



Calibrating a Microsimulation Model of Medicare Policy Reform to Match Administrative Benchmarks for Enrollment and Spending

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The Urban Institute's Medicare policy microsimulation model, MCARE-SIM, was designed to estimate the effects of potential policy reforms for Medicare enrollees. MCARE-SIM has been used to estimate the implications for household spending and government costs of a unified cost-sharing design for fee-for-service (FFS) Medicare and to estimate changes in household and government spending of alternative single-payer policies (Blumberg et al. 2019; Garrett et al. 2019). Microsimulation models typically combine multiple data sources to produce a current picture of enrollment, household spending, and government spending under current law. Such models are often used to forecast the costs of continuing under current law, even though the most recent available data sources are typically a few years old. Some projection and updating are necessary even for estimating enrollment and spending levels under current law in the current year. Once a baseline is established for forecasting spending under current law, researchers and analysts can evaluate and compare how proposed policies change baseline spending.

Using microsimulation models to estimate the levels and distribution of current-law Medicare enrollment and spending presents several challenges. Official estimates from multiple sources may be inconsistent or measured in different ways, or one data source may provide more complete or detailed information than others. Such differences require that analysts decide which sources to prioritize and choose a target from among several benchmarks with which to align the model.

In this methodological brief, we describe the set of available estimates for Medicare enrollment and spending, the targets we chose among these benchmarks, and the methods we used to calibrate the MCARE-SIM model to match our selected targets. We also describe the approach we used to update the estimates to represent best estimates for 2020, several years after we first produced the estimates and five years after the reference year of our main data source.

Data Sources and Calibration Approach

The primary data source for MCARE-SIM is the 2015 Medicare Current Beneficiary Survey (MCBS). Survey respondents are Medicare beneficiaries enrolled in either traditional fee-for-service (FFS) Medicare or Medicare Advantage (MA) for at least one month of 2015. The survey also includes beneficiaries under age 65 who qualify for Medicare because of a disability and those residing in institutional care facilities. The MCBS provides information on demographic characteristics, medical expenditures, use of medical services, health status, access to health care, and sources of supplemental insurance coverage. In addition to survey data, the MCBS Cost and Use files contain administrative claims data on health service utilization, Medicare outlays, and out-of-pocket liabilities for Medicare-covered services. However, claims data are only available for FFS enrollees, because benefits for MA enrollees are administered by private plans. Using these data, we produce baseline estimates of Medicare enrollment and spending; enrollment and spending by third-party plans, such as Medicaid, employer-sponsored insurance (ESI), or Medigap; and beneficiary out-of-pocket spending.¹

We adjust the MCBS estimates to align with those from official data sources so our analyses reflect current Medicare enrollment and expenditures. The following benchmark sources are based on administrative data and provide official spending and enrollment estimates:

- **Centers for Medicare & Medicaid Services (CMS)** program statistics²
- **Medicare Trustees** 2018 annual report (Medicare Trustees 2018)
- **Medicare Payment Advisory Commission (MedPAC)** 2018 *Health Care Spending and the Medicare Program* data book
- **Congressional Budget Office (CBO)**³ March 2016 Medicare baseline

We align our data to match selected targets from these sources so that MCARE-SIM accurately represents current-law conditions for the base data year of 2015. Though original unadjusted spending and enrollment estimates from the MCBS were already close to official data sources, we adjust the data to match selected targets in 2015.

After matching to 2015 enrollment and spending target estimates, we trend the data forward to reflect expected enrollment and spending estimates in 2020. To obtain 2020 estimates of spending under current law and under the proposed policy, we apply growth rates (described in detail below) to the MCBS survey weights and spending values. The projections account for population and demographic changes and medical cost inflation. We also update annually adjusted Medicare program

rules, such as those related to premiums and cost sharing. Using the data projected to 2020, we estimated the effects of a potential Medicare reform as if it had been implemented in that year (Garrett et al. 2019).

Medicare Enrollment Benchmark Estimates and Alignment with Target Estimates and Benchmarking Results

Because beneficiaries must choose whether to participate in MA or traditional FFS Medicare, and in the latter case choose to participate in some Medicare Parts but not others, there is no single measure of Medicare enrollment. Instead, there are separate enrollment estimates for each Medicare Part, which complicates benchmarking and alignment. Most FFS Medicare beneficiaries enroll in Parts A (coverage for inpatient services) and B (coverage for outpatient services), with fewer selecting to enroll in Part D (coverage for prescription drug services). Benchmark estimates from official data sources most often report enrollment and spending estimates separately for FFS and MA and further separate FFS estimates by Parts A, B, and D. We adjust the MCBS data used in MCARE-SIM separately by Part so we can maintain internal consistency in our estimates across Medicare Parts A, B, D, and MA.

Table 1 shows enrollment estimates from the MCBS and MCARE-SIM compared with those from other data sources. The MCBS estimates for each Part are quite similar to benchmarks, which we expect because administrative data are used to produce the MCBS weights. For example, CMS program statistics report that 55.1 million people were enrolled in Part A in 2015 (overall, combining FFS Medicare and MA), whereas the MCBS estimate is 54.5 million. Official data sources report enrollment as full-year-equivalent (FYE) estimates, or person-years of enrollment, treating those who were only enrolled for part of the year as a portion of an enrollee (e.g., two beneficiaries who are each enrolled in Medicare for six months of the calendar year count as one FYE enrollee). The provided MCBS weights produce estimates of the total number of people ever enrolled in a year, which is higher than FYE enrollment. To compare MCBS estimates with our benchmarks, we created a parallel set of weights that produce FYE estimates. The MCBS estimates in table 1 show FYE enrollment, though in some MCARE-SIM analyses we prefer to use ever-enrolled weights to report enrollment estimates.⁴

TABLE 1

Estimates of Medicare Enrollment from Benchmark Sources, the Medicare Current Beneficiary Survey, and MCARE-SIM, by Medicare Part, 2015 and 2020

Millions of people

	2015	2020
Part A		
<i>Benchmark sources</i>		
CMS program statistics (total)*	55.1	—
CMS program statistics (FFS only)	37.7	—
CMS program statistics (MA only)	17.4	—
Medicare Trustees (total)	55.2	62.9
CBO (total)	55	62
CBO (FFS only)	38	38
MCBS (total)	54.5	63.6
MCBS (FFS only)	36.0	41.9
MCARE-SIM (total)*	55.1	64.4
Part B		
<i>Benchmark sources</i>		
CMS program statistics (total)*	50.8	—
CMS program statistics (FFS only)	33.3	—
CMS program statistics (MA only)	17.5	—
Medicare Trustees (total)	50.8	57.9
CBO (total)	51	57
MCBS (total)	51.5	60.2
MCBS (FFS only)	33.0	38.4
MCARE-SIM (total)*	50.8	59.3
Part D		
<i>Benchmark sources</i>		
CMS program statistics (total)*	39.5	—
Medicare Trustees (total)	41.8	48.8
MedPAC (total)	41.9	—
CBO (total)	41	48
MCBS (total)	41.8	48.9
MCARE-SIM (total)*	39.6	46.3

Sources: CMS Medicare FFS data; *Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds* (Washington, DC: Medicare Trustees) and MedPAC (2018); “March 2016 Medicare Baseline,” Congressional Budget Office; Urban Institute analysis of MCBS data; MCARE_SIM.

Notes: CMS is Centers for Medicare & Medicaid Services. FFS is fee for service. MA is Medicare Advantage. CBO is Congressional Budget Office. MCBS is Medicare Current Beneficiary Survey. A dash means the data are not available. For MCBS estimates, enrollment is calculated using full-year-equivalent weights. Total enrollment represents all beneficiaries enrolled in either Part A, B, or D during the year. Some beneficiaries are enrolled in some Parts and not others, so enrollment for each Part does not add up to total enrollment.

* CMS estimates are the targeted values, and MCARE-SIM estimates are resultant values.

We use enrollment estimates by Part from CMS program statistics as our target values, because CMS administers the Medicare program and provides the most detailed enrollment information by demographic groups, such as age, race, dual Medicare-Medicaid eligibility, and MA or FFS status. These details allow us to more accurately match enrollment estimates for several populations of interest.

Using the MCBS microdata, we observe every potential combination of enrollment by Part separately for those with FFS Medicare or MA coverage (e.g., FFS Medicare enrolled in Parts A, B, and D; FFS Medicare enrolled in Parts A and B only; FFS Medicare enrolled in Part A only; enrolled in MA with Part D).⁵ However, the data reported in CMS program statistics present only aggregate enrollment totals for each Part separately for those in FFS Medicare and MA. This leaves us with more enrollment combinations than aggregate targets. To resolve this problem and match the overall reported enrollment for each Part in CMS program statistics, we solve for the weighting adjustments that match our targets while minimizing an objective function (i.e., loss function) that penalizes adjustments further from 1 (i.e., a value of 1 would make no adjustment to the original MCBS survey weight). Thus, our adjusted weights are designed to match overall CMS program statistics by Part, while staying as close as possible to the share of beneficiaries enrolled in each combination of Medicare’s Parts as measured in the MCBS.

To age our aligned 2015 data and estimate enrollment in 2020, we use data from the Urban Institute’s Mapping America’s Futures database to calculate population growth rates by age group and race.⁶ We present these annual growth rates in table 2, which shows that these annual growth rates are smallest (closest to 1) for the population under age 65 and larger for those above 65, consistent with demographic trends showing the US population has been rapidly aging in recent years.⁷ Growth rates for Hispanic people and non-Hispanic people who do not identify as Black or white (classified as “other races” in the dataset) are greater than growth rates for non-Hispanic white and non-Hispanic Black people.

TABLE 2
MCARE-SIM Enrollment Growth Rates, by Age and Race/Ethnicity

Age group	Race/Ethnicity				
	All	Non-Hispanic white	Non-Hispanic Black	Hispanic	Other
<65	1.011	0.994	1.001	1.022	1.041
>65	1.036	1.030	1.044	1.060	1.069
65–69	1.041	1.033	1.052	1.066	1.070
70–74	1.049	1.045	1.051	1.063	1.076
75–79	1.034	1.030	1.038	1.051	1.066
80–84	1.016	1.007	1.029	1.045	1.060
85+	1.022	1.014	1.031	1.070	1.065

Source: Nan Marie Astone, Steven Martin, H. Elizabeth Peters, Austin Nichols, Kaitlin Franks Hildner, Allison Stotle, and Pam Blumenthal, “[Mapping America’s Futures](#),” Urban Institute, December 1, 2017.

Notes: Growth rates are compound annual growth rates. The under 65 population from Mapping America’s Futures is not representative of the Medicare population under age 65, most of whom have disabilities.

We apply these annual growth rates for each combination of age group and race in the MCARE-SIM sample to the 2015 data already adjusted for enrollment by Part. CBO and Medicare Trustees also provide projections of future enrollment by Part, which are shown in the second column of table 1. Though we make no further adjustments to match these projections, they serve as reference points for our 2020 estimates.

Table 1 also shows the final, adjusted enrollment estimates for MCARE-SIM by Part for 2015 and 2020. With our adjustments, the 2015 MCARE-SIM figures align with benchmarks from CMS program statistics for Parts A, B, and D (targeted and resultant values indicated by *). We also show projected enrollment estimates for 2020. As noted, we do not make further adjustments to these estimates to match 2020 projections from CBO and Medicare Trustees. However, as evidenced in the table, our projections are close to the benchmark estimates for that year.

Medicare FFS Spending Benchmark Estimates and Alignment with Targets

Here we describe our approach to aligning MCARE-SIM with selected targets for Medicare program spending for FFS enrollees, as employed in a recent analysis (Garrett et al. 2019). We will describe how we measure spending for MA enrollees in a separate brief. Table 3 shows unadjusted per enrollee program spending estimates (top panel) and total spending estimates (bottom panel) for FFS beneficiaries from the MCBS and official data sources for Parts A, B, and D. The table reports 2015 estimates from each source, as well as projections for 2020 if available. As we did for the enrollment estimates, we selected CMS program statistics as our source for target values for spending under Parts A and B in 2015.

For Part D, the Trustees' spending levels align closely with those reported by MedPAC (CMS program statistics do not provide information on Part D spending). However, Medicare Part D will ultimately also finance drug subsidy payments and manufacturer discounts. Because we incorporate MCBS-reported plan payments in addition to our own calculated subsidy and manufacturer discount payments in MCARE-SIM, we benchmark our overall Part D estimates to MedPAC, because it specifies which components of Part D outlays are included in each of its estimates.

TABLE 3

Estimates of per Beneficiary and Total Medicare FFS Spending from Benchmark Sources, the Medicare Current Beneficiary Survey, and MCARE-SIM, by Medicare Part, 2015 and 2020

	Expenditures per Beneficiary (\$)	
	2015	2020
Part A		
<i>Benchmark sources</i>		
CMS program statistics (FFS only)*	4,830	—
Medicare Trustees (total)	5,049	5,564
CBO (total)	5,054	5,571
MCBS (FFS only)	4,584	—
MCARE-SIM (FFS only)*	4,830	5,288
Part B		
<i>Benchmark sources</i>		
CMS program statistics (FFS only)*	5,346	—
Medicare Trustees (total)	5,544	6,862
CBO (total)	5,470	6,552
MCBS (FFS only)	5,182	—
MCARE-SIM (FFS only)*	5,346	6,578
Part D		
<i>Benchmark sources</i>		
Medicare Trustees ^a	2,152	2,313
MedPAC (plan)	2,196	—
MedPAC (plan + discounts)	2,340	—
MedPAC (plan + subsidy + discounts)*	2,904	—
MCBS (plan)	2,339	—
MCBS (plan + discounts)	2,516	—
MCBS (plan + subsidies + discounts)	3,164	—
MCARE-SIM (FFS only)*	2,904	3,052
Total		
MCARE-SIM (FFS only)	13,080	14,918
	Total Expenditures (Millions of \$)	
	2015	2020
Part A		
<i>Benchmark sources</i>		
Medicare Trustees (total)	278,705	349,976
CMS program statistics (FFS only)*	182,091	—
CBO (total)	277,970	345,402
MCBS (FFS only)	165,024	—
MCARE-SIM (FFS only)*	182,091	231,663
Part B		
<i>Benchmark sources</i>		
Medicare Trustees (total)	281,635	397,310
CMS program statistics (FFS only)*	178,022	—
CBO (total)	278,970	373,464
MCBS (FFS only)	171,006	—
MCARE-SIM (FFS only)*	178,022	254,747
Part D		
<i>Benchmark sources</i>		
Medicare Trustees ^a	90,000	113,000
MedPAC (plan-only aggregate)	92,000	—

MedPAC (plan + discounts)	98,000	—
MedPAC (plan + subsidy + discounts)*	122,000	—
MCBS (plan)	98,000	—
MCBS (plan + discounts)	105,000	—
MCBS (plan + subsidy + discounts)	132,000	—
MCARE-SIM (plan + subsidy + discounts)*	115,000	141,000
Total		
MCARE-SIM (FFS only)	475,000	628,000

Sources: CMS Medicare FFS data; *Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds* (Washington, DC: Medicare Trustees) and MedPAC (2018); “March 2016 Medicare Baseline,” Congressional Budget Office; Urban Institute analysis of MCBS data; M-CARE SIM.

Notes: CMS is Centers for Medicare & Medicaid Services. FFS is fee for service. CBO is Congressional Budget Office. MCBS is Medicare Current Beneficiary Survey. MedPAC is Medicare Payment Advisory Commission. A dash means the data are unavailable. For MCBS estimates, expenditures are annualized and then calculated using full-year-equivalent weights. Per beneficiary expenditures are calculated as outlays divided by the enrollment count for each Part. Part D spending is directly reported in the MCBS, whereas subsidy and discount amounts in MCARE-SIM are constructed based on calculations for overall Part D spending.

^a Excludes rebates and discounts.

* CMS estimates are the targeted values for Part A and Part B expenditures, MedPAC estimates are the targeted values for Part D expenditures, and MCARE-SIM estimates are resultant values.

The spending benchmarks include total spending for Medicare beneficiaries, including those enrolled for part of the year. In matching enrollment targets, however, we deflate weights for part-year enrollees to create FYE enrollment, which could underestimate spending. To compare spending estimates from the MCBS with benchmarks, we annualize per enrollee Medicare expenditures by scaling up each beneficiary’s spending to represent 12 months of spending and then calculate estimates using FYE weights.⁸ Inflating spending amounts by annualizing them exactly offsets the deflation of the weights for part-year enrollees applied in converting to FYE weights. Many beneficiaries are only enrolled in Medicare for part of the year, particularly those who turn 65 or die in the middle of the year. Without annualization, weighted total spending would be incorrect and too low.

Using the per enrollee estimates, we calculate adjustment factors separately for each Part. We compute the adjustment factor for each Part as the ratio of the target per enrollee spending estimate (from CMS program statistics for Parts A and B and from MedPAC for Part D) to the corresponding unadjusted MCBS amount. We then multiply enrollee-level spending data by the adjustment factors. To project the aligned 2015 spending values to 2020 levels, we first calculate an annual growth rate from 2015 to 2020 for per enrollee spending under each Part using 2015 and projected 2020 estimates from the 2018 Medicare Trustees report. We apply these growth rates to adjusted Medicare spending for each Part. For example, table 3 shows the Trustees estimate that Part A spending per enrollee increased from \$5,049 in 2015 to a projected \$5,564 in 2020. The implied annual growth rate is 1.02.⁹

Table 3 shows the resultant adjusted per enrollee and total spending estimates in MCARE-SIM for FFS Medicare under each Part for both 2015 and 2020. By design, per enrollee spending by Part aligns exactly with the targeted amounts (indicated by *). Because we simultaneously match enrollment and per enrollee spending amounts for Parts A and B from the same source, we also match the total spending amount for these services. Total MCARE-SIM spending for Part D services (\$115 billion)

differs somewhat from the MedPAC benchmark (\$122 billion), because the enrollment and per enrollee spending amounts are from different sources. Per enrollee and total spending estimates for 2020 are also close to benchmark estimates, though our methods do not force them to match exactly.

Future Directions

As we further develop MCARE-SIM, we will make updates to the current-law spending and enrollment estimates to reflect later years and make near-term projections using more recent data. Future work will incorporate MCBS data from later years (e.g., currently available 2018 data). In other work we will describe in a forthcoming brief, we incorporate MA spending into the model. MA enrollment as a share of total Medicare enrollment has been rapidly increasing since its introduction (Jacobson, Damico, and Neuman 2018). When projecting enrollment estimates to future years, particularly beyond the near term, it will be useful to explicitly account for forecasted growth in MA penetration to more accurately describe the likely makeup of the future Medicare population. Subsequent work with MCARE-SIM model has also integrated data from the American Community Survey, which has a sample size large enough to produce state-level estimates. In order to produce state-level enrollment and spending estimates for future years, it will be important to incorporate state-specific growth rates.

Finally, 2020 projections made before that year could not have accounted for the COVID-19 pandemic and any effects it may have had on Medicare enrollment or spending. The results we present should be interpreted as what would have been projected for 2020 (circa 2018) in the absence of the COVID-19 pandemic. Though those over 65 are most at risk of death and many under 65 have become disabled and newly eligible for Medicare, we do not anticipate that the pandemic has strongly altered short-term Medicare enrollment. In the longer term, the pandemic could affect the level and composition of Medicare spending in ways not yet understood. In light of the pandemic and associated changes to beneficiary incomes and health care utilization, future projections for the evolution of Medicare enrollment and spending under current law and modeled policy reforms should incorporate what can be known or reasonably assumed for the likely path of these variables.

Notes

- ¹ We provide further detail of constructed out-of-pocket and third-party spending in Garrett et al. 2019.
- ² “Medicare Utilization and Payment Section,” Centers for Medicare & Medicaid Services, February 24, 2020, https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMSProgramStatistics/2016/2016_Utilization#Medicare%20Part%20A%20and%20Part%20B%20Summary.
- ³ “March 2016 Medicare Baseline,” Congressional Budget Office, March 24, 2016, <https://www.cbo.gov/sites/default/files/recurringdata/51302-2016-03-medicare.pdf>.
- ⁴ For example, computing enrollee spending with ever-enrolled weights most accurately represents the spending in a calendar year, because partial-year enrollees are counted as having their actual part-year spending (rather than having their spending annualized, as required when using FYE weights).
- ⁵ Most choices beneficiaries make involve only a few of the potential combinations of Medicare enrollment by Part. In the 2015 MCBS, 43 percent of enrollees are in FFS Medicare and enrolled in Parts, A, B, and D; 33 percent are enrolled in MA in combination with a Part D drug plan; 17 percent are in FFS Medicare enrolled with Parts A and B coverage, but no Part D coverage; 6 percent are enrolled in FFS Medicare with Part A coverage only; and 1 percent are enrolled in MA without a Part D plan. These combinations represent 98 percent of all enrollees in the MCBS. None of the remaining potential coverage combinations account for more than 1 percent of enrollees.
- ⁶ Nan Marie Astone, Steven Martin, H. Elizabeth Peters, Austin Nichols, Kaitlin Franks Hildner, Allison Stotle, and Pam Blumenthal, “Mapping America’s Futures,” Urban Institute, updated December 1, 2017.
- ⁷ Jonathan Vespa, “The US Joins Other Countries with Large Aging Populations,” US Census Bureau, updated October 8, 2019, <https://www.census.gov/library/stories/2018/03/graying-america.html>; “The US Population Is Aging,” Urban Institute, Program on Retirement Policy, accessed August 12, 2020.
- ⁸ Total spending estimates in the MCBS are typically produced by calculating weighted spending estimates using the original MCBS weights that sum to the number of people ever enrolled in a year. This would account for part-year spending by part-year enrollees. Our use of FYE weights lowers the weight of part-year enrollees, and, without making any correction (i.e., annualizing the spending of part-year enrollees), would lower weighted total spending estimates.
- ⁹ Though not reported in the table, which focuses on Medicare program spending, we also use predicted 2020 cost-sharing rules from the Medicare program website to calculate beneficiary and third-party spending based on Medicare spending and utilization; see “Medicare Costs at a Glance,” Medicare.gov, accessed August 12, 2020, <https://www.medicare.gov/your-medicare-costs/medicare-costs-at-a-glance>.

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