Issue Brief Appendix
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Milbank Memorial Fund
Using evidence to improve population health

Improving COVID-19 Outcomes for Medicare Beneficiaries: A Public Health–Supported Advanced Primary Care Paradigm

APPENDIX

METHODS

Study Populations. The universe of beneficiaries for this retrospective cohort study is Medicare fee-for-service beneficiaries who were eligible to participate in the MDPCP.[8] Specifically, beneficiaries must have resided in Maryland from January 2020 through January 2021 and had continuous Medicare Part A and B coverage in that period. Beneficiaries must also be community-dwelling with no residency in a long-term-care facility, not eligible for Medicare on the basis of end-stage renal disease, and not incarcerated.

This study compared COVID-19 outcomes among two MDPCP-eligible populations. The study group comprised Medicare beneficiaries who participated in the MDPCP continuously throughout 2020 or until the beneficiary died. The comparison group was composed of Medicare beneficiaries who were eligible for attribution to a primary care practice but the practice elected not to participate in MDPCP in 2020. All beneficiaries remained in their respective cohort, regardless of their MDPCP participation in January of 2021. These groups are henceforth referred to as MDPCP group and nonparticipating group. By ensuring that both study populations have established relationships with primary care practices, the study aimed to isolate the impact of MDPCP participation, rather than the impact of a primary care relationship.

Data Sources. This study relied on the Medicare Claim and Claim Line Feed (CCLF) data provided by CMS in support of the MDPCP. This data set includes all Medicare Parts A, B, and D claims for all study and comparison group beneficiaries. The CCLF data contains claims from April 2018 through January 31, 2021. As the goal of the analysis was to measure COVID-19-related utilization, only claims from January 1, 2020, to January 31, 2021, were used.

MDPCP files provided by CMS were used to determine whether eligible beneficiaries participated in MDPCP. CVI data for each beneficiary was used to quantify COVID-19 risk in a single indicator. A CVI score of 5 is the highest score, indicating severe risk, and scores of 1 or 2 are the lowest scores, indicating no increased risk of COVID-19. Scores of 1 and 2 were grouped together in analysis.

Matching. A force match design matched the nonparticipating group to the MDPCP group on gender, age, race, county of residence, CVI, and dual eligibility for Medicare and Medicaid to ensure comparable populations. The matching was completed by assigning each beneficiary to one of the 5,277 permutations that combine gender,

age, race, county of residence, CVI, and dual eligibility values. The 15 largest Maryland counties based on the number of MDPCP beneficiaries were matched individually. All remaining counties were combined into an "Other" category. The top 15 counties represented 83% of all MDPCP participating beneficiaries before matching. Permutations with fewer than 18 beneficiaries were then combined, accounting for 8.30% of the MDPCP group and 7.46% of the nonparticipating group. These low-volume subcategories were removed from the data. From the remaining subcategories, beneficiaries were randomly selected from the population until the differences in distributions within each matched category were not significant using the chi-squared statistical test.

The MDPCP group in this study included 287,785 beneficiaries. After removing the low-volume subcategories, the MDPCP group included 263,891 beneficiaries. Before matching, the nonparticipating group included 233,726 beneficiaries. The force match removed 168,360 beneficiaries (72.0%) from the nonparticipating group. After matching, the nonparticipating group contained 65,366 beneficiaries.

Statistical Analysis. Key demographic and clinical characteristics were compared across the MDPCP group and nonparticipating group to determine any statistical differences. For all categorical variables (Table 1), chi-squared tests were performed. For continuous variables [average COVID-19 inpatient length of stay; Hierarchical Condition Category (HCC) score; and Area Deprivation Index (ADI)], *t*-tests were performed. For the variable telehealth service count, the nonparametric Mann-Whitney U Test was performed as this variable did not follow a normal distribution.

Study outcomes include the prevalence of COVID-19 diagnosis; COVID-19 admission length of stay; COVID-related emergency department (ED) visit rate, hospital admission rate, and hospital admission with intensive care unit (ICU) utilization rate; mortality rate; monoclonal antibodies infusion counts; and count of telehealth service claims for COVID-19-positive beneficiaries. COVID-19 diagnosis was determined by the existence of a primary or secondary ICD-10 diagnosis code on the claim (Table 2). COVID-19-related deaths included any claim type with a COVID-19 diagnosis and either death as the discharge status or a death date between the claim from date and the claim through date. The study compared each of these outcome measures across the MDPCP group and nonparticipating group to test for differential effects of COVID-19 on the two populations. Chi-squared tests were used for comparisons on categorical and proportional variables and Z-tests for proportional variables measuring percentage of total claims.

The statistical analyses were replicated across each race/ethnicity subpopulation within the study groups. Analyses were conducted with SAS software. Statistical significance was set at $p < 0.05$ for all statistical tests, and all tests were two-tailed.

Categorical Variables Used in Analysis

- Age category
- Gender
- Race
- Dual Medicare-Medicaid eligibility flag
- County of residence
- CVI score
- COVID-19 diagnosis
- Beneficiaries with COVID-19 inpatient claims
- Beneficiaries with COVID-19 ED claims
- COVID-19 death count
- Beneficiaries with COVID-19 inpatient claims as % of beneficiaries with a COVID-19 diagnoses
- Beneficiaries with COVID-19 ED claims as % of beneficiaries with a COVID-19 diagnoses
- COVID-19 beneficiaries with neither inpatient nor ED claims
- COVID-19 death rate as % of beneficiaries with a COVID-19 diagnoses
- COVID-19 inpatient ICU claims as % of COVID inpatient claims
- COVID-19 inpatient non-ICU claims as % of COVID inpatient claims
- COVID-19 members given monoclonal antibody infusion

Appendix Table 1. COVID-19 Diagnosis Codes

COVID-19 Diagnosis Code	Description
J1281	pneumonia due to SARS-associated coronavirus
B9721	SARS-associated coronavirus as the cause of diseases classified elsewhere
U071	2019-nCoV acute respiratory disease

Appendix Table 2. Demographic and Clinical Risk Factor Comparison Between the MDPCP Group and the Nonparticipating Group.

	MDPCP Group (*n* = 263,891)	Nonparticipating Group (*n* = 65,366)	
Measures	***n* (%)**	***n* (%)**	***p*-value**
Age Category			
64 and younger	19,517 (7.4)	4,835 (7.4)	1.000
65 to 69	39,655 (15.03)	9,807 (15)	
70 to 74	72,247 (27.38)	17,904 (27.39)	
75 to 79	55,413 (21)	13,724 (21)	
80 to 84	37,296 (14.13)	9,244 (14.14)	
85 and older	39,763 (15.07)	9,852 (15.07)	
Gender			
Female	158,795 (60.17)	39,338 (60.18)	0.9751
Male	105,096 (39.83)	26,028 (39.82)	
Race			
Asian	3,357 (1.27)	822 (1.26)	0.9995
Black	52,077 (19.73)	12,891 (19.72)	
Hispanic	1,198 (0.45)	294 (0.45)	
Other	2,306 (0.87)	568 (0.87)	
Unknown	3,704 (1.4)	913 (1.4)	
White	201,249 (76.26)	49,878 (76.31)	
Dual Medicare-Medicaid Eligibility Flag			
No	238,094 (90.22)	58,999 (90.26)	0.7868
Yes	25,797 (9.78)	6,367 (9.74)	

COVID Vulnerability Index (CVI) Score			
1 or 2	41,296 (15.65)	10,217 (15.63)	0.9996
3	81,454 (30.87)	20,182 (30.88)	
4	83,619 (31.69)	20,716 (31.69)	
5	57,522 (21.8)	14,251 (21.8)	
County			
Anne Arundel	25,454 (9.65)	6,307 (9.65)	1.000
Baltimore	44,134 (16.72)	10,932 (16.72)	
Baltimore City	23,929 (9.07)	5,932 (9.08)	
Calvert	5,111 (1.94)	1,266 (1.94)	
Carroll	11,351 (4.3)	2,816 (4.31)	
Charles	4,959 (1.88)	1,222 (1.87)	
Frederick	12,882 (4.88)	3,194 (4.89)	
Harford	15,157 (5.74)	3,758 (5.75)	
Howard	14,075 (5.33)	3,486 (5.33)	
Montgomery	35,379 (13.41)	8,759 (13.4)	
Other	25,614 (9.71)	6,345 (9.71)	
Prince George's	21,232 (8.05)	5,251 (8.03)	
Saint Mary's	5,555 (2.11)	1,378 (2.11)	
Washington	9,105 (3.45)	2,254 (3.45)	
Wicomico	4,876 (1.85)	1,207 (1.85)	
Worcester	5,078 (1.92)	1,259 (1.93)	
Average Hierarchical Condition Category (HCC) Score	1.2776	1.2928	0.0054
Average Area Deprivation Index (ADI) Score*	4.87	4.77	<0.0001

** ADI represented in deciles. ADI with values P, U, and NA set to missing. Total missing percentage is 5.83% in MDPCP Group data and 6.35% in nonparticipating Group data.*

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