition category risk scores acquired from the Centers for Medicare & Medicaid Services. Derivation based on quartiles.

[5]Prescription burden based on total number of prescriptions filled per enrollee during calendar year 2007. Derivation based on quartiles.

SOURCE: Medicare Part D Prescription Drug Event files, Medicare Denominator file, and US Census Bureau.

**Exhibit 6. Number of Medicare Part D Beers Medication[1] Recipients[2] based on the 2003 Fick et al. List[3] and Percent by Dual Eligibility Status, Gender, Age Group, Origin, and Region, 2007. Age 65 and Over**

| *Region* | Midwest | | Northeast | | South | | West | | Other | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | All |
| *Total Recipients* | 266,321 | 896,928 | 275,215 | 595,704 | 723,836 | 1,643,208 | 373,637 | 965,582 | 2,015 | 135,634 | 1,641,024 | 4,237,056 | 5,878,080 |
| Dual + Non-dual | 1,163,249 | | 870,919 | | 2,367,044 | | 1,339,219 | | 137,649 | | 5,878,080 | | |
| *Characteristic* | | | | | | | | | | | | | |
| Gender % | | | | | | | | | | | | | |
| Female | 77.8 | 69.3 | 74.6 | 67.6 | 76.8 | 67.6 | 70.5 | 67.0 | 64.0 | 62.9 | 75.2 | 67.7 | 69.8 |
| Male | 22.2 | 30.7 | 25.4 | 32.5 | 23.2 | 32.4 | 29.5 | 33.0 | 36.0 | 37.1 | 24.9 | 32.3 | 30.3 |
| Age Group % | | | | | | | | | | | | | |
| 65–74 | 40.6 | 47.2 | 42.9 | 44.9 | 45.0 | 51.6 | 45.4 | 47.2 | 51.6 | 55.8 | 44.0 | 48.9 | 47.5 |
| 75–84 | 36.8 | 38.2 | 36.6 | 40.3 | 36.7 | 36.4 | 38.5 | 38.5 | 37.8 | 32.8 | 37.1 | 37.7 | 37.5 |
| 85+ | 22.7 | 14.6 | 20.5 | 14.8 | 18.3 | 12.1 | 16.1 | 14.4 | 10.6 | 11.4 | 18.8 | 13.5 | 15.0 |
| Race/Ethnic Origin % | | | | | | | | | | | | | |
| Black | 15.4 | 3.8 | 14.6 | 6.2 | 26.7 | 9.0 | 6.3 | 3.0 | 6.7 | 6.2 | 18.1 | 6.1 | 9.4 |
| Hispanic | 1.6 | 0.2 | 8.8 | 0.8 | 8.0 | 1.3 | 14.2 | 2.0 | 27.5 | 22.9 | 8.6 | 1.9 | 3.7 |
| Other | 4.4 | 0.8 | 11.0 | 1.7 | 3.7 | 1.2 | 27.3 | 5.6 | 17.8 | 3.7 | 10.4 | 2.3 | 4.6 |
| White | 78.6 | 95.2 | 65.6 | 91.3 | 61.6 | 88.5 | 52.2 | 89.4 | 48.0 | 67.2 | 62.9 | 89.8 | 82.3 |

Exhibit 6 (cont.)

| *Region* | Midwest | | Northeast | | South | | West | | Other | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Enrollment Status* | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | Dual[4] | Non-dual[5] | All |
| Disease Burden[6] | | | | | | | | | | | | | |
| High | 48.7 | 22.9 | 48.6 | 26.2 | 47.1 | 23.9 | 40.1 | 22.5 | 38.0 | 35.9 | 46.0 | 24.1 | 30.2 |
| Medium–High | 30.5 | 24.0 | 31.5 | 25.7 | 32.4 | 24.4 | 33.7 | 24.0 | 34.6 | 32.6 | 32.2 | 24.7 | 26.8 |
| Medium–Low | 16.2 | 23.9 | 16.2 | 22.7 | 17.5 | 23.0 | 21.7 | 23.7 | 22.7 | 18.6 | 18.0 | 23.1 | 21.7 |
| Low | 4.6 | 29.1 | 3.7 | 25.4 | 3.1 | 28.7 | 4.5 | 29.8 | 4.7 | 12.9 | 3.8 | 28.1 | 21.3 |
| Missing | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| Prescription Burden[7] | | | | | | | | | | | | | |
| High | 68.2 | 28.1 | 65.3 | 23.8 | 61.4 | 29.1 | 54.9 | 19.1 | 42.2 | 28.5 | 61.7 | 25.8 | 35.8 |
| Medium–High | 19.1 | 30.5 | 19.9 | 29.6 | 22.6 | 32.3 | 23.5 | 28.1 | 26.4 | 31.3 | 21.8 | 30.6 | 28.1 |
| Medium–Low | 8.5 | 26.1 | 9.9 | 28.8 | 10.9 | 25.1 | 13.8 | 31.5 | 19.1 | 23.5 | 11.0 | 27.2 | 22.7 |
| Low | 4.2 | 15.3 | 4.9 | 17.9 | 5.2 | 13.5 | 7.8 | 21.3 | 12.4 | 16.8 | 5.6 | 16.4 | 13.4 |

[1]Beers, M. H., Ouslander, J. G., Rollingher, I., Reuben, D. B., Brooks, J., and Beck, J. C. (1991). Explicit criteria for determining inappropriate medication use in nursing home residents. *Archives of Internal Medicine*, *151*(9),1825–1832. Legend drugs considered inappropriate based on dose were excluded from this analysis.

[2]A Medicare Part D Beers medication recipient is a Part D enrollee who received at least one Beers drug in 2007.

[3]Fick, D. M., Cooper, J. W., Wade, W. E., Waller, J. L., Maclean, J. R., and Beers, M. H. (2003). Updating the Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. *Archives of Internal Medicine*. *163,* 2716–2724.

[4]Beneficiaries enrolled in Part D for the entire twelve months as dual enrollees for calendar year 2007.

[5]Beneficiaries enrolled in Part D for the entire twelve months as non-dual enrollees for calendar year 2007.

[6]Disease burden based on hierarchical condition category risk scores acquired from the Centers for Medicare & Medicaid Services. Derivation based on quartiles.

[7]Prescription burden based on total number of prescriptions filled per enrollee during calendar year 2007. Derivation based on quartiles.

SOURCE: Medicare Part D Prescription Drug Event files, Medicare Denominator file, and US Census Bureau.

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