# Medicare Part D Data Linked with the Health Outcomes Survey: Association between Quality of Care using Prescription Drugs and Mortality as Outcomes among those Enrolled in the Medicare Advantage Program

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## Executive Summary

**Background.** On January 1, 2006, the Centers for Medicare and Medicaid Services implemented the Medicare Drug Benefit, or "Medicare Part D." Although reports point to positive effects of the Part D benefit, several questions remain unanswered about its overall effect on patient outcomes in the Medicare Advantage Program. One of the major unanswered questions involves the impact of the benefit of the Part D program on selected medications for those elderly with common chronic illnesses on their mortality.

**Objectives.** We evaluated the relationship between use of medications based upon nationally recognized clinical practice guidelines and health outcomes using mortality among Medicare Advantage (MA) patients enrolled in the Medicare Part D program.

**Methods.** We linked data from the Medicare Health Outcomes (HOS) Survey cohort 9 (April 2006 – May 2008) with the Medicare Part D prescription benefit files (January 1$^{st}$, 2006 – December 31$^{st}$, 2007) to calculate the medication based performance indicators for five high volume chronic conditions (diabetes, coronary artery disease (CAD), congestive heart failure (CHF), chronic obstructive lung disease (COPD)/asthma and depression). We used analysis of variance to examine the variations of the performance indicators across plans and correlation analyses to examine the associations of performance indicators and mortality at the patient and the plan levels. Mortality was operationalized as the ratio of observed/expected mortality rates with the expected mortality based upon propensity analysis with demographic and clinical covariates.

**Results.** Analysis of variance confirmed that the 203 MA plans differed significantly in their performance indicators ($P<0.001$). The smallest variation range was for diabetic patients

receiving from 52.2% to 100% of the indicated medications. The largest variation range was for patients with depression receiving antidepressants (7.4% to 66.7%). At the patient level, there were weak associations between the use of lipid-lowering medications and mortality among patients with diabetes ($r = -0.02$, $p=0.005$) and CAD ($r = -0.04$, $p<0.0001$). Beta-blocker use was also associated with a lower mortality among patients with CHF, albeit a weak correlation ($r = -0.02$, $p=0.034$). At the plan level, the higher prevalence of angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARB) ($r = -0.40$, $p<0.0001$) and beta-blockers ($r = -0.27$, $p<0.0001$) were found to be significantly associated with a lower mortality among patients with CHF, while for lipid-lowering medications ($r = -0.11$, $p=0.091$) it approached significance. Antidepressants showed a paradoxical correlation. They were associated with higher mortality in depressed patients at the patient level with a weak correlation ($r = 0.02$, $p=0.007$), and a higher mortality at the plan level ($r = 0.28$, $p<0.0001$).

**Conclusions.** While our results are not definitive, they reveal a complex relationship between outcome and different medication based process indicators. These findings support selective associations between mortality and process indicators that warrant further study using data such as the Healthcare Effectiveness Data and Information Set (HEDIS) and follow-up information that combines process measures and outcomes over a longer period of time.

## Introduction

By age 75, the average American has 2 or 3 chronic medical conditions.[1] The management of patients with chronic conditions can be challenging and costly.[2] The Medicare Modernization Act Prescription Drug Benefit plan (Part D) established a prescription drug benefit for all 43 million Medicare beneficiaries in the United States.[3] The prescription benefit has increased the proportion of Medicare enrollees with prescription drug coverage.[4] The Centers for Medicaid & Medicare Services (CMS) report that among seniors eligible for Medicare, Part D enrollees save on out-of-pocket expenses compared with those not enrolled in Part D.[5] Although reports point to positive effects of the Part D benefit, several questions remain unanswered about its overall effect on patient outcomes.[6,7] One of the major unanswered questions involves the impact of the benefit of the Part D program on selected medications for those elderly with common chronic illnesses on their mortality. The Medicare Health Outcomes Survey (HOS) provides a unique opportunity to examine the outcomes of Medicare Advantage (MA) patients enrolled in the Medicare Part D program.

There are now clearly defined therapeutic and preventive interventions that are known to affect health outcomes. Examples include the following: the use of HMG CoA reductase inhibitors for the treatment of hyperlipidemias that has reduced mortality by as much as 30% and the administration of angiotensin-converting enzyme (ACE) inhibitors in patients with heart failure and depressed left ventricular function that lowers the six month mortality by 40% and the 12-month by 31% ($p=0.003$).[8,9] Aspirin for primary and secondary prevention of cardiovascular disease is another significant outpatient intervention to reduce mortality.[10] Inhaled

steroids have reduced the mortality of patient with chronic obstructive pulmonary disease by 29% (95% CI, 22% to 35%).[11] However, recent research indicates that some of the most debilitating, costly, and treatable illnesses are undertreated. In several large studies in the United States, less than half the patients with serious depression received effective medication or at least short-term psychotherapy.[12] Elderly patients with heart failure are less likely to receive evidence-based treatments and consequently have a worse prognosis.[13] They received ACE inhibitors, beta-blockers, and anticoagulants less frequently than younger patients did. The 1- year mortality rate was significantly higher in patients ≥70 years old (22% vs. 13.7%, P<0.001). Despite substantial evidence that antiplatelet therapy saves lives and reduces adverse events in patients with coronary artery disease (CAD), use of the most widely available and lowest cost antiplatelet agent, aspirin, continues to be disappointingly low.[14] At one teaching hospital, one third of patients with acute myocardial infarction who were eligible for treatment with beta-blocker drugs did not receive any of those drugs, contrary to the guidelines of the American College of Cardiology.[15] As a result, the mortality rate among these patients was 20 to 40 percent higher than that among patients given a beta-blocker. Few patients with diabetes are taking aspirin (44%), lipid-lowering (20%), or ACE inhibitors (39%) therapy.[16] Compared to those taking aspirin or ACE inhibitors, the odds of dying for those patients without ACE inhibitor therapy was 1.7 (95% CI, 1.2 - 3.9) and those with no aspirin therapy was 2.89 (95% CI, 1.9 - 4.3).

This study examined the relationship between use of medications based upon nationally recognized clinical practice guidelines (CPG) and health outcomes using mortality among MA patients enrolled in the Medicare Part D program. Linking process indicators and outcomes is critical to accurately estimating healthcare quality and quantifying its benefits. The specific

objectives of this study were (1) to evaluate the variation of nationally recommended use of medications for five high volume diagnoses (diabetes, CAD, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD) / asthma, and depression) across MA plans and (2) to examine the association of nationally recognized use of medications and mortality at the patient and plan levels.

## Methods

### Study Population

The HOS Performance Measurement analysis is limited to beneficiaries who meet the following analytic criteria:

1. Were age sixty-five or older at the time of completing the baseline survey.
2. Had enough data to score baseline PCS or MCS scores using a previously validated Modified Regression Estimation (MRE) algorithm for missing data as well as adjustments for contextual issues such mode of administration (phone versus mail-out).[17]
3. Were members of a health plan at baseline that remained in HOS at follow-up.
4. Had a baseline survey disposition of M10 (mail, complete survey), M11 (mail, partial complete survey), M31 (mail, break-off), T10 (telephone, complete survey), T11 (telephone, partial complete survey), or T31 (telephone, break-off).

We used the Medicare HOS cohort 9 (April 2006 - May 2008) because on January 1, 2006, CMS implemented the Medicare Part D program. Beneficiaries were randomly sampled from each managed care plan participating in the Medicare Advantage Plans in 2006 for the cohort 9 baseline administration. There were 203 contract/market areas, and 1,000 beneficiaries were randomly sampled from each (if a contract/market area had fewer than 1,000 members, all beneficiaries were included). The total number of beneficiaries sampled was 188,515, including both the aged and disabled (see Figure 1). Among the 188,515 beneficiaries, 111,667 met all 4-study criteria. Of the 111,667 patients, 94,630 had Medicare Part D claims. Out of the 94,630 Medicare Part D patients, 7,148 (7.54%) died by the time of the two-years of follow-up.

**Study Measures**

We used two study measures:

1) *Two-year mortality rates*: Building upon prior work,[18] we used mortality as the study outcome. Mortality is a measure that is particularly relevant to elderly patients and might reflect potentially poor quality of care.[19] We used the Medicare HOS mortality files to ascertain the vital status of the MA patients.

2) *Performance indicators*: We assessed how well plans followed nationally recognized guidelines for five high volume diagnoses: diabetes, coronary artery disease (CAD), congestive heart failure (CHF), chronic obstructive lung disease (COPD)/asthma and depression (table 1). These diagnoses were self-reported in the HOS survey. Within each of the five diagnoses, there were one to three drug interventions that were measured. The number of patients receiving the desired drug constituted the numerator. There were two performance indicators for the diagnosis of diabetes: percentage of patient with diabetes treated with ACE inhibitors or angiotensin receptor blockers (ARB) and lipid lowering medications. There were two indicators for the diagnosis of CAD: percentage of patients with CAD treated with beta-blockers and lipid lowering medications. There were three indicators for the diagnosis of CHF: percentage of patients with CHF treated with ACE inhibitors or ARBs, beta-blockers and lipid lowering medications. There was one indicator for the diagnoses of COPD/asthma and depression: percentage of patients with COPD/asthma treated with steroid inhalers and percentage of patients with depression treated with anti-depressants. We used the Medicare Part D prescription benefit file to calculate the performance indications. This file contains information that was collected between January 1$^{st}$, 2006 and December 31$^{st}$, 2007. We did not use National Drug Codes from

the U.S. Food and Drug Administration because this classification scheme has not been updated since 1976.[20] To identify the medications for each of the selected class groups, we used the Tarascon Pocket Pharmacopoeia 2009 Classic Shirt-Pocket Edition 23rd edition.

**Analytic Plan**

First, we calculated the prevalence of the performance indicators for each plan (objective 1). Within each of the five diagnoses (diabetes, CAD, CHF, COPD / asthma and depression), we measured one to three drug interventions. The number of patients receiving the desired drug constituted the numerator. We used analysis of variance to examine the variations of the performance indicators across plans.

Second, we used correlation analyses at the patient and the plan levels to examine the association of performance indicators and mortality (objective 2). We expected negative correlations between the performance indicator prevalence estimates (proportion of those with an indicated medication given a specific diagnosis according to the accepted guidelines) and mortality because the higher the number of patients receiving the desired drug, the lower the mortality. For the analysis we used the ratio of observed/expected mortality rates as the study outcome. In calculating the expected mortality rates, we used 3 steps:

*Step 1*: we calculated propensity scores, defined as the probability of a patient on a drug or not given a set of known predictor variables, to build treatments groups that are similar with respect to outcome risk factors.[21] We applied a logistic regression model, in which the log of the "odds' of the event is modeled as a linear function of the predictor

variables. We used the following predictor variables: age, gender (male/female), race/ethnicity (whites/African-American/Hispanics/others), married (yes/no), less than high school education (yes/no), homeowner (yes/no), body mass index, baseline physical functioning, baseline mental functioning, activities of daily living (ADL), presence of medical/psychiatric conditions (diabetes, hypertension, stroke, COPD/asthma, cancer, arthritis of the hip, arthritis of the hand, low back pain, congestive heart disease, osteoporosis, sciatica, depression), current smoker (yes/no). We included only the significant predictor variables in the model in order to generate the propensity scores.

*Step 2*: We used the propensity scores to generate weights using the approach modeled after Horwitz and Thompson.[22] Assuming that there is no unmeasured confounding, we obtained unbiased estimates of the probability of being on treatment by comparing treatment groups within each of the levels of the propensity score. The weights were defined as the (Total number of patients on a drug/10)/ number of patients on a drug in one decile and the (Total number of patients not on a drug/10)/ number of patients not on a drug. Each individual was assigned with one of the two weights in each decile.

*Step 3*: We applied the weights from step 2 as a probability weight to a logistic model (probability weighted regression model) in order to generate the expected mortality rates. In this model, mortality was the dependent variable and being on a drug (yes/no) was the independent variable.

## Results

Our study focused on 94,630 MA patients with Medicare Part D claims (table 2). When compared with MA patients without Medicare Part D claims (N=17,037), MA patients with Medicare Part D claims were more likely to be female, non-White, non-married, with less than a high school education and with a lower income. The MA patients with Medicare Part D claims had higher prevalence of chronic conditions when compared to those without Medicare Part D claims, including diabetes (23.0% vs. 18.1%, $p<0.0001$), hypertension (65.9% vs. 55.1%, $p< 0.0001$), coronary artery disease (15.7% vs. 14.6%, $p=0.0003$), congestive heart failure (9.3% vs. 7.9%, $p<0.0001$), COPD/asthma (14.4% vs. 11.8%, $p<0.0001$) and depression (28.6% vs. 23.0%, $p<0.0001$). The MA patients with Medicare Part D claims had lower physical health (39.0 (SD $\pm$ 12) vs. 40.8 (SD $\pm$ 11), $p<0.0001$) and mental health (51.6 (SD $\pm$ 11) vs. 53.1 (SD $\pm$ 10), $p<0.0001$) than those without Medicare Part D claims on the basis of the summary scores from the Veterans RAND 12 Item Health Survey (VR-12). However, there was no difference in the 2-year mortality rates between patients with or without Medicare Part D claims (7.55% vs. 7.54%, respectively).

The Medicare Part D file contained 5,943,875 prescriptions and 16,712 (11-digit) National Drug Codes. The mean number of prescriptions for patients for each drug code was 3.22 over the 2-year follow-up period with a minimum of 1 and a maximum of 38 prescriptions.

Analysis of variance confirmed that the 203 plans differed significantly in their performance indicators ($P<0.001$) (Appendix A). The indicator prevalence estimates for diabetic patients ranged from 52.2% to 100% for ACE inhibitors/ARBs and 33.3% to 90.0% for lipid lowering medications. For CAD patients estimates ranged from 42.4% to 100% for beta-blockers and 51.8% to 100% for lipid lowering medications. Estimates for CHF patients ranged from 38.5% to 86.7% for ACE inhibitors/ARBs, from 33.3% to 100% for lipid lowering medications and from 46.7% to 93.3% for beta-blockers. For COPD/asthma patients, the indicator for inhaled steroids ranged from 21.3% to 71.4%. Last, the indicator for antidepressants for patients with depression ranged from 7.4% to 66.7%.

There were significant correlations between the performance indicators and the observed/expected mortality ratios. At the patient level, there were weak associations, albeit in the hypothesized direction, between lipid-lowering medications and a lower mortality among patients with diabetes ($r= –0.02$, $p=0.005$) and CAD ($r= –0.04$, $p<0.0001$). Beta-blockers were also associated with a lower mortality among patients with CHF ($r= –0.02$, $p=0.034$). At the plan level for those patients with CHF, ACE inhibitors/ARBs ($r= –0.40$, $p<0.0001$) and beta-blockers ($r= –0.27$, $p<0.0001$) were found to be significantly associated with a lower mortality. Lipid-lowering medications ($r= –0.11$, $p=0.091$) were associated with lower mortality but not significant. Antidepressant medications showed a paradoxical correlation. They were associated with a higher mortality in depressed patients at the patient ($r=0.02$, $p=0.007$) and at the plan level ($r=0.28$, $p<0.0001$).

## Discussion

This study showed a wide variation of nationally recommended use of drugs across MA plans. There were significant correlations between selected use of medications and mortality. We were able to identify performance indicators for conditions such CHF, which were significantly associated with better outcomes (lower mortality) at the plan level. The Medicare Part D prescription benefit file can supplement the quality of medical care information obtained from process of care measures. The fact that we found a few but important correlations between process indicators and mortality highlight the additional contribution of mortality for quality assessments.

Studies have shown that the Medicare Part D has led to increases in drug use and decreases in expenses for older adults.[23] However, large variations in the drug utilization across plans are confirmed by our results. Such variation may in part be a function of the cost and drugs covered by plan. Exact coverage and costs are different for each Medicare drug plan, but all plans must provide at least a standard level of coverage set by Medicare. The actual drug plan costs vary depending on the prescriptions used, whether the drugs are on the plan's formulary, and whether the patient qualifies for extra help paying the Part D costs. Further, studies have found recent increases in premiums.[24] Policymakers continue to question government's role in areas such as negotiating prices directly with pharmaceutical manufacturers and limiting the number of plans offered. The substantial variation in drug utilization reported in this study may be influenced by the complex differences found in the plan design, enrollment, and the impact of the program on beneficiaries.

Adherence to pharmacotherapy for heart failure is poor among older adults in part because of high prescription drug costs. Studies have found that Medicare Part D was associated with improved access to medications and adherence to pharmacotherapy in older adults with heart failure.[25] Those previously lacking drug coverage were more likely to fill prescriptions for an ACE/ARB plus a beta-blocker after Part D (adjusted odds ratio = 1.73, 95% CI 1.42-2.10, P < 0.0001) and more likely to be adherent to such pharmacotherapy (adjusted odds ratios = 2.95, 95% CI 1.85-4.69, P <0 .0001) relative to the comparison group. This report highlights a few important correlations between process indicators for CHF (ACE inhibitors/ARBs, lipid lowering medications and beta blockers) and mortality noting the additional contribution of these process indicators for quality assessments.

We also found a paradoxical relationship between mortality and the use of anti-depressants at the patient and plan levels. Depression imposes important burdens on the elderly. Despite this, rates of initiation of and adherence to recommended pharmacotherapy are frequently low in this population.[26] Among a large Medicare cohort of fee-for-service beneficiaries with diabetes, comorbid depression was associated with an increase in all-cause mortality over a two-year period corroborating our findings in this study.[27] Future research will be required to determine whether the increase in mortality associated with depression is due to potential behavioral mediators (i.e., smoking, poor adherence to diet).

Though our efforts to link mortality with process indicators yielded mixed results, this is not unique to our experience. Studies in which both process and outcomes were evaluated found that they were not always consistent with each other.[28] Studies have found weak relationships between processes of care and overall mortality.[29] Similar results were found in studies of specific conditions. Bradley et al, for example, found that only a few acute myocardial infarction process measures (beta-blocker at admission, aspirin at admission, and smoking cessation) correlated with hospitals' mortality rates.[30]

There are several limitations of this study. First, we found that 15.2% of the HOS patients did not have Part D Medicare claims. We can formulate several possibilities regarding these patients: they are not enrolled in Part D period or they are enrolled but not using meds at all or they have other prescription coverage (e.g., they have a company's retirement insurance covering it). Second, the Medicare Part D claim file does not contain drug class assignment. We compared our drug class algorithm with the HEDIS 2008 National Drug Coding class assignment. We found that both approaches produced similar results (Appendix B). Third, the Medicare Part D data included medication information from January 2006 thru December 2007 (24 months), while HOS cohort 9 data represented a time frame from April 2006 thru May 2008. The HOS data did not overlap with the Medicare data for the first three months in 2006 and the Medicare data did not overlap with the HOS data for the last 4 months in 2008. This lack of overlap provides more potential error in the attempt to establish baseline medication profiles in 2006 with the other clinical baseline measures that include morbidities and physical and mental functioning (VR-12). Future analysis would be improved with better overlap of the Medicare data with the HOS data including baseline measures of physical and mental functional status

using the VR-12. Fourth, we examined mortality over a 2 year period. The efficacious impacts of medications according to the clinical guidelines may take a longer period of time in chronic conditions such as diabetes and CAD. For example, the progression and regression of CAD may take at least 3 years or more to occur.[31] Future studies should examine the impact of process indicators on improved mortality using longer follow-up periods. They can also consider mortality analysis that includes time to event (mortality) as there is greater follow-up time using mortality curves (e.g. Cox Proportional Hazard Models). The time limited nature of the data for this study limited the analysis to expected mortality. As the Medicare Advantage Program has a longer experience it is hoped that more data will become available that spans a greater time frame. Fifth, those patients for whom the drug is contraindicated were not excluded from the denominator; e.g. a CHF patient who is allergic to ACE/ARB. A more accurate count of patients receiving the desired drug can be made if patient allergies are listed in the Medicare Part D file. Sixth, we did not examine the doughnut hole and the effect of changes on clinical outcomes. This issue continues to raise equity in access concerns among elderly patients.[32]

In summary, our results are not definitive, and reveal a complex relationship between outcome and different process indicators. Nevertheless, there is support for the relationship between mortality and processes of care that warrants further investigation.

## Recommendations for CMS

With the growing number of MA plans, CMS is looking to refine their methods of measuring and improving the performance of the MA plans. Our findings highlight the additional contribution of mortality for quality assessments.

The fact that we found a few but important correlations between process indicators and mortality might indicate that the Medicare Part D claim file was sufficiently robust to find such associations. However, this database can be improved by including: 1) drug class assignments, 2) Part D enrollees without claims, 3) age, sex and ICD-9-DM diagnoses and 4) over the counter medications such as aspirin.

Health care organizations are increasing their scrutiny of the care provided to Medicare enrollees with chronic diseases. Medicare Part D can supplement the quality of medical care information obtained from process of care measures such as the Healthcare Effectiveness Data and Information Set (HEDIS). We look forward to conducting future studies with richer information that tracks the use of medications as indicators of quality of care coupled with HEDIS measures with lengthier follow-up to examine the effect on the survival of Medicare Advantage recipients.

**Figure 1. Medicare Health Outcomes Survey (HOS) Analytic Cohort 9**

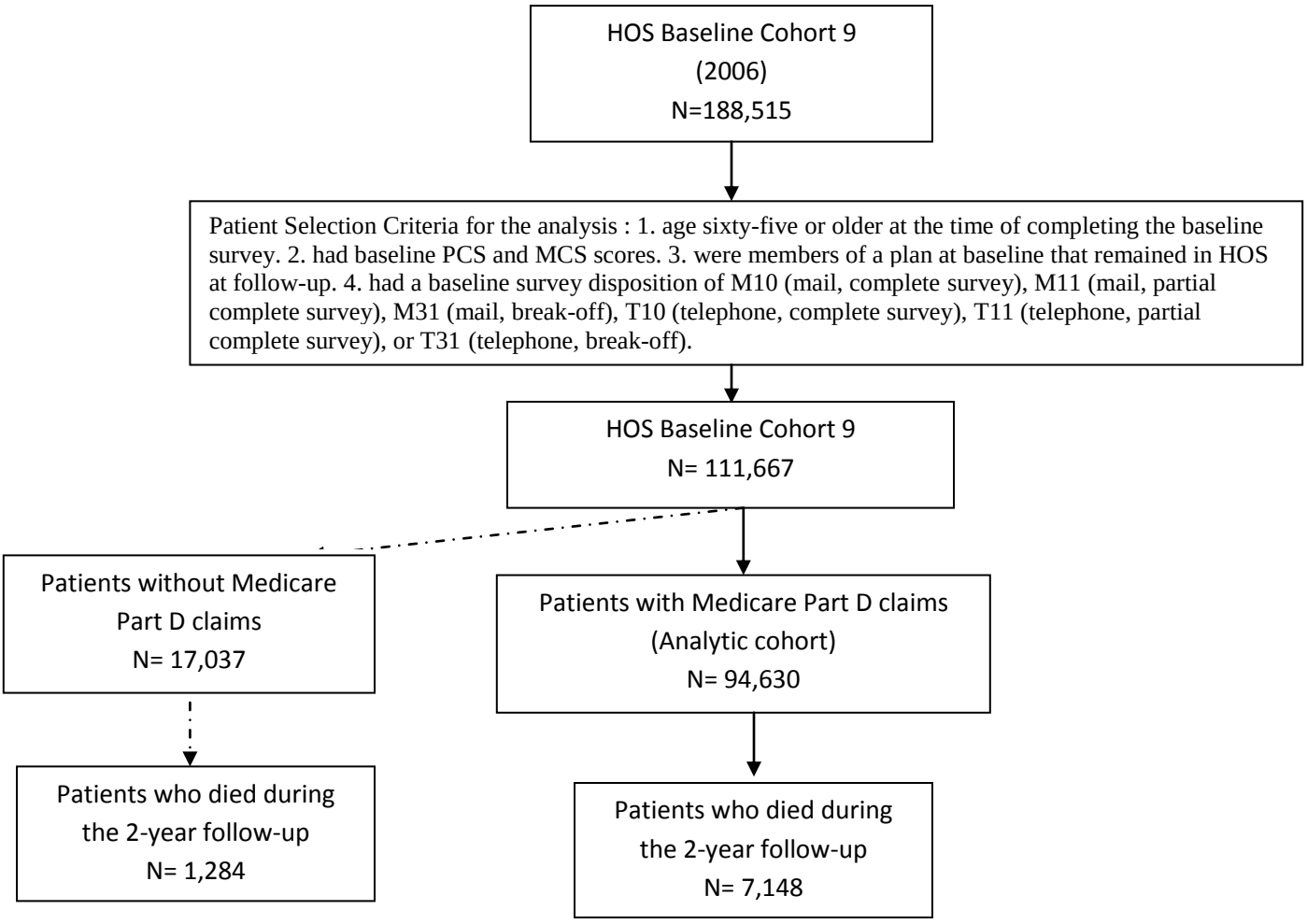

**Table 1. Performance Indicators**

| Condition | Performance Indicator | Clinical Practice Guideline/Reference |
|---|---|---|
| Diabetes | ACE inhibitors/ARB | ADA Standards of Care 2005/DQIP |
| | Lipid lowering Medication | ADA Standards of Care 2005/DQIP |
| Coronary Artery Disease | Beta-blockers | ACC/AHA |
| | Lipid Lowering Medication | ACC/AHA |
| Congestive Heart Failure | On ACEI/ARB | ACC/AHA |
| | Beta-blocker | ACC/AHA |
| | Lipid Lowering Medication | ACC/AHA |
| COPD | On steroid inhaler | ATS |
| Depression | On antidepressant[33] | APA |

ACC/AHA= American College of Cardiology/American heart Association; ACCP= American College of Clinical Pharmacy; ACE= angiotensin converting enzyme inhibitor; ADA= American Diabetes Association; ARB= angiotensin receptor blocker; DQIP= Diabetes Quality Improvement Project; ATS=American Thoracic Society; APA=American Psychiatric Association

**Table2. Patient Characteristics of Medicare Advantage (MA) Patients with and without Medicare Part D claims from the Medicare Health Outcomes Survey cohort 9**

| | **MA patients with Medicare Part D claims** (n=94,630) | **MA patients without Medicare Part D claims (n=**17,037) | p-value |
|---|---|---|---|
| Age | 75.4 (±6) | 75.1 (±6) | NS |
| Female | 60.9% | 49.7% | <.0001 |
| White | 85.4% | 90.1% | <.0001 |
| African American | 9.1% | 7.2% | |
| Hispanics | 1.9% | 0.6% | |
| Others | 3.7% | 2.1% | |
| Married | 54.4% | 60.0% | <.0001 |
| Less than high school education | 27.8% | 24.6% | <.0001 |
| Income | | | <.0001 |
| Less than $5,000 | 3.8% | 2.6% | |
| $5,000-$9,999 | 8.5% | 6.0% | |
| $10,000-$19,999 | 26.4% | 24.9% | |
| $20,000-29,999 | 11.4% | 21.2% | |
| $30,000-39,999 | 19.3% | 13.7% | |
| $40,000-49,999 | 7.0% | 8.2% | |
| $50,000-79,999 | 7.6% | 8.1% | |
| $80,000-99,999 | 1.9% | 2.0% | |
| $100,000 or more | 2.4% | 1.9% | |
| Don't know | 11.7% | 11.2% | |
| Medicaid eligibility | 7.3% | 2.5% | <.0001 |
| Diabetes | 23.0% | 18.1% | <.0001 |
| Hypertension | 65.9% | 55.1% | <.0001 |
| Coronary Artery Disease | 15.7% | 14.6% | 0.0003 |
| Congestive Heart Failure | 9.3% | 7.9% | <.0001 |
| COPD/asthma | 14.4% | 11.8% | <.0001 |
| Depression | 28.5% | 23.0% | <.0001 |
| Baseline Physical Health (Mean ± SD)* | 39.0 (±12) | 40.8 (±11) | <.0001 |
| Baseline Mental Health (Mean ± SD)* | 51.6 (±11) | 53.1 (±10) | <.0001 |
| Mortality rate, 2-year | 7.55% | 7.54% | NS |

*Physical and mental summary scores standardized to a U.S. population with a norm of 50.0. Higher scores denote better health.

**Table3. Correlations between Performance Indicators and Mortality**

| Condition | Performance Indicator | At the patient | At the plan level |
|---|---|---|---|
| Diabetes | ACE inhibitor/ARB | -0.01 (p=0.190) (n=17,608) | -0.07 (p=0.294) (n=203) |
| | Lipid lowering medication | **-0.02 (p=0.005) (n=17,653)** | -0.09 (p=0.199) (n=203) |
| CAD | Lipid lowering medication | **-0.04 (p<.0001) (n=12,155)** | 0.06 (p=0.352) (n=203) |
| | Beta blockers | 0.01 (p=0.401) (n=11,937) | -0.07 (p=0.257) (n=203) |
| CHF | ACE/ARB | **-0.001 (p=0.006) (n=7,157)** | **-0.40 (<.0001) (n=203)** |
| | Lipid lowering medications | **-0.061 (p<.0001) (n=6,936)** | **-0.11 (p=0.091) (n=203)** |
| | Beta blockers | **-0.02 (p=0.034) (n=6,835)** | **-0.27 (p<.0001) (n=203)** |
| COPD | Inhaled steroids | -0.01 (p=0.350) (n=10,024) | 0.03 (p=0.608) (n=203) |
| Depression | Antidepressants | **0.02 (p=0.007) (n=19,991)** | **0.28 (p<0.0001) (n=203)** |

Appendix A: Variation of Performance Indicators by Medicare Advantage Plans

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| **Overall** | **70.35** | **69.05** | **72.26** | **66.94** | **68.03** | **62.38** | **68.30** | **43.32** | **39.09** |
| H0150 | 71.32 | 68.38 | 79.17 | 72.22 | 67.24 | 56.90 | 65.52 | 44.16 | 38.33 |
| H0151 | 65.83 | 64.17 | 58.11 | 66.22 | 68.09 | 59.57 | 57.45 | 31.65 | 34.21 |
| H0154 | 76.69 | 67.67 | 62.82 | 71.79 | 74.55 | 56.36 | 69.09 | 39.19 | 51.74 |
| H0302 | 76.52 | 68.70 | 70.79 | 69.66 | 54.55 | 52.27 | 68.18 | 46.39 | 41.72 |
| H0303 | 71.03 | 67.29 | 60.81 | 66.22 | 76.09 | 45.65 | 67.39 | 40.00 | 45.97 |
| H0307 | 73.00 | 65.00 | 78.95 | 67.11 | 74.00 | 72.00 | 74.00 | 47.62 | 38.67 |
| H0316 | 74.62 | 66.15 | 70.83 | 53.13 | 57.45 | 48.94 | 57.45 | 41.18 | 42.46 |
| H0317 | 66.67 | 33.33 | 66.67 | 66.67 | | 100.00 | | | 54.55 |
| H0351 | 72.00 | 68.00 | 59.09 | 62.50 | 67.92 | 43.40 | 60.38 | 38.96 | 38.13 |
| H0354 | 74.19 | 68.82 | 67.65 | 67.65 | 66.67 | 69.23 | 79.49 | 47.22 | 42.48 |
| H0502 | 83.64 | 73.64 | 69.74 | 75.00 | 84.00 | 52.00 | 66.00 | 57.14 | 53.29 |
| H0504 | 75.44 | 67.54 | 73.86 | 65.91 | 70.18 | 70.18 | 71.93 | 52.24 | 37.80 |
| H0523 | 68.32 | 55.45 | 70.89 | 63.29 | 71.43 | 59.18 | 61.22 | 27.71 | 33.33 |
| H0524 | 77.39 | 88.70 | 78.46 | 76.92 | 69.23 | 69.23 | 73.08 | 71.43 | 46.97 |
| H0532 | 70.48 | 69.52 | 80.77 | 70.51 | 77.50 | 67.50 | 70.00 | 48.60 | 48.61 |
| H0543 | 69.47 | 68.42 | 78.13 | 65.63 | 75.61 | 58.54 | 70.73 | 49.18 | 35.04 |
| H0544 | 82.47 | 77.27 | 85.25 | 73.77 | 68.09 | 70.21 | 68.09 | 44.12 | 34.97 |
| H0545 | 66.67 | 71.32 | 71.26 | 66.67 | 57.14 | 55.36 | 60.71 | 38.36 | 33.72 |
| H0562 | 72.73 | 77.27 | 77.94 | 64.71 | 76.32 | 57.89 | 50.00 | 47.69 | 31.34 |
| H0564 | 69.31 | 60.40 | 75.44 | 70.18 | 70.59 | 67.65 | 79.41 | 30.67 | 31.58 |
| H0571 | 64.24 | 70.30 | 72.34 | 46.81 | 77.78 | 66.67 | 77.78 | 31.25 | 13.50 |
| H0602 | 75.36 | 66.67 | 68.85 | 55.74 | 66.67 | 44.44 | 55.56 | 43.86 | 45.83 |
| H0609 | 65.05 | 60.19 | 71.21 | 65.15 | 66.67 | 58.82 | 54.90 | 49.40 | 37.70 |
| H0630 | 71.72 | 73.74 | 83.08 | 76.92 | 78.95 | 76.32 | 78.95 | 49.43 | 48.91 |
| H0657 | 56.34 | 50.70 | 76.00 | 52.00 | 56.67 | 46.67 | 46.67 | 42.00 | 44.44 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H0752 | 66.67 | 69.70 | 79.37 | 66.67 | 51.52 | 63.64 | 75.76 | 44.44 | 32.28 |
| H0755 | 64.91 | 74.56 | 70.73 | 70.73 | 51.22 | 60.98 | 70.73 | 44.29 | 34.75 |
| H1013 | 80.58 | 74.76 | 82.35 | 72.55 | 81.82 | 72.73 | 63.64 | 58.54 | 29.09 |
| H1016 | 65.00 | 70.00 | 75.58 | 61.63 | 78.72 | 78.72 | 70.21 | 42.86 | 38.89 |
| H1019 | 67.90 | 76.54 | 74.00 | 58.00 | 56.52 | 65.22 | 65.22 | 52.08 | 33.09 |
| H1026 | 73.08 | 75.64 | 62.30 | 62.30 | 85.71 | 71.43 | 90.48 | 36.36 | 40.00 |
| H1032 | 67.24 | 69.83 | 68.49 | 68.49 | 72.09 | 58.14 | 74.42 | 39.39 | 39.74 |
| H1034 | 73.91 | 78.99 | 80.00 | 79.05 | 74.58 | 72.88 | 76.27 | 47.17 | 45.03 |
| H1035 | 76.32 | 74.56 | 73.81 | 61.90 | 58.18 | 67.27 | 58.18 | 27.85 | 37.41 |
| H1036 | 69.44 | 75.00 | 73.91 | 60.87 | 80.56 | 72.22 | 66.67 | 38.18 | 37.69 |
| H1045 | 75.00 | 75.00 | 79.49 | 84.62 | 75.00 | 85.71 | 92.86 | 32.14 | 35.11 |
| H1076 | 70.24 | 66.67 | 82.61 | 76.09 | 80.77 | 73.08 | 69.23 | 31.91 | 41.91 |
| H1080 | 67.62 | 57.14 | 71.43 | 65.71 | 64.00 | 48.00 | 76.00 | 35.48 | 34.29 |
| H1099 | 72.88 | 74.58 | 70.45 | 64.77 | 60.00 | 65.00 | 52.50 | 46.58 | 40.97 |
| H1170 | 73.28 | 75.86 | 86.57 | 82.09 | 67.44 | 72.09 | 74.42 | 44.29 | 37.17 |
| H1230 | 78.57 | 81.82 | 80.65 | 72.58 | 82.86 | 68.57 | 74.29 | 62.50 | 24.64 |
| H1251 | 71.43 | 68.91 | 69.57 | 50.00 | 80.00 | 64.00 | 60.00 | 50.00 | 27.35 |
| H1349 | 72.83 | 59.78 | 64.00 | 60.00 | 65.67 | 53.73 | 62.69 | 42.31 | 47.29 |
| H1350 | 67.74 | 61.29 | 80.36 | 55.36 | 67.57 | 62.16 | 62.16 | 45.83 | 48.51 |
| H1406 | 72.50 | 71.67 | 73.68 | 73.68 | 78.85 | 69.23 | 76.92 | 41.38 | 23.38 |
| H1415 | 79.02 | 65.03 | 55.56 | 83.33 | 74.36 | 56.41 | 66.67 | 45.45 | 17.81 |
| H1463 | 79.38 | 68.04 | 77.14 | 68.57 | 66.04 | 60.38 | 69.81 | 41.89 | 45.30 |
| H1468 | 68.85 | 68.03 | 69.23 | 64.84 | 62.12 | 62.12 | 69.70 | 32.95 | 36.13 |
| H1472 | 75.00 | 75.00 | 100.00 | 50.00 | | | | 50.00 | 57.14 |
| H1553 | 68.75 | 75.89 | 76.67 | 71.11 | 72.50 | 57.50 | 70.00 | 35.29 | 47.10 |
| H1555 | 72.03 | 61.86 | 72.94 | 69.41 | 68.42 | 50.88 | 68.42 | 35.37 | 51.03 |
| H1558 | 72.88 | 61.02 | 67.27 | 74.55 | 73.81 | 57.14 | 73.81 | 44.23 | 49.54 |
| H1651 | 68.33 | 70.83 | 75.00 | 82.81 | 58.93 | 58.93 | 69.64 | 50.00 | 42.06 |
| H1716 | 71.43 | 66.07 | 84.62 | 63.46 | 83.87 | 74.19 | 74.19 | 41.82 | 51.47 |
| H1806 | 64.29 | 60.71 | 66.67 | 66.67 | 58.33 | 33.33 | 58.33 | 58.33 | 55.00 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H1849 | 70.07 | 68.61 | 68.27 | 64.42 | 66.67 | 59.65 | 70.18 | 34.18 | 43.11 |
| H1903 | 67.11 | 67.11 | 62.67 | 65.33 | 77.36 | 56.60 | 77.36 | 25.00 | 31.40 |
| H2108 | 76.27 | 63.56 | 72.13 | 68.85 | 73.21 | 69.64 | 75.00 | 58.21 | 29.70 |
| H2150 | 83.97 | 86.54 | 83.51 | 72.16 | 84.62 | 79.49 | 79.49 | 66.67 | 39.73 |
| H2204 | 70.77 | 70.00 | 76.19 | 75.00 | 61.90 | 59.52 | 73.81 | 41.77 | 44.07 |
| H2206 | 61.79 | 73.98 | 82.50 | 73.75 | 58.33 | 80.56 | 80.56 | 54.02 | 44.20 |
| H2256 | 66.10 | 71.19 | 78.48 | 73.42 | 72.09 | 72.09 | 74.42 | 52.44 | 49.65 |
| H2261 | 63.85 | 71.54 | 76.60 | 67.02 | 51.92 | 65.38 | 69.23 | 49.44 | 38.82 |
| H2312 | 74.04 | 74.04 | 73.49 | 78.31 | 74.14 | 63.79 | 84.48 | 55.06 | 33.11 |
| H2354 | 72.22 | 50.00 | 51.85 | 70.37 | 45.00 | 45.00 | 65.00 | 35.00 | 32.26 |
| H2450 | 78.90 | 79.82 | 77.45 | 79.41 | 74.55 | 67.27 | 76.36 | 43.48 | 50.34 |
| H2459 | 67.68 | 63.64 | 79.17 | 73.61 | 56.67 | 50.00 | 73.33 | 38.46 | 45.80 |
| H2461 | 78.45 | 72.41 | 73.08 | 73.08 | 73.33 | 55.56 | 73.33 | 46.43 | 46.79 |
| H2462 | 70.34 | 73.73 | 81.00 | 78.00 | 65.08 | 68.25 | 82.54 | 47.76 | 51.72 |
| H2610 | 64.34 | 75.19 | 75.00 | 61.96 | 71.43 | 61.90 | 66.67 | 35.62 | 42.33 |
| H2611 | 100.00 | 85.71 | 100.00 | 100.00 | 60.00 | 60.00 | 80.00 | 71.43 | 66.67 |
| H2649 | 68.60 | 70.25 | 67.50 | 62.50 | 60.66 | 55.74 | 65.57 | 41.38 | 36.36 |
| H2654 | 64.84 | 60.94 | 60.98 | 62.20 | 65.91 | 52.27 | 65.91 | 36.14 | 39.60 |
| H2663 | 64.80 | 64.00 | 68.89 | 74.44 | 67.92 | 60.38 | 75.47 | 40.96 | 45.08 |
| H2667 | 68.04 | 62.89 | 62.07 | 65.52 | 63.33 | 53.33 | 56.67 | 36.67 | 53.44 |
| H2672 | 65.63 | 62.50 | 67.47 | 63.86 | 64.81 | 57.41 | 62.96 | 40.00 | 50.00 |
| H2802 | 65.04 | 60.16 | 63.83 | 71.28 | 61.22 | 65.31 | 77.55 | 40.66 | 38.13 |
| H2803 | 63.64 | 68.60 | 72.58 | 72.58 | 70.59 | 61.76 | 70.59 | 29.85 | 42.96 |
| H2931 | 75.44 | 64.04 | 65.14 | 66.06 | 71.88 | 64.06 | 78.13 | 30.51 | 31.25 |
| H2949 | 67.35 | 66.33 | 76.56 | 64.06 | 57.78 | 62.22 | 66.67 | 43.84 | 35.56 |
| H2960 | 75.38 | 65.38 | 82.56 | 54.65 | 74.51 | 60.78 | 60.78 | 49.49 | 41.42 |
| H2961 | 65.52 | 58.62 | 65.15 | 57.58 | 76.00 | 58.00 | 60.00 | 35.35 | 31.36 |
| H3107 | 61.86 | 64.41 | 73.77 | 75.41 | 65.79 | 73.68 | 78.95 | 43.14 | 24.63 |
| H3112 | 70.00 | 90.00 | 76.92 | 84.62 | 81.82 | 81.82 | 81.82 | 52.63 | 19.23 |
| H3152 | 57.98 | 60.50 | 57.14 | 64.94 | 67.57 | 62.16 | 78.38 | 58.67 | 35.09 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H3154 | 68.81 | 61.47 | 63.24 | 70.59 | 61.54 | 61.54 | 56.41 | 37.70 | 41.22 |
| H3156 | 72.41 | 82.76 | 72.73 | 77.27 | 52.17 | 60.87 | 86.96 | 60.00 | 40.98 |
| H3164 | 78.99 | 74.79 | 86.00 | 74.00 | 82.98 | 70.21 | 59.57 | 50.88 | 24.28 |
| H3204 | 66.00 | 69.00 | 72.60 | 53.42 | 58.82 | 62.75 | 58.82 | 40.91 | 50.63 |
| H3251 | 68.38 | 66.91 | 73.61 | 63.89 | 68.18 | 52.27 | 59.09 | 58.82 | 46.81 |
| H3305 | 66.04 | 66.04 | 85.37 | 73.17 | 86.67 | 66.67 | 93.33 | 50.00 | 39.47 |
| H3307 | 77.59 | 63.79 | 73.85 | 72.31 | 61.90 | 76.19 | 85.71 | 39.02 | 29.36 |
| H3312 | 64.04 | 64.04 | 74.42 | 72.09 | 48.57 | 65.71 | 74.29 | 55.56 | 29.13 |
| H3327 | 57.14 | 71.43 | 90.00 | 70.00 | 66.67 | 75.00 | 83.33 | 66.67 | 33.33 |
| H3328 | 60.00 | 86.67 | 77.78 | 88.89 | 85.71 | 71.43 | 71.43 | 50.00 | 29.41 |
| H3330 | 79.69 | 73.44 | 75.00 | 83.33 | 77.42 | 58.06 | 74.19 | 55.00 | 23.31 |
| H3335 | 57.78 | 62.22 | 66.20 | 60.56 | 57.58 | 45.45 | 66.67 | 49.32 | 41.60 |
| H3336 | 89.61 | 79.22 | 86.67 | 60.00 | 85.71 | 76.19 | 76.19 | 45.16 | 11.83 |
| H3351 | 74.19 | 72.58 | 84.21 | 55.26 | 42.31 | 69.23 | 65.38 | 42.31 | 40.00 |
| H3359 | 88.43 | 79.34 | 82.00 | 66.00 | 82.93 | 73.17 | 73.17 | 61.02 | 15.71 |
| H3361 | 71.60 | 66.67 | 58.54 | 58.54 | 66.67 | 51.52 | 57.58 | 34.21 | 27.66 |
| H3362 | 68.69 | 72.73 | 76.56 | 70.31 | 66.67 | 53.33 | 73.33 | 39.29 | 41.18 |
| H3366 | 69.07 | 73.20 | 67.12 | 60.27 | 59.46 | 72.97 | 70.27 | 48.48 | 34.93 |
| H3370 | 71.55 | 75.86 | 79.52 | 69.88 | 75.76 | 63.64 | 75.76 | 50.82 | 29.50 |
| H3379 | 70.00 | 63.33 | 63.16 | 65.79 | 86.67 | 80.00 | 66.67 | 46.15 | 36.36 |
| H3384 | 57.14 | 67.86 | 70.21 | 63.83 | 52.17 | 56.52 | 69.57 | 43.48 | 40.74 |
| H3387 | 73.27 | 57.43 | 58.70 | 69.57 | 60.00 | 57.50 | 72.50 | 48.72 | 7.38 |
| H3388 | 56.76 | 60.81 | 79.63 | 79.63 | 66.67 | 66.67 | 70.83 | 47.17 | 48.86 |
| H3449 | 69.09 | 67.27 | 77.65 | 70.59 | 73.81 | 69.05 | 78.57 | 44.26 | 47.37 |
| H3456 | 74.13 | 69.93 | 66.67 | 70.67 | 69.05 | 66.67 | 76.19 | 39.73 | 34.97 |
| H3503 | 74.07 | 51.85 | 72.88 | 79.66 | 75.68 | 54.05 | 72.97 | 42.42 | 42.22 |
| H3619 | 72.45 | 77.55 | 78.57 | 60.71 | 71.11 | 66.67 | 62.22 | 43.28 | 49.21 |
| H3653 | 76.56 | 64.06 | 62.64 | 75.82 | 73.21 | 62.50 | 71.43 | 43.68 | 36.97 |
| H3655 | 58.52 | 61.48 | 72.41 | 66.67 | 53.19 | 74.47 | 68.09 | 33.72 | 39.60 |
| H3657 | 78.49 | 65.59 | 74.32 | 75.68 | 71.05 | 60.53 | 73.68 | 43.14 | 28.18 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H3659 | 70.63 | 60.32 | 65.48 | 61.90 | 73.91 | 54.35 | 73.91 | 37.14 | 32.14 |
| H3660 | 69.23 | 68.38 | 72.90 | 60.75 | 60.87 | 50.00 | 58.70 | 41.94 | 45.27 |
| H3664 | 66.67 | 67.41 | 62.00 | 69.00 | 58.33 | 50.00 | 63.89 | 47.62 | 47.75 |
| H3668 | 68.84 | 67.39 | 69.44 | 67.59 | 80.00 | 71.67 | 66.67 | 39.80 | 44.63 |
| H3672 | 63.03 | 63.03 | 61.40 | 56.14 | 67.57 | 56.76 | 54.05 | 48.39 | 36.36 |
| H3706 | 54.76 | 64.29 | 71.79 | 73.08 | 56.16 | 68.49 | 63.01 | 35.58 | 40.63 |
| H3749 | 61.61 | 64.29 | 62.50 | 54.69 | 67.19 | 59.38 | 68.75 | 46.34 | 41.18 |
| H3755 | 76.47 | 58.82 | 64.47 | 68.42 | 70.59 | 50.98 | 70.59 | 27.85 | 42.01 |
| H3805 | 82.02 | 77.53 | 75.00 | 72.22 | 76.56 | 67.19 | 68.75 | 40.28 | 38.46 |
| H3851 | 70.19 | 72.12 | 76.25 | 60.00 | 63.83 | 51.06 | 61.70 | 50.00 | 45.38 |
| H3856 | 75.51 | 72.45 | 73.02 | 68.25 | 58.54 | 48.78 | 65.85 | 34.38 | 54.40 |
| H3864 | 65.43 | 67.90 | 80.00 | 52.31 | 81.25 | 59.38 | 59.38 | 55.38 | 44.83 |
| H3907 | 61.22 | 72.45 | 65.85 | 62.20 | 65.71 | 68.57 | 74.29 | 38.71 | 43.70 |
| H3909 | 67.96 | 76.70 | 75.34 | 73.97 | 81.08 | 67.57 | 72.97 | 40.43 | 47.96 |
| H3916 | 68.07 | 68.91 | 80.00 | 61.25 | 67.74 | 58.06 | 61.29 | 47.89 | 41.59 |
| H3931 | 70.19 | 75.00 | 79.07 | 73.26 | 76.19 | 73.81 | 83.33 | 50.00 | 34.85 |
| H3949 | 69.68 | 65.16 | 68.92 | 66.22 | 69.57 | 62.32 | 66.67 | 40.63 | 27.81 |
| H3952 | 64.18 | 73.13 | 78.57 | 80.36 | 71.43 | 71.43 | 75.00 | 35.71 | 36.17 |
| H3954 | 62.75 | 64.71 | 71.25 | 73.75 | 46.81 | 59.57 | 82.98 | 43.64 | 37.90 |
| H3957 | 66.67 | 60.12 | 72.81 | 71.93 | 61.40 | 71.93 | 66.67 | 43.21 | 42.08 |
| H3959 | 70.16 | 61.29 | 69.90 | 70.87 | 61.11 | 59.26 | 68.52 | 48.89 | 32.57 |
| H3962 | 66.67 | 65.97 | 79.05 | 62.86 | 65.57 | 67.21 | 62.30 | 51.85 | 39.07 |
| H3964 | 73.83 | 71.03 | 77.50 | 72.50 | 78.38 | 81.08 | 67.57 | 49.23 | 26.58 |
| H4003 | 75.00 | 63.33 | 61.90 | 52.38 | 70.69 | 58.62 | 65.52 | 23.64 | 18.56 |
| H4004 | 70.65 | 66.17 | 61.59 | 42.38 | 75.00 | 67.24 | 49.14 | 32.53 | 32.50 |
| H4005 | 68.83 | 72.08 | 65.31 | 46.94 | 70.24 | 63.10 | 50.00 | 36.07 | 30.77 |
| H4006 | 70.45 | 69.32 | 54.93 | 50.70 | 71.05 | 63.16 | 68.42 | 32.08 | 24.34 |
| H4102 | 69.11 | 60.16 | 68.75 | 77.08 | 70.00 | 68.00 | 86.00 | 33.96 | 42.70 |
| H4152 | 64.29 | 62.24 | 68.42 | 66.32 | 85.00 | 62.50 | 75.00 | 46.75 | 44.44 |
| H4406 | 73.79 | 66.21 | 65.57 | 62.30 | 74.51 | 56.86 | 47.06 | 29.73 | 38.29 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H4454 | 78.57 | 74.29 | 69.57 | 63.77 | 78.57 | 69.05 | 78.57 | 38.36 | 47.62 |
| H4456 | 73.11 | 63.87 | 75.27 | 63.44 | 73.47 | 59.18 | 73.47 | 38.82 | 46.15 |
| H4461 | 68.14 | 76.11 | 77.78 | 60.61 | 79.07 | 69.77 | 67.44 | 37.66 | 45.34 |
| H4506 | 72.88 | 71.19 | 65.79 | 63.16 | 78.05 | 63.41 | 60.98 | 43.42 | 34.94 |
| H4510 | 75.63 | 73.11 | 73.61 | 62.50 | 58.33 | 56.25 | 62.50 | 48.78 | 32.37 |
| H4513 | 73.11 | 62.18 | 62.50 | 60.94 | 63.64 | 63.64 | 70.45 | 32.73 | 35.92 |
| H4520 | 73.56 | 65.52 | 82.00 | 62.00 | 58.62 | 68.97 | 62.07 | 42.37 | 47.12 |
| H4564 | 80.23 | 77.91 | 73.42 | 69.62 | 66.67 | 64.71 | 72.55 | 48.21 | 52.00 |
| H4590 | 71.43 | 70.63 | 74.63 | 67.16 | 70.37 | 81.48 | 55.56 | 47.95 | 34.13 |
| H4604 | 63.20 | 64.80 | 74.68 | 43.04 | 66.04 | 67.92 | 49.06 | 40.74 | 46.20 |
| H5005 | 68.75 | 71.88 | 76.27 | 57.63 | 62.00 | 60.00 | 56.00 | 43.08 | 43.61 |
| H5050 | 78.43 | 72.55 | 82.76 | 75.86 | 62.50 | 45.83 | 79.17 | 50.00 | 50.00 |
| H5102 | 67.54 | 60.53 | 58.10 | 68.57 | 70.89 | 49.37 | 72.15 | 21.33 | 43.57 |
| H5151 | 63.89 | 60.42 | 66.67 | 72.50 | 64.21 | 56.84 | 67.37 | 30.49 | 40.68 |
| H5211 | 65.79 | 68.42 | 80.00 | 80.00 | 57.14 | 66.67 | 76.19 | 52.38 | 44.19 |
| H5215 | 52.24 | 59.70 | 65.22 | 60.87 | 70.83 | 62.50 | 58.33 | 46.94 | 27.85 |
| H5253 | 69.44 | 69.44 | 65.57 | 59.02 | 61.54 | 58.97 | 66.67 | 29.33 | 23.73 |
| H5254 | 65.48 | 60.71 | 68.25 | 66.67 | 62.50 | 53.13 | 68.75 | 41.82 | 41.25 |
| H5256 | 63.16 | 56.14 | 60.47 | 72.09 | 64.86 | 45.95 | 59.46 | 32.50 | 51.28 |
| H5262 | 76.79 | 75.00 | 70.59 | 86.27 | 81.25 | 65.63 | 90.63 | 51.11 | 47.56 |
| H5264 | 59.49 | 58.23 | 76.92 | 58.97 | 53.66 | 58.54 | 58.54 | 50.00 | 58.33 |
| H5402 | 71.55 | 75.86 | 71.62 | 55.41 | 60.00 | 56.67 | 63.33 | 30.77 | 43.36 |
| H5404 | 77.05 | 77.05 | 75.00 | 54.55 | 60.47 | 67.44 | 58.14 | 44.78 | 32.03 |
| H5407 | 86.96 | 80.43 | 71.43 | 66.67 | 64.29 | 71.43 | 57.14 | 37.50 | 32.69 |
| H5411 | 66.67 | 84.06 | 80.56 | 69.44 | 66.67 | 66.67 | 70.83 | 66.67 | 38.78 |
| H5415 | 71.43 | 80.36 | 75.00 | 61.36 | 56.52 | 65.22 | 60.87 | 34.38 | 37.31 |
| H5416 | 76.12 | 65.67 | 64.71 | 50.00 | 57.14 | 50.00 | 64.29 | 33.33 | 46.15 |
| H5500 | 69.05 | 64.29 | 83.33 | 73.81 | 71.43 | 71.43 | 61.90 | 34.15 | 50.00 |
| H5506 | 71.15 | 67.31 | 69.23 | 66.67 | 43.48 | 52.17 | 60.87 | 50.00 | 56.00 |
| H5507 | 70.59 | 62.50 | 71.03 | 70.09 | 73.33 | 53.33 | 61.67 | 50.54 | 47.89 |

| | Diabetes (N=21,059) | | CAD (N=14,176) | | CHF (N=8,464) | | | COPD (13,126) | Depression (N=26,096) |
|---|---|---|---|---|---|---|---|---|---|
| | ACE inhibitor/ARB | Lipid-lowering medications | Lipid-lowering medications | Beta-Blockers | ACE inhibitor/ARB | Lipid-lowering medications | Beta-Blockers | Inhaled Steroids | Antidepressants |
| H5508 | 70.54 | 70.54 | 78.95 | 54.74 | 62.75 | 70.59 | 64.71 | 37.33 | 43.75 |
| H5509 | 71.08 | 69.88 | 66.97 | 57.80 | 64.10 | 66.67 | 76.92 | 38.54 | 44.00 |
| H5510 | 68.21 | 75.50 | 84.92 | 76.19 | 70.69 | 75.86 | 74.14 | 46.91 | 44.14 |
| H5512 | 71.19 | 84.75 | 70.59 | 68.63 | 70.00 | 65.00 | 80.00 | 51.85 | 47.44 |
| H5515 | 76.47 | 67.65 | 73.58 | 66.04 | 78.79 | 57.58 | 72.73 | 54.17 | 41.05 |
| H5516 | 61.94 | 75.37 | 80.85 | 61.70 | 63.64 | 70.45 | 79.55 | 43.82 | 43.04 |
| H5517 | 61.62 | 58.92 | 59.03 | 60.42 | 62.79 | 50.00 | 67.44 | 25.00 | 41.67 |
| H5521 | 69.85 | 72.06 | 83.53 | 71.76 | 71.05 | 68.42 | 76.32 | 44.05 | 45.52 |
| H5524 | 75.68 | 67.57 | 70.91 | 63.64 | 58.62 | 62.07 | 62.07 | 48.72 | 52.11 |
| H5525 | 65.63 | 68.75 | 69.62 | 74.68 | 71.93 | 56.14 | 77.19 | 35.00 | 46.27 |
| H5526 | 62.50 | 75.00 | 74.63 | 70.15 | 51.85 | 62.96 | 62.96 | 42.86 | 33.78 |
| H5527 | 69.23 | 65.38 | 60.00 | 64.00 | 63.33 | 63.33 | 66.67 | 37.93 | 46.84 |
| H5528 | 61.11 | 62.04 | 66.22 | 64.86 | 48.00 | 56.00 | 52.00 | 55.10 | 18.75 |
| H5529 | 61.46 | 70.83 | 75.95 | 63.29 | 73.53 | 79.41 | 70.59 | 40.28 | 50.00 |
| H5530 | 92.00 | 84.00 | 72.22 | 55.56 | 66.67 | 55.56 | 66.67 | 63.64 | 57.14 |
| H5531 | 74.07 | 66.67 | 70.83 | 58.33 | 42.86 | 42.86 | 57.14 | 68.18 | 39.53 |
| H5532 | 67.26 | 66.37 | 75.00 | 67.31 | 52.00 | 64.00 | 66.00 | 45.83 | 49.28 |
| H5533 | 62.34 | 66.23 | 80.36 | 71.43 | 38.46 | 53.85 | 80.77 | 44.68 | 57.75 |
| H6360 | 83.84 | 82.83 | 80.56 | 72.22 | 71.11 | 77.78 | 80.00 | 40.35 | 33.33 |
| H9001 | 61.68 | 79.44 | 74.12 | 72.94 | 68.57 | 65.71 | 74.29 | 38.81 | 43.94 |
| H9003 | 75.28 | 80.90 | 75.00 | 79.41 | 66.67 | 66.67 | 63.64 | 44.87 | 52.63 |
| H9005 | 61.80 | 66.29 | 71.43 | 77.14 | 71.19 | 54.24 | 69.49 | 53.03 | 50.00 |
| H9011 | 70.51 | 70.51 | 86.67 | 76.67 | 85.71 | 71.43 | 85.71 | 51.61 | 28.21 |
| H9016 | 74.19 | 74.19 | 65.67 | 59.70 | 69.44 | 66.67 | 61.11 | 44.83 | 28.68 |
| H9047 | 67.50 | 72.50 | 82.67 | 73.33 | 79.17 | 64.58 | 66.67 | 53.52 | 40.85 |
| H9101 | 76.35 | 75.68 | 76.06 | 83.10 | 71.88 | 68.75 | 78.13 | 56.67 | 31.64 |
| H9103 | 82.91 | 84.18 | 83.33 | 79.17 | 72.55 | 70.59 | 77.45 | 63.72 | 60.92 |
| H9104 | 76.05 | 69.46 | 74.67 | 62.67 | 73.33 | 53.33 | 63.33 | 48.24 | 41.71 |

ACEI= angiotensin converting enzyme inhibitor; ARB= angiotensin receptor blocker

Appendix B. Comparison between our drug class classification and the HEDIS 2008 National Drug Coding class assignment

| **Condition** | **Indicator** | **Our drug class classification** | HEDIS 2008 National Drug Coding class assignment |
|---|---|---|---|
| Diabetes (N=21,059) | ACEIARB | 14,814 (70.35%) | 14,803 (70.29%) |
| CAD (N=14,176) | ACEIARB | 8,731 (61.59%) | 8,726 (61.55%) |
| | BetaBlockers | 9,490 (66.94%) | 9,416 (66.42%) |
| CHF (N=8,464) | ACEIARB | 5,758 (68.03%) | 5,750 (67.93%) |
| | BetaBlockers | 5,781 (68.3%) | 5,776 (68.24%) |
| COPD (N=13,126) | InhaledCort | 5,686 (43.32%) | 4,857 (37%) |
| Depr (N=26,096) | Antidepressants | 10,200 (39.09%) | 10,187 (39.04%) |

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