

**Medicare Health Outcomes Survey (HOS)  
2015-2017 Cohort 18 Case-Mix Adjustment  
August 2018**

The longitudinal outcomes for the Medicare Health Outcomes Survey (HOS) 2015-2017 Cohort 18 Performance Measurement analysis are based on risk-adjusted mortality rates, changes in physical health as measured by the physical component summary (PCS) score, and changes in mental health as measured by the mental component summary (MCS) score for the participating Medicare Advantage Organizations (MAOs). For reporting purposes, death and PCS outcomes are combined into one overall measure of change in physical health. Thus, there are two primary outcomes: (1) Alive and PCS Better + Same (vs. PCS Worse or Death) and (2) MCS Better + Same (vs. MCS Worse). For the Medicare Part C Star Ratings, the primary outcomes are reported as the percentage of respondents within an MAO who are “Improving or Maintaining Physical Health” (C04), and the percentage within an MAO who are “Improving or Maintaining Mental Health” (C05) over the two-year period, after adjustment for case-mix.

The analysis of death outcomes for the HOS performance measurement includes beneficiaries who are age 65 or older at baseline, completed the HOS at baseline with a calculable PCS or MCS score, and whose MAO participated in the HOS at follow up. Beneficiaries are included in the analysis of PCS and MCS change scores if they are age 65 or older at baseline, alive at follow up, enrolled in their original MAO at follow up, and completed the HOS with calculable PCS and MCS scores at baseline and follow up. HOS outcomes are analyzed by calculating the national averages, and the differences between actual and expected contract-level results for death, PCS, and MCS over two years. The expected results are adjusted for the case-mix of beneficiaries within an MAO to control for pre-existing baseline differences across MAOs with respect to covariates, such as baseline measures of sociodemographic characteristics, chronic medical conditions, and functional health status. The PCS results are combined with the percentage remaining alive in the MAO. An adjusted contract-level percentage for each of the two primary outcomes (PCS and MCS change scores) is calculated by combining the national average and the MAO difference score, using a logit transformation.

Tables 1-3 below include a series of 12 different multivariate logistic regression models (six death models, three PCS models, and three MCS models) that are used to case-mix adjust HOS outcomes, and to calculate expected outcomes for each beneficiary. For each of the three types of models (death, PCS, and MCS), the first model (Model A) is used for those beneficiaries with complete data and the other alternative models are used for those respondents with different patterns of missing data for the model outcome. To address the issue of missing data, a series of cascading logistic regression models was developed. Alternative death, PCS, and MCS models allow for missing income, education, marital status, and homeownership, which generally are the most commonly missing variables. These models also allow for the CMS administrative (rather than self-reported) race/ethnicity, which is non-missing for all beneficiaries. In addition, the alternative death models allow for different patterns of missing across the baseline chronic medical conditions and functional status items.

The coefficients in the tables report the log-odds for beneficiaries with a given characteristic having the expected outcome compared to beneficiaries in the reference category for that characteristic, controlling for all other model characteristics. In Table 2: HOS PCS Better + Same Model Covariates, the Model A coefficient for “Female” is -0.163, indicating a lower probability of PCS Better + Same for female compared to male respondents (the reference category), who otherwise have the same demographic and health characteristics. However, the coefficient for age and gender interaction in the PCS Better + Same Model A is 0.003, indicating a very small positive difference in the expected outcome between females and males of the same age. It is important to note that the case-mix patterns are not always consistent across the 12 different logistic regression models.

More information about the calculation of HOS outcomes at the beneficiary and MAO contract levels is available on the HOS website at [www.hosonline.org](http://www.hosonline.org).

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Table 1: HOS Death Model Covariates

Death Model Covariates	Model A	Model B	Model C	Model D	Model E	Model F
<b><i>Baseline Demographics</i></b>						
Constant	-6.881	-7.010	-7.032	-4.285	-4.703	-8.195
Age (linear)	0.065	0.066	0.064	0.064	0.068	0.071
Age 75+	0.022	0.018	0.023	0.026	0.024	0.044
Age 85+	0.015	0.021	0.023	0.029	0.025	0.018
Age and gender interaction	0.002	0.001	0.001	0.003	0.001	0.001
Female	-0.622	-0.496	-0.434	-0.619	-0.582	-0.552
Married	-0.145	-0.150				
Hispanic only	-0.481	-0.498				
Asian only	-0.702	-0.764				
Native Hawaiian or Pacific Islander only	-0.090	-0.069				
Black only	-0.176	-0.179				
American Indian or Alaskan Native only	-0.218	-0.099				
Multiracial	-0.088	-0.078				
CMS Hispanic only			-0.582	-0.601	-0.681	-0.584
CMS Asian or Pacific Islander only			-0.787	-0.725	-0.781	-0.791
CMS Black only			-0.115	-0.122	-0.161	-0.152
CMS American Indian or Alaskan Native only			-0.190	-0.123	-0.190	-0.087
CMS other race only			-0.240	-0.181	-0.190	-0.243
CMS unknown race only			-0.344	-0.330	-0.396	-0.582
Receive Medicaid	0.072	0.084	0.179	0.299	0.327	0.703
Eligible for SSI	0.161	0.133	0.199	0.170	0.156	0.846
Home owner	-0.154	-0.156				
High school graduate or greater	0.080	0.067				
Household income <\$20,000	0.042	0.030				
<b><i>Baseline Functional Status</i></b>						
One-item measure of General Health compared to others	0.235	0.250	0.228			
Physical Functioning/Activities of Daily Living Scale	-0.019	-0.018	-0.020			
General Health item	0.202	0.209	0.205			
Physical Functioning item (limitations in moderate activities)	-0.047	-0.047	-0.028			
Physical Functioning item (limitations climbing several flights of stairs)	0.033	0.029	0.045			
Role Physical item (accomplished less than would like)	0.042	0.042	0.003			
Role-Physical item (limited in the kind of work or other activities)	0.047	0.050	0.056			
Role-Emotional item (accomplished less than would like)	0.018	0.009	0.016			

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<b>Death Model Covariates</b>	<b>Model A</b>	<b>Model B</b>	<b>Model C</b>	<b>Model D</b>	<b>Model E</b>	<b>Model F</b>
Role-Emotional item (did not do work or other activities as carefully)	-0.021	-0.024	-0.033			
Bodily Pain item (pain interfered with normal work)	-0.087	-0.097	-0.093			
Mental Health item (felt calm and peaceful)	-0.014	-0.016	-0.018			
Vitality item (had a lot of energy)	0.020	0.029	0.063			
Mental Health item (felt downhearted and blue)	-0.001	0.002	0.016			
Social Functioning item (health interfered with social activities)	-0.090	-0.089	-0.082			
<b>Baseline Chronic Medical Conditions</b>						
Hypertension	-0.115					
Angina/coronary artery disease	-0.036					
Congestive heart failure	0.536					
Myocardial infarction	0.159					
Other heart conditions	0.014					
Stroke	0.119					
Pulmonary disease	0.309					
Gastrointestinal disorders	-0.177					
Arthritis of hip or knee	-0.324					
Arthritis of hand or wrist	-0.147					
Sciatica	-0.300					
Diabetes	0.111					
Depression	-0.071					
Any cancer other than skin cancer	0.419					
Colon cancer treatment	0.320					
Breast cancer treatment	-0.061					
Prostate cancer treatment	-0.198					
Lung cancer treatment	1.119					
Large positive disease groups <sup>1</sup>		1.894	1.821	1.888		
Medium positive disease groups <sup>2</sup>		0.712	0.727	0.902		
Nominal disease groups <sup>3</sup>		-0.090	-0.046	-0.054		
Negative disease groups <sup>4</sup>		-1.326	-1.377	-1.536		
<b>Baseline Summary Scores</b>						
Baseline PCS				-0.049	-0.049	
Baseline MCS				-0.027	-0.025	

<sup>1</sup> congestive heart failure, any cancer, lung cancer, and colon/rectal cancer

<sup>2</sup> pulmonary disease, stroke, diabetes, and myocardial infarction

<sup>3</sup> angina/coronary artery disease, breast cancer, depression, and other heart conditions

<sup>4</sup> gastrointestinal disorders, arthritis [both types], sciatica, hypertension, and prostate cancer

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Table 2: HOS PCS Better + Same Model Covariates

PCS Better + Same Model Covariates	Model A	Model B	Model C
Constant	1.851	1.868	1.926
Age (linear)	-0.011	-0.012	-0.011
Age 75+	-0.024	-0.024	-0.026
Age 85+	0.036	0.028	0.033
Age and gender interaction	0.003	0.004	0.003
Female	-0.163	-0.239	-0.206
Married	0.022	0.026	
Hispanic only	-0.010	-0.022	
Asian only	0.058	0.037	
Native Hawaiian or Pacific Islander only	0.010	-0.007	
Black only	0.060	0.054	
American Indian or Alaskan Native only	0.168	0.217	
Multiracial	0.050	0.015	
CMS Hispanic only			-0.074
CMS Asian or Pacific Islander only			0.026
CMS Black only			0.027
CMS American Indian or Alaskan Native only			0.076
CMS other race only			0.035
CMS unknown race only			0.250
Receive Medicaid	-0.049	-0.066	-0.109
Eligible for SSI	-0.027	-0.043	-0.040
Home owner	0.026	0.041	
High school graduate or greater	0.074	0.084	
Household income <\$20,000	-0.063		

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Table 3: HOS MCS Better + Same Model Covariates

MCS Better + Same Model Covariates	Model A	Model B	Model C
Constant	2.257	2.288	2.681
Age (linear)	-0.009	-0.011	-0.012
Age 75+	-0.032	-0.031	-0.030
Age 85+	0.009	0.010	0.008
Age and gender interaction	0.005	0.005	0.005
Female	-0.392	-0.410	-0.335
Married	-0.138	-0.095	
Hispanic only	-0.205	-0.226	
Asian only	-0.085	-0.124	
Native Hawaiian or Pacific Islander only	-0.469	-0.507	
Black only	-0.090	-0.115	
American Indian or Alaskan Native only	-0.341	-0.374	
Multiracial	-0.148	-0.163	
CMS Hispanic only			-0.300
CMS Asian or Pacific Islander only			-0.109
CMS Black only			-0.115
CMS American Indian or Alaskan Native only			-0.522
CMS other race only			-0.188
CMS unknown race only			0.206
Receive Medicaid	-0.129	-0.249	-0.388
Eligible for SSI	-0.388	-0.408	-0.411
Home owner	0.152	0.156	
High school graduate or greater	0.277	0.321	
Household income <\$20,000	-0.223		