Medicare Advantage Star Rating Quality Measurements

A Study of the Impact of Dual Eligible Enrollees on the Performance of Star Rating Measures

INNOVACARE HEALTH

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Executive Summary

The Centers for Medicare and Medicaid Services (CMS) implemented a Five-Star Program, in response to the Affordable Care Act requirements. The program bases a substantial portion of Medicare Advantage (MA) plan payments on the star ratings, which are intended to represent the quality of care provided by each MA plan.

In this document we respond to CMS' Request for Information - Data on Differences in Medicare Advantage (MA) and Part D Star Rating Quality Measurements for Dual-Eligible versus Non-Dual-Eligible Enrollees. We investigate the correlation in, as well as the causal relationship between, dual eligible status and plans' performance on the star ratings measures. Along with dual status, we include socioeconomic and health status in our study.

We conclude that there is a causal relationship between dual eligible status and lower star ratings on certain performance measures. Other socioeconomic and health status factors can also heavily influence star ratings. These factors are largely outside of an MA plan's control. Star ratings assigned without taking into consideration these factors are significantly biased against plans serving more disadvantaged populations. Basing MA plan payments on such ratings is inappropriate and creates a disincentive for health plans to enroll disadvantaged members.

We urge CMS to acknowledge the influences on star ratings of dual status and other factors not directly linked to, or under the control of a plan's performance, and take immediate steps to rectify the situation. In this document, we offer two concrete approaches that CMS could take to address this serious issue.

Background

The Five-Star program measures a Medicare Advantage plan's performance in more than 50 specific areas that address care processes, intermediate outcomes, outcomes, access and patient experience[2]. CMS assigns star rating thresholds for each measure, developed using statistical modeling approaches described later in this section. Each measure is also assigned a weight; the weighted average of a plan's performance across all individual criteria is the plan's overall Star Rating. For the 2014 star ratings, CMS assigned the highest weight to outcome (such as Health Plan Quality Improvement) and intermediate outcome (such as Diabetes Care – Blood Sugar Controlled and Part D Medication Adherence) measures. Process measures (such as Care for Older Adults) are assigned the lowest relative weight. An integration factor (i-factor) is applied to reward consistently high performance.

In calculating the individual star ratings, CMS applies a case-mix adjustment to the CAHPS (Medicare Consumer Assessment of Healthcare Providers and Systems) measures. Most CAHPS measures fall under the patient experience category and are based on survey responses. The case-mix adjustment intends to take into consideration differences in the characteristics of enrollees that may potentially impact survey responses. Case-mix variables include dual eligible status, education, age, and other variables. Aside from CAHPS measures, other measures are not case-mix adjusted, and all plans are measured using identical rating thresholds.

Using identical rating thresholds for certain measures ignores disparities in plans' populations. Such disparities are outside of a plan's control and can directly influence plan performance outcomes. Socioeconomic disparities have been established to be the most fundamental cause of health disparities [1,2]. Dual eligible status, with a direct linkage to income level, is an indicator of socioeconomic status. Among industry studies, Inovalon [3] demonstrates that there exists a significant performance gap between dual eligible and non-dual eligible members, even after adjusting for other important socioeconomic and clinical risk factors. Our analysis resulted in similar conclusions.

[2] A table that includes measure names for each composite measure/domain is provided in Appendix B.1.

To respond to CMS' RFI and demonstrate a causal relationship between dual eligible status and lower star ratings, we conducted panel analysis and multivariate regression using public and plan-specific data. Our analysis and results are presented in following sections.

Objectives

This study aims to address the following research question: **Does providing care for dual eligible enrollees impact a plan's ability to meet CMS performance measures?**

The two main objectives of this analysis are as follows:

- Examine the causal relationship between the level of dual-eligible enrollees (and related factors, such as average health status and education level) and an MA plan's performance in each of the measurement categories: Process Measures, Outcome Measure, Intermediate Outcome Measures, Patients' Experience and Complaints Measure, Measures Capturing Access
- Examine individual-level socioeconomic and health status factors that influence the member's compliance to care, and consequently affect plan performance on star measures

Methodology Overview

We employed a two-part analysis, with each part corresponding to an objective listed above. For the first objective of establishing a causal relationship between dual eligible enrollees and plan performances, we utilized four years of publicly available data from the CMS website on the historical breakdown of plan performances on each of the Five Star Rating measures for all Medicare Advantage plans from Rating Year 2012 to 2015. We further supplemented this data with additional socioeconomic information associated with the areas served by each plan by year. With accordance to the CMS definition of measurement categories, we created composite variables for each of the measurement categories[3].

In order to establish causality between dual eligible enrollees and a plan's performance on CMS measures, we employ the following:

1. Panel data

Panel data refers to data structure where there are multiple observations of the same entities over time. In this instance, we were able to obtain 4 years of rating data, from 2012 to 2015, and observe the performance of each contract on each individual CMS performance measure. This data structure provides more information than looking at a point-in-time snapshot of plan performances in these measures.

2. Fixed effects models

We utilized fixed effects panel models to establish causal relationships due to their ability to control for characteristics that are not observable to the statistician. These are factors, should they be present, which are intrinsic and unique to each MA contract that we cannot measure but do not change with time. An overly simplistic model that does not account for these factors will not produce reliable estimates of causal relationships[4].

3. Multivariate logistic regression

[3] Patients' Experience and Complaints, Process, Access, Intermediate Outcomes and Outcome Measure
[4] For a more extensive discussion on the usage of fixed effects model on causal inference, please refer to the Appendix section.

For the second objective of examining individual-level socioeconomic and health status factors that influence the member's compliance to care, we used two years of member level data on a number of clinical measures for two InnovaCare MA contracts. Using multivariate logistic regression models, we examined the relationship between the median household income levels, the dual eligible status of the member, the number and types of chronic conditions of the member, and the level of cost-sharing the member experiences. We further subset the analysis to those members who do not qualify for the dual eligible ("Platino" in Puerto Rico) plan, since the level of cost sharing for the dual eligibles acts to confound our results on adherence.

We provide the specific model specifications in the Appendix section of the report.

Findings

Contract-Level Analysis

In the table below, we present the regression results from the fixed effects panel models for the five composite measures: Patients' Experience and Complaints, Access, Process, Intermediate Outcomes, and Outcomes. The outcome measures are located across the top of the table below[5]. Each of the columns represent a separate fixed effects regression with the coefficients for the % of Dual Eligible Enrollees and education level highlighted.

Table 2 – Regression results for CMS Performance Measure Categories

	Patients' Experience and Complaints	Access	Process	Intermediate Outcomes[1]	Outcomes[1]
% of Dual Eligible Enrollees	0.189	-0.167	-0.0610	**-0.832*** **	**-0.137***
	(0.352)	(0.539)	(0.196)	(0.100)	(0.0704)
Education level - Without HS Diploma	0.0526	0.0197	-0.00386	**-0.0810*** **	-0.00587
	(0.0328)	(0.0501)	(0.0183)	(0.00568)	(0.00381)

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Note: The regression models also control for time trends and contract-level risk score.
[1]Random Effects model coefficients presented here due to Hausman test results.

We note that for the composite performance measure of Patients' Experience and Complaints, the regression model indicates that a 1 unit increase in the % of dual eligible (going from no dual eligibles in a plan to 100% dual eligibles in a plan) increases the star rating by 0.189 stars, even after controlling for all other variables in the regression. However, this result is not statistically significant and as such we conclude that the percentage of dual eligible in a plan has no impact on a plan's performance on measures in this category. We conclude similarly for the Access and Process measures.

[5] For further details on what specific CMS performance measures are included in each composite category, please refer to section B.1 in the Appendix.

Looking at the composite measure of Intermediate Outcomes, we note a statistically significant relationship between the percentage of dual eligibles in the plan (as noted by the asterisks in the table) and the star rating in this category. More specifically, we can say that a 100% increase in the dual eligible in a plan leads to a 0.832 decrease in a plan's performance in Intermediate Outcomes measures. In addition, we also note that plans have worse performances on these measures for serving areas with lower education levels with statistically significant star rating decrease of 0.08.

For the composite measure of Outcomes, we also note a statistically significant relationship between the percentage of dual eligibles in the plan and the star rating. A 100% increase in the dual eligible in a plan leads to a 0.137 decrease in a plan's star performance in these measures on average.

Member-Level Analysis

To supplement our contract-level analysis, we ran additional multivariate logistic regression analysis to explore the following specific compliance measures within our own member data: D13 (Part D Medication Adherence for Oral Diabetes Medications), D14 (Part D Medication Adherence for Hypertension (RAS antagonists)) and D15 (Part D Medication Adherence for Cholesterol (Statins)). These are all medication adherence measures. The results from the multivariate logistic regression models are presented in the table below.

Compliance Measures for Medication Adherence

Table 3 – Regression results for member compliance on medication adherence measures (Odds Ratio)

	Medications For Diabetes	Medications For Diabetes	Medications For Hypertension	Medications For Hypertension	Medications For Cholesterol	Medications For Cholesterol
Platino (1=Yes; 0=No)	**1.411*** **	0.952	**1.163*** **	0.962	**1.342*** **	**0.931** **
	(0.0203)	(0.0452)	(0.0106)	(0.0291)	(0.0132)	(0.0313)
log Median Household Income	**1.080*** **	**1.076*** **	**1.088*** **	**1.087*** **	**1.067*** **	**1.066*** **
	(0.0271)	(0.0286)	(0.0170)	(0.0179)	(0.0178)	(0.0189)
MA Cost Sharing		**0.949*** **		**0.950*** **		**0.972*** **
		(0.00670)		(0.00412)		(0.00492)
Part D Cost Sharing		**0.994** *		**1.005** **		**0.988*** **
		(0.00303)		(0.00190)		(0.00215)

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Note: The regressions control for **Part C RAF, Part D RAF, Diabetes, Heart Failure, Hypertension, Cancer, Depression, and Rheumatoid Arthritis.**

We present in the above table the regression coefficients for dual eligible status (Platino) and income (in logged form) twice for each measure. The first set of results for each measure represents the estimated coefficients when we do not control for the level of MA and Part D cost sharing that is faced by the members. The second set of results reflect the estimates of the coefficients for dual eligible status and income when we control for cost sharing.

We note first for the Medication Adherence for Oral Diabetes Medications measure that when we do not control for cost sharing, Platino members are 41% (odds ratio of 1.41) more likely to be compliant on that measure and that this result is statistically significant. However, when we include the cost sharing faced by the members into the regression model, we note that the Platino members are no longer more compliant, with an odds ratio less than 1 (although this relationship is not statistically significant). However, when we control for the log median household income of the member's zip code, we see that 1 unit increase in log income, or a 1% increase in income, is associated with an almost 8% increase in the likelihood of compliance for the Medication Adherence for Oral Diabetes Medications measure. We also

see that higher MA and Part D cost sharing leads to lower odds of compliance. We note similar patterns for the Medication Adherence for Hypertension (RAS antagonists) measure.

For the Medication Adherence for Cholesterol (Statins) measure, we note that after controlling for the cost sharing level of the member, a Platino member is almost 7% less likely to be compliant for this measure. We also note the same patterns for compliance in response to income and cost sharing.

Non-Platino members

We performed additional analysis on the non-Platino members only, since we noted in the previous analysis that a member's cost sharing level has a statistically significant effect on compliance behavior, and that non-Platino members have cost sharing levels that are materially greater than those for Platino members. We further note that, even though these individuals do not qualify for the Platino plan, their median incomes are generally quite low as well as evidenced in Table 4 below.

Table 4: Median Household Income by Platino Status

	Median Household Income in Puerto Rico	Median Household Income in the United State
Platino	$18,773	$51,371
Non-Platino	$20,785	

We therefore examined the impact of income level, a major component of a person's SES, for non-Platino members only[6].

[6] Since we do not have income information for each of the members in the two plans, we use the median household income at each member's zip code as a proxy for their income level.

Our regression results are as follows:

Table 5 – Regression results for non-Platino member compliance on medication adherence measures (Odds Ratio)

	Medications For Diabetes	Medications For Hypertension	Medications For Cholesterol
Log Median Household Income	**1.228*** **	**1.376*** **	**1.276*** **
	(0.0690)	(0.0503)	(0.0505)
Part D RAF	**1.124** **	**1.066** **	**1.164*** **
	(0.0513)	(0.0306)	(0.0369)
# of Conditions	0.984	**1.031*** **	0.986
	(0.0150)	(0.00987)	(0.0108)

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Note: The regressions control for **Diabetes, Heart Failure, Hypertension, Cancer, Depression, Rheumatoid Arthritis, MA Cost Sharing and Part D Cost sharing.**

The results demonstrate that the median household income of the area that the members live in has a significant relationship with the compliance behavior of those members. A higher median household income leads to a significant increase in the likelihood of compliance for the members. For the Medication Adherence for Oral Diabetes Medications measure, a one unit increase in log median household income is associated with a 23% higher likelihood of compliance on that measure. For the Medication Adherence for Hypertension (RAS antagonists) measure, the association is even stronger for income at almost 38% increase in likelihood of compliance. For the Medication Adherence for Cholesterol (Statins) measure, one unit of increase in log median household income is associated with an increased odds of compliance of 28%.

Discussion

In our analyses, we found dual eligible enrollees do not impact the plans' performances on CMS performance measures related patients experiences, access or process. However, we do note a negative causal relationship between dual eligible enrollees in a plan and star ratings for intermediate outcome measures and outcome measures. The negative causal relationship is significant for the intermediate outcomes and outcomes measures. Since these two measure categories are weighted more heavily with a factor of 3, instead of 1.5 or 1 like the other three categories, this serves to penalize MA contracts with more dual eligible enrollees twice. Once by not adjusting for the SES impact and putting such plans at a disadvantage that isn't under their control, and again by applying a double weight to that measure.

When we examine our internal member level data and focused on three particular compliance measures, we note that, after controlling for the lower levels of cost sharing faced by dual eligible enrollees, dual eligible enrollees are less likely to be compliant[7]. When we examine the non-dual eligible population in our membership, we note statistically significant positive relationships between income level and a member's likelihood to be compliant on a measure. We find this to be further evidence that income, an important component of SES, is highly correlated with compliance behavior.

The causal relationship we found suggests a significant bias in the Five-Star rating system. Patient outcomes depend on a complex mix of factors, some of which are outside of a plan's control. Failing to acknowledge and account for such factors in the CMS quality measures can lead to unintended consequences. This creates a risk that disadvantaged plans will be dis-incentivized to make more investments in improving the quality of care at best; and incentivizes providers and plans to cherry pick their patients at worst.

[7] Although, we note that the results were only statistically significant for the Medication Adherence for Cholesterol (Statins) measure. Future studies with a longer panel of member adherence data could potentially mediate this analytical challenge.

Recommendations

We urge CMS to work with the MA plans and other industry experts to develop alternatives to the current CMS quality rating methodology to account for dual eligible status and other SES factors such as income level regardless of dual eligible status, and health status factors.

The current absence of recognition of SES and health status, including dual eligible status, on most performance measures in the MA Five-Star program leads to funding reductions to the populations most in need of funding. This in turn diminishes the ability of the plan to make the investments needed to improve care for those populations. In order to facilitate improvement in the Star Rating program, we would like to offer the following specific recommendations. As a plan, we are interested in further collaborating with CMS and the industry however we can.

1) Recommended Approach I

To account for the drivers of quality measure results not under plan control, the MA plans should be stratified into groups with similar SES and demographic factors. Separate cut points for each measure should be established and applied to all plans within each of these groups. Such stratification could be based on the percentage of dual eligible members, or other SES factors.

Such approach is not unprecedented. The star rating system developed by CMS for nursing home facilities contains different cut points by state. According to the Nursing Home Compare Five-Star Quality Rating System: Technical Users' Guide, "CMS' Five-Star quality ratings for the health inspection domain are based on the relative performance of facilities within a State. This approach helps to control for variation between States."

2) Recommended Approach II

As an alternative or addition to stratifying the population and setting separate cut points, CMS should consider adjusting quality measure results to account for SES and demographic factors that influence plan performance. Certain outcome measures are more prone to influences of factors outside of plan control.

We strongly believe that the current five-star program has failed to account for various factors outside of MA plan control in measuring plan performance with respect to quality. Significant biases exist in the star ratings. No matter which recommended approach CMS takes, we urge CMS to address this issue immediately to ensure parity in plan performance measurement and funding allocation.

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Appendices

A. Data

A.1 Public Data Analysis

In order to assess the causal relationship between MA contract's percentage of dual-eligible enrollees and other factors and a contract's performance in the various measure categories, we use 2012 - 2015 data from CMS on the performance of individual MA contract in each of the measure categories. We supplement this data with area-level socioeconomic data from the US Census Bureau and plan-level health status data from CMS for the corresponding years.

There are several steps in collecting analysis data for each rating year from 2012 to 2015, and the summary of data years is in Table 3.

Table 3: Summary of Data Years

Data Name	2012 RY	2013 RY	2014 RY	2015 RY
Enrollment	December 2010	December 2011	December 2012	December 2013
SNP	December 2010	December 2011	December 2012	December 2013
Part C Risk Score	2010 PY	2011 PY	2012 PY	2012 PY
Education Level	2008 - 2012	2008 - 2012	2008 - 2012	2008 - 2012
Poverty/Income	2010	2011	2012	2012

A. Star Rating Data

We obtained four years of panel data for all of the quality and performance measures and star ratings at the measure level as well as the overall star ratings data from the CMS website [4] for each MA contract. In our analysis, we excluded contracts that were not assigned an overall star rating by CMS and assigned zero values if the measure-level numeric data and star ratings data were unavailable.

B. MA Enrollment by Contract/Plan/State/County Data

For each rating year, we obtained the corresponding enrollment data by contract/plan/state/county from CMS website [5].

C. Special Needs Plan (SNP) Data

In order to determine the percentage of dual eligible enrollees by contract, we used the Special Needs Plan data from CMS website [6] for each enrollment year including contract number, plan ID, Special Needs Plan type and plan enrollment, and then we calculated the percentage of Dual SNP for each contract by dividing the Dual SNP enrollment by the total enrollment.

D. MA Part C Risk Score Data

We introduce the MA Part C risk score as an independent variable in our multivariate model since the Part C risk scores reflect the population's health status. From CMS website [7] we obtain the plan-level average Part C risk scores and calculate the weighted average of Part C risk score by enrollment for each contract. Note that we use 2012, instead of 2013, Part C risk score for 2015 RY since it is the latest data that can be approached.

E. Socioeconomic Data (Median Household Income, Education level)

In our analysis, the following socioeconomic factors are considered:

- Education level: Percentage of adults age 25 and older without a high school diploma in the US
- Median Household Income: Annual median household income in the US

We obtained the above socioeconomic data at the county level from the US Census Bureau [8] and the USDA [9] for each rating year and joint with the MA enrollment data by linking the FIPS state county codes. Then we calculated the weighted average of the socioeconomic factors by enrollment for each contract. Note that for 2015 RY we are using poverty level and median household income in 2012 since it

is the latest available data in the US Census Bureau website; in addition, the 2008 - 2012 average percentages are used as the education level for all years in our analysis.

A.2 Plan Specific Data Analysis

For our second objective, we use member-level claims data for rating year 2014 and 2015 for contracts H4003 and H4004. We supplement this individual-level claims data with area-level socioeconomic data for each member.

We collect two years of our own contracts member-level data, 2012 dates of service for 2014 RY and 2013 dates of service for 2015 RY, with the following fields for the purpose of the study:

1. Demographic and Claims Data

We include HIC number, contract number, platino/Dual Eligible indicator, Low Income indicator, zip code, county, PBP, Actuarial value of the Part C and Part D cost sharing of the plan, and Part C and Part D risk scores, the number of chronic conditions as defined by CMS [10], and indicators of the six specific chronic disease including: Diabetes, Heart Failure, Hypertension, Depression, Cancer and Rheumatoid Arthritis/Osteoarthritis.

2. Socioeconomic Data

Since the socioeconomic data are not available for the members in our contracts, we obtained the Puerto Rico median household income at zip code level from US Census Bureau's 2008-2012 American Community Survey 5-Year Estimates, and linked the median household income for each member by the zip code.

3. Measure-level Compliance Data

We obtained several clinical measures for which data is available with members' compliance. The following measures are included in the member-level analysis.

- Medication Adherence for Diabetes Medications

- Medication Adherence for Hypertension (RAS antagonists)
- Medication Adherence for Cholesterol (Statins)

B. Variables

B.1 Public Data Analysis

For the outcome variables of this analysis, we constructed composite variables for each of the quality measure categories as follows:

Composite Measure Name	Individual measures
Patients' Experience and Complaints Measures	Getting Needed Care
	Getting Appointments and Care Quickly
	Customer Service
	Overall Rating of Health Care Quality
	Overall Rating of Plan
	Complaints about the Health Plan
	Members Choosing to Leave the Plan
	Complaints about the Drug Plan (for every 1,000 members)
	Members Choosing to Leave the Plan (lower percentages are better because it means fewer members choose to leave the plan)
	Members' Overall Rating of Drug Plan
	Members' Ability to Get Prescriptions Filled Easily When Using the Drug Plan
	Care Coordination
Access Measures	Beneficiary Access and Performance Problems
	Plan Makes Timely Decisions about Appeals
	Reviewing Appeals Decisions
	Call Center – Foreign Language Interpreter and TTY/TDD Availability
	Availability of TTY/TDD Services and Foreign Language Interpretation When Members Call the Drug Plan
	Drug Plan Makes Timely Decisions about Appeals (for every 10,000 members)
	Fairness of Drug Plan's Denials to Member Appeals, Based on an Independent Reviewer
	Problems Medicare Found in Members' Access to Services and in the Plan's Performance (on a scale from 0 to 100, higher numbers are better because it means fewer problems)
Process Measures	Colorectal Cancer Screening
	Cardiovascular Care – Cholesterol Screening
	Diabetes Care – Cholesterol Screening

Composite Measure Name	Individual measures
	Glaucoma Testing
	Annual Flu Vaccine
	Monitoring Physical Activity
	Adult BMI Assessment
	Care for Older Adults – Medication Review
	Care for Older Adults – Functional Status Assessment
	Care for Older Adults – Pain Screening
	Osteoporosis Management in Women who had a Fracture
	Diabetes Care – Eye Exam
	Diabetes Care – Kidney Disease Monitoring
	Rheumatoid Arthritis Management
	Improving Bladder Control
	Reducing the Risk of Falling
	Drug Plan Provides Accurate Price Information for Medicare's Plan Finder Web site and Keeps Drug Prices Stable During the Year (higher scores are better)
Intermediate Outcomes Measures	Diabetes Care – Blood Sugar Controlled
	Diabetes Care – Cholesterol Controlled
	Controlling Blood Pressure
	Plan Members 65 and Older Who Received Prescriptions for Certain Drugs with a High Risk of Side Effects, When There May Be Safer Drug Choices
	Using the Kind of Blood Pressure Medication That Is Recommended for People with Diabetes
	Taking Oral Diabetes Medication as Directed
	Taking Blood Pressure Medication as Directed
	Taking Cholesterol Medication as Directed
Outcomes Measures	Improving or Maintaining Physical Health
	Improving or Maintaining Mental Health
	Plan All-Cause Readmissions
	Health Plan Quality Improvement
	Drug Plan Quality Improvement

The main independent variable of interest is the percentage of dual-eligible enrollees within a plan. In addition, the analysis controls for plan-level risk adjustment factors[8], the education level of the plan area, and area and time fixed effects.

[8] We transformed the contract-level risk score into a categorical variable with the following bins: 0.5-0.7, 0.7-0.8, 0.8-0.9, 0.9-1.0, 1.0-1.1, 1.1-1.2, 1.2-1.3, 1.3-1.4, 1.4+. The risk scored was transformed to create more meaningful differentiations in changes in risk scores and to create a distribution of risk scores that is closer to a normal distribution.

B.2 Plan Specific Data Analysis

The main outcomes of interest is a dichotomous outcome variable of compliance (1=yes; 0=no) on performance measures D13, D14 and D15. The main independent variable of interest is whether the member is a Platino (dual eligible) member (1=yes; 0=no).

The plan multivariate regression analysis also controls for member level disease factors such as:

- Whether the member is diagnosed with (1=yes; 0=no):
    - Diabetes
    - Heart Failure
    - Hypertension
    - Cancer
    - Depression
    - Rheumatoid Arthritis
- Number of chronic conditions a member is diagnosed with
- Part D Risk Adjustment Factor
- MA cost sharing
- Part D Cost Sharing
- Log of median household income

C. Methodology

C.1 Public Data Analysis

With panel data, we are able to have multiple observations for each contract across time. This allows our model to account for heterogeneity across these entities, or contracts. In other words, we are able to account for any unique ways by which each Medicare Advantage Plan manages their population health, run their plans, and influence member outcomes and star rating performances. Failure to account for this

source of heterogeneity, by only relying on cross-sectional data from a single time period, will likely result in biased estimates.

This data structure also allowed us to control for omitted variable bias, which is otherwise an impediment to establishing causal relationships, through the usage of fixed effects models. This issue arises when there are any number of plan characteristics that are unmeasured and unobserved for a given contract that could potentially simultaneously influence our performance outcome of interest and other observed variables.

For the analysis we ran both fixed effects and random effects panel models with time fixed effects. We controlled for the population illness burden of the plan with risk scores. We also modeled the SES of the plan populations with a combination of the percentage of dual eligibles within the plan and the percentage of individuals in the area served by the plan that is without a high school diploma. Model selection between the fixed effects model and the random effects model was done using the Hausman test. Thus, when statistically justified, we chose the random effects model.

Empirical Model

$$OutcomeCategory_{i,t} = \beta_0 + \beta_1 PercentageDualEligibles_{i,t} + \beta_2 RiskAdjustmentScore_{i,t} + \beta_3 X_{i,t} + \mu_t + \mu_{i,t}$$

$OutcomeCategory_{i,t}$ stands for the rating score in a particular measure category for plan *i* at time *t*. The variable $PercentageDualEligibles_{i,t}$ is the main variable of interest representing the percentage of dual-eligible enrollees within a plan. In addition, we control for a plan's risk adjustment score with $RiskAdjustmentScore_{i,t}$ and time fixed effects μ_t and a vector of various plan level characteristics, $\mathbf{X}_{i,t}$.

C.2 Plan Specific Data Analysis

We looked at two years of member level data on a number of adherence measures for two InnovaCare MA contracts. Using multivariate logistic regression models, we examined the relationship between the

median income level, the dual eligible status of the member, the number and type of chronic conditions of the member, and the level of cost-sharing the member experiences. We further subset the analysis to those members who qualify for dual eligibility (Platino plan) and those that do not, since the level of cost sharing for the dual eligibles could be confounding our results on adherence.

The individual level analysis with binary outcome variables of adherence or non-adherence is modeled using multivariate logistic regression models. In this portion of the analysis, we looked for significant associations between the Platino status (dual eligible status) of the member and their compliance behavior on various measures, while controlling for disease burden, the median household income of the area they live in, and their level of cost sharing.

The logistic model is as follows for each member *i*:

$$\text{logit}(E[Y_i|x_i]) = \beta_0 + \beta_1 \text{Platino}_i + \beta_2 \text{LogMedianHouseholdIncome}_i + \beta_3 \text{PartCRAF}_i + \beta_4 \text{PartDRAF}_i + \beta_5 \text{NumberofChronicConditions}_i + \beta_6 \text{Diabetes}_i + \beta_7 \text{HeartFailure}_i + \beta_8 \text{Hypertension}_i + \beta_9 \text{Cancer}_i + \beta_{10} \text{Depression}_i + \beta_{11} \text{Arthritis}_i + \beta_{12} \text{MACostSharing}_i + \beta_{13} \text{PartDCostSharing}_i + \text{mu}_i$$

In the second portion of the analysis, we looked exclusively at the non-Platino members and examined the relationship between income and compliance behavior while controlling for the factors above.

Contact

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About InnovaCare Health

InnovaCare, Inc. is a leading provider of managed healthcare services in North America. Through two primary avenues of care, Provider Networks and Medicare Advantage, InnovaCare is committed to quality healthcare by creating models that are sustainable, cost-effective and fully integrated with advanced technologies.

