

Personalized Preventive Care Reduces Healthcare Expenditures Among Medicare Advantage Beneficiaries

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Slowing the rise in Medicare healthcare spending is among the nation's top health policy priorities. The Congressional Budget Office (CBO) estimates that Medicare spending will grow at an average of 7 percent each year from 2010 to 2018, compared with overall United States inflation rates of about 2 percent from 2010 to 2013.^{1,2} The pattern of healthcare spending growth, however, has changed dramatically over the past 2 decades. From 1987 to 1997, most spending growth was linked to intensive inpatient services, primarily associated with heart disease.³ In more recent years, much of the growth in spending among Medicare beneficiaries is attributable to rising spending on the management of chronic disease—especially diabetes, arthritis, hyperlipidemia, hypertension, kidney disease, and mental disorders. In addition, the channels of medical spending have changed such that, common chronic conditions are typically treated in outpatient settings and/or with prescription drugs rather than through hospitalizations and inpatient care.³

Among community-dwelling Medicare beneficiaries, more than half are treated annually for 5 or more medical conditions.⁴ Nearly 7 in 10 Americans aged 65 years or older are living with 2 or more common chronic health conditions.⁵ Each year, the typical Medicare beneficiary sees 2 primary care physicians and 5 specialists working in 4 different practices.⁶ An average of 33% of beneficiaries change their assigned primary care physician from one year to the next. This dispersion of medical care delivery means that chronically ill patients managing multiple conditions receive episodic care from multiple providers who rarely coordinate the care they deliver.^{4,6}

Over the past decade, chronic disease management and care coordination programs proliferated in an attempt to fill this gap. Most of the programs were telephone-based interventions staffed by nurses who develop and update care plans to meet patients' needs, educate patients about self-care and

ABSTRACT

Objectives

To investigate the impact on healthcare expenditure and utilization trends of a personalized preventive care program designed to deliver individualized care focused on disease prevention among Medicare Advantage beneficiaries.

Study Design

MD-Value in Prevention (MDVIP) consists of a network of affiliated primary care physicians who utilize a model of healthcare delivery based on an augmented physician-patient relationship and focused on personalized preventive healthcare. The cost-effectiveness of the program was estimated using medical and pharmacy claims data relative to nonmembers.

Methods

Multivariate modeling was used to control for demographic, socioeconomic, supply of healthcare services, and health status differences between members and nonmembers. Healthcare expenditure and utilization trends for members and nonmembers were tracked from the pre-period prior to member enrollment for a period of 2 years post enrollment.

Results

MDVIP members experienced significantly reduced utilization rates for emergency department visits and inpatient admissions. Reduced medical utilization resulted in program savings of \$86.68 per member per month (PMPM) in year 1 and \$47.03 PMPM in year 2 compared with nonmembers.

Conclusions

A primary care model based on an augmented physician-patient relationship and focused on personalized preventive medicine can reduce Medicare Advantage healthcare spending.

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Take-Away Points

Personalized medicine is a relatively new healthcare delivery model designed to provide more individualized care focused on disease prevention while delivering high-quality, coordinated care with easy access. The MDVIP program is based on an augmented physician-patient relationship and focused on personalized preventive care. This study investigated the impact of an enhanced preventive care delivery system on healthcare expenditure and utilization trends among Medicare Advantage beneficiaries.

- Healthcare savings were realized from significantly reduced emergency department and inpatient admission utilization rates.
- A primary care model focused on personalized preventive medicine can reduce Medicare Advantage spending.

medication adherence, and monitor patients' care. In most programs, the disease/care managers are not integrated into physicians' practices and maintain contact with patients remotely.⁷ Generally, disease/care management programs use various criteria to target high-cost or high-risk patients.^{7,8} CMS has tested several demonstrations of disease management and care coordination programs; most have been unsuccessful in reducing medical expenditures (specifically hospitalizations), increasing medication adherence, or improving quality-of-care indicators.⁸⁻¹¹

Successful programs tended to supplement telephone calls with in-person meetings, promote direct interactions with physicians, deliver evidence-based education to patients, include strong medication management (often delivered by a pharmacist), and provide comprehensive transitional care after hospitalization.⁸⁻¹³ CMS concluded that programs that reduced hospitalizations tended to target a subset of high-risk beneficiaries based on a combination of diagnoses and severity levels. Diagnoses included congestive heart failure, chronic obstructive pulmonary disease, or coronary artery disease, and severity included the criterion of 1 or more hospitalizations in the year before enrollment.⁸

As the targeting of "successful" disease- and care-management programs has narrowed, the concept of population health management among older adults has been less effectively addressed by the stakeholders of interest. Issues include development and scalability of appropriate programs, marketing to a geographically dispersed group of older adults, and financing of broader population-based programs. The importance of health management among those seniors with fewer or no chronic conditions has been demonstrated in actuarial models developed to test the impact of population health and wellness interventions on healthcare expenditures.¹⁴ Beneficiaries were categorized using a claims-based risk score assessing the burden of chronic disease (CMS-Hierarchical Condition Category Score) as a proxy for health risks.^{14,15} The dis-

tribution of risks within the population predicted that as individuals age, they shift into progressively higher risk categories.

Lessons learned from employer health management programs serving employees could be applied to senior populations. Successful population risk management depends on health strategies that include not only the management of high-risk, high-cost individuals, but preventive health programs to maintain low-risk health status in other individuals and keep them functioning well for as many years as possible.^{16,17} Research has demonstrated that those who manage their health well as they age are able to delay the onset of chronic disease and disability by several years.¹⁷⁻²⁰ Each additional year spent at low-risk health status results in higher quality of life for the individual and lower spending for the medical system.¹⁴

Individualized medicine, a relatively new approach to healthcare delivery, seeks to address the issues of coordinating care and providing preventive care to senior populations.²¹⁻²³ The model integrates personalized preventive medicine and wellness management while delivering high levels of coordination within the treatment milieu. The delivery system includes greater focus on evidence-based preventive services, increased physician availability to improve management of patient health, and increased access to other healthcare resources.²² As CMS continues to consider medical service delivery models that have the potential to mitigate Medicare spending, the effectiveness of an enhanced preventive health delivery model will be of considerable interest.

The purpose of this study was to investigate the impact of a model of preventive healthcare delivery designed to provide more personalized care focused on disease prevention within a Medicare Advantage population. Primary outcomes compared 1) utilization of healthcare services tracked from baseline over the next 2 years, and 2) healthcare expenditure trends over the same time period for members and nonmembers.

METHODS

MDVIP Practice Model

MD-Value in Prevention (MDVIP) consists of a network of affiliated primary care physicians who utilize a model of comprehensive healthcare management based on an augmented physician-patient relationship and focused on personalized preventive healthcare. The MDVIP model

Table 1. Characteristics of MDVIP Practices and Traditional Practices

MDVIP Practice	Traditional Practice
Focus on proactive prevention	Focus on symptoms and diagnosis of health problems
≤600 patients per physician	>2400 patients per physician
8-12 patients per day seen	30-35 patients per day seen
Care delivered only by personal physician	Care delivered by available physicians/extenders
30-90 minutes per visit	<8 minutes per visit
Personal physician available 24/7	Emergency “on-call service”
MDVIP physician network available when traveling	Walk-in clinics or emergency departments when traveling
Coordination of care with specialists, hospitalists	Little coordination of care or follow-up
Patients get all their questions answered	Patients don't have time to ask questions
Same-day appointments	Average 4-6 week wait for appointment
On-time appointments	Waiting rooms

MDVIP indicates MD-Value in Prevention.

delivers health screenings (eg, depression, anxiety, sleep, nutrition, sexual function, vision, and hearing) and diagnostics (eg, testing for diabetes, bone disease, and cardiovascular disease) for a membership fee (paid by the member) of \$125 to \$183 per month.^{21,22} Practices are limited to no more than 600 patients per physician to allow for the added time and resources for the physician to deliver the additional services and to provide the personalized attention required for management of each patient's relevant health issues. With smaller practice sizes, members receive same-day or next-day appointments for urgent and non-urgent care and the ability to reach their primary care physician 24 hours a day. The network currently includes over 600 doctors and over 200,000 patients nationally. Affiliated physicians have an average age of 58 years; 70% are internists and 30% are family practitioners. The average age of members is 66 years; 40% to 45% are enrolled in Medicare plans.

The model is not a third-party payer (ie, health insurance does not cover the monthly fee) and the fees cover only the extended prevention and wellness services provided by the primary care physician (PCP). Members, therefore, still pay via conventional mechanisms (eg, health insurance) for inpatient and outpatient visits, services provided by specialists, and other medical services (eg, radiological and laboratory tests). Members benefit from an annual wellness program visit, 60 to 90 minutes long, that is modeled after the comprehensive physical typically included in an executive healthcare package. This annual wellness program includes proprietary blood panels, diagnostic tests, screens, and hands-on evaluation.

The model's underlying premise is that the focus on prevention and wellness, and the additional attention from and access to physicians (ie, higher quality of care

delivery), will lead to better health status, lower emergency department (ED) and hospital utilization, and ultimately lower healthcare expenditures. **Table 1** summarizes key distinguishing characteristics of MDVIP practices compared with traditional practices as experienced by Medicare Advantage beneficiaries.

Study Population

MDVIP Members. Members were identified from UnitedHealthcare Medicare Advantage databases using 2007-2012 enrollment files provided by MDVIP. Eligibility for this study was defined as 65 years and older (Medicare-eligible), or 64 years or younger and on Medicare medical disability and having continuous health plan membership with a minimum of 3 months prior to MDVIP enrollment during 2009 and a minimum of 18 months post enrollment 2009-2012.

MDVIP Nonmembers. Nonmembers were identified from UnitedHealthcare Medicare Advantage databases. To control for physician selection bias, nonmembers were identified from patient lists of affiliated physicians prior to their becoming MDVIP network physicians. MDVIP maintains an exclusive contract with their affiliated physicians; thus, former patients who did not become members when their physicians transitioned to the MDVIP model of care qualified as controls. Eligibility for nonmembers was similar to members and distribution and continuous health plan membership with a minimum of 3 months prior to a matched range of enrollment dates (2009) with a minimum of 18 months' follow-up (2009-2012).

Control Variables. Control variables included member demographic (including age, gender, plan type, region of the United States, and residing, or not, in a Metropoli-

tan Service Area [MSA]), socioeconomic (eg, income, and local concentration of health services, including number of acute care hospital beds, specialists, and primary care physicians), and health status (eg, Charlson Comorbidity Index [CCI] score, Psychiatric Diagnostic Group [PDG] score, and number of inpatient admissions in the pre period. Non-MDVIP Medicare Advantage plan types included exclusive provider organization (EPO), health maintenance organization (HMO), indemnity, point of service (POS), preferred provider organization (PPO), and others. Region of the United States was based on zip code and assigned as Northeast, Midwest, South, or West. Annual income was inferred as high ($>\$45,809$), medium-high ($\geq \$36,250$ and $<\$45,809$), medium ($\geq \$29,875$ and $<\$36,250$), or low ($<\$29,875$), based on whether the median income in the individual's zip code area was in the highest, second-highest, third-highest, or lowest quartile in 2010, according to US Census records. MSA was defined as living in a metropolitan area population ($\geq 50,000$), or other. Supply of healthcare services was defined based on the number of PCPs and specialists (per 100,000) and hospital beds (per 1000) in the member/nonmember zip codes of residence.²⁴

Health status was determined from medical claims diagnoses and place of service utilization coding and included the CCI score (0, 1+)²⁵, PDG score (0, 1+)²⁶, and the annual number of inpatient admissions. The CCI is a measure of the risk of 1-year all-cause mortality attributable to selected comorbidities. PDGs are validated psychiatric diagnostic groups analogous to major diagnostic groups in the diagnostic-related group (DRG) system, but provide better classification of individuals with substance abuse and/or mental health disorders. Variables denoting missing data were included in the analyses; however, for brevity, results associated with missing data are not shown in the tables included with this manuscript but are available upon request.

Modeling. Two sets of analyses were conducted to: 1) describe the characteristics of the members, and 2) estimate the likelihood of enrollment and match nonmembers to member characteristics.

Descriptive. The first set of analyses categorized members by demographics, socioeconomics, supply of services, and clinical characteristics, and compared members with nonmembers, using univariate techniques without adjusting for case mix differences. This was done to determine if case mix differences needed to be adjusted for between the groups prior to comparing the outcome variables. Chi-square and Student *t* tests were used in these analyses to test for differences in categorical and continuous

variables, respectively. All analyses were performed using SAS software (Version 9.2, Cary, North Carolina).

Propensity Matching. Propensity score matching was used to minimize case mix differences between members and nonmembers. In this second set of analyses, a logistic model was used to estimate the likelihood of enrolling in the program. The variables used in the model were those previously described. The propensity score for each sample individual was defined as each member's predicted probability of being in the program. This probability was then used to match members to similar nonmembers. Propensity score matching is a convenient and acceptable way to remove case mix differences when evaluating health and wellness programs.²⁷

Second-stage regressions are often warranted to remove any remaining case mix differences after matching, and to adjust for skewed medical expenditure distributions that are often common in healthcare. In a final set of medical expenditure statistical analyses, we used Exponential Conditional Mean regression models to estimate the impact of the program compared with nonmembers on medical expenditure trends.

Outcome Variables. Utilization of medical services was examined to provide a mechanism that could potentially drive changes in healthcare expenditure trends. Utilization metrics included annual rates of ED visits, inpatient admissions, and readmissions, as well as length (in days) of hospital stay and average inpatient expenditures comparing members with matched nonmembers. Healthcare expenditure cost trends were compared with pre-MDVIP enrollment to post enrollment for MDVIP members and nonmembers. Co-payments and membership fees paid by the members were not included in this evaluation because they were not relevant to the savings realized by the payer—the health plan, Medicare Advantage—and we are evaluating the program from the perspective of the payer. Healthcare expenditures are presented as total medical and pharmacy, medical only, and pharmacy only for pre-enrollment, year 1, and year 2.

RESULTS

The study population included 2360 members and 5521 nonmembers. Outliers were excluded at the top 1 percentile of annual healthcare expenditures, resulting in 28 cases (N = 2332) being deleted from the member subgroup and 105 cases (N = 5416) being deleted from the nonmember subgroup. Members differed from nonmembers on most of the demographic, socioeconomic, supply of services, and health status variables, demon-

strating the need for the propensity score matching to adjust for these case mix differences. After matching, 2320 members and 2320 nonmembers remained in the study population. Most of the significant differences in characteristics between members and nonmembers were eliminated with the matching methodology (**Table 2**). Utilization trends for years 1 and 2, investigated to document the potential source of healthcare savings, indicated significantly lower rates for ED visits and inpatient admissions (**Table 3**). While there were trends associated with members for lower readmission rates, lower lengths of stay, and lower average inpatient expenditures, none of these additional utilization measure comparisons were significant.

Medical and pharmacy expenditure trends for Years 1 and 2 indicated that members compared with nonmembers (matched, regression-adjusted and excluding outliers) saved \$86.68 per member per month (PMPM) in Year 1 and \$47.03 PMPM in Year 2 from their relative baseline expenditures prior to enrollment (ie, difference between member and nonmember expenditure trends over the time period; Table 3). Likely a result of the relatively small study population and the large variance of Medicare healthcare expenditures, only Year 1 medical and pharmacy savings amounts approached statistical significance. Medical and pharmacy expenditure trends were also analyzed separately, with results indicating that savings were realized primarily from moderated medical cost trends among members compared with nonmembers. In contrast, pharmacy expenditures increased significantly for members, as is expected with increased pharmaceutical compliance, but the magnitude of these increases was less than the savings in medical expenditures.

DISCUSSION

MDVIP provides a model of personalized preventive care that delivers a more individualized approach to its patients, focusing on disease prevention and wellness. MDVIP's model is uniquely positioned to provide enhanced preventive care to those Medicare Advantage beneficiaries with or without chronic comorbidities enabling better medical management over time as well as providing expected diagnostic services for illness episodes. We found in a previous study that Medicare MDVIP members compared with nonmembers had significantly lower medical services utilization in a primary care setting.²¹

This study similarly demonstrated reduced utilization rates for ED and inpatient admissions. Associated with these reduced utilization rates were savings of \$87 PMPM

in year 1 and \$47 PMPM in year 2 after enrollment—savings primarily from reduced medical expenditures. For the 2320 members, the savings totaled about \$3.7 million over the 2 years. These savings accrued directly to the Medicare Advantage health plans.

For members, there was a minimal annual savings in co-payments for medical services received (calculated separately) of about \$160 in year 1 and \$180 in year 2—savings not sufficient to offset the membership fee (about \$1650 annually). However, members find value in the personalized preventive care programs for the advantages of individualized care with greater access to physicians and a focus on preventive care, care coordination, and disease prevention and management.

This model of healthcare delivery integrates wellness into a personalized primary care model that focuses on provision of medical services but also the management of health, including lifestyle behaviors and chronic conditions.^{21,22} The model leverages the influence of physicians³⁰ with an augmented physician-patient relationship and the development of a personalized wellness plan based on the patient's health status. The underlying premise is that delivery of preventive medicine can improve health status and reduce healthcare spending with decreased utilization of ED (since physicians are available to directly manage health concerns) and of inpatient admissions (with better management of chronic conditions, preventive screenings to promote early diagnoses, and lower levels of treatment). This current study is one of the first to demonstrate the cost-effectiveness of a personalized preventive care model within a Medicare population. The feasibility of this model of healthcare delivery in other Medicare populations (eg, fee-for-service) has yet to be determined.

To date, CMS has focused programmatic efforts on high-risk/high-cost Medicare patients. Its conclusion is that current disease/case management programs are what work best to reduce hospitalizations—but for only a subset of very sick patients, those generally with at least 1 hospitalization within the year prior to enrollment in the programs.⁸ While the efforts to mitigate spending and promote better medical management for the sickest patients are noteworthy, more attention needs to be given to the healthier Medicare beneficiaries who are much more numerous.

Lessons learned from employer-based health management programs indicate that managing risk across a population requires a 2-pronged approach: providing programs for high-risk subgroups and, as or more importantly, providing opportunities to assist currently healthy beneficiaries in managing their health as they age.^{16,28,29} Without

Table 2. Demographics of Members and Nonmembers Before and After Propensity Score Matching

	Before Matching			After Matching		
	Members Mean or %	Nonmembers Mean or %	P	Members Mean or %	Nonmembers Mean or %	P
Demographics	2332	5416	—	2320	2320	—
Age (years)	72.7	71.8	<.001	72.7	72.3	.17
≤64	16.1	21.2	<.001	16.2	17.8	.53
65-74	44.5	41.5		44.4	43.6	
75-84	28.7	27.0		28.7	28.1	
85+	10.7	10.4		10.7	10.6	
Gender						
Male	48.1	45.6	.04	48.1	48.7	.68
Female	51.9	54.5		51.9	51.3	
Income (geocoded from zip code)						
High (>\$45,809)	67.1	63.6	<.001	67.0	66.2	.72
Upper medium (≥\$36,250 and <\$45,809)	18.0	21.0		18.1	17.6	
Lower medium (≥\$29,875 and <\$36,250)	5.9	7.1		5.9	6.8	
Low (≥\$29,875)	3.9	4.5		3.9	3.9	
Plan type						
EPO	3.6	4.8	<.001	3.6	3.9	.85
HMO	0.6	0.9		0.6	0.6	
Indemnity	38.9	33.0		38.8	37.5	
POS	25.3	22.1		25.3	26.3	
PPO	27.5	32.6		27.6	27.0	
Others	4.2	6.6		4.2	4.7	
Supply of medical services (from zip code)						
Acute care hospital beds per 1000	2.1	2.2	.02	2.1	2.1	.40
PCPs per 100,000	24.0	23.7	.13	24.0	24.8	.004
Specialists per 100,000	135.1	139.6	<.001	135.2	134.2	.35
Baseline health status						
Charlson Comorbidity Index						
0	78.3	72.0	<.001	78.2	77.4	.55
≥1	21.7	28.0		21.9	22.6	
Psychiatric Diagnostic Group						
No (score = 0)	97.6	95.5	<.001	97.5	97.3	.58
Yes (score ≥1)	2.4	4.5		2.5	2.7	
Inpatient admissions ^a	10.2	14.0	<.001	10.2	10.2	1.00

EPO indicates exclusive provider organization; HMO, health maintenance organization; PCP, primary care physician; POS, point of service; PPO, preferred provider organization. ^aInpatient admissions were used for propensity score weights/matching but not in the regression adjustments.

Region of the country (Northeast, South, Midwest and West), location (Metropolitan and other), and pre-enrollment and post months were not shown for brevity.

Table 3. Emergency Department, Inpatient Utilization, and Medical Expenditure Trends Over Time After Matching for Members and Nonmembers

	After Matching		
	Members Mean or %	Nonmembers Mean or %	P
Utilization Measures	2,320	2,320	—
Emergency department visits—Year 1	12.8	16.0	.003
Emergency department visits—Year 2	12.2	16.0	<.001
Inpatient admissions—Year 1	13.5	16.8	.002
Any readmission	28.5	30.4	.59
Average length of stay	11.8	13.5	.49
Total inpatient expenditures	\$17,577	\$18,057	.79
Inpatient admissions—Year 2	11.9	14.6	.008
Any readmission	27.8	32.5	.20
Average length of stay	12.5	13.4	.61
Total inpatient expenditures	\$17,763	\$17,658	.96
Baseline expenditures (PMPM)	\$388	\$391	.91
Medical	\$294	\$312	.47
Pharmacy	\$94	\$79	.05
Year 1 expenditures (PMPM)	\$575	\$633	.13
Medical	\$457	\$534	.04
Pharmacy	\$118	\$99	.05
Year 2 expenditures (PMPM)	\$602	\$645	.30
Medical	\$477	\$547	.08
Pharmacy	\$125	\$98	.01

PMPM indicates per member per month.

attention to disease prevention and wellness, the migration of individuals to higher risk categories will continue as they age (ie, a natural progression of aging and disease), especially as Americans continue to live longer.¹⁴ Therefore, slowing down the upward transitions must be a priority if population health management is to be successful in this population.^{19,20}

Limitations include a relatively small study population enrolled in a Medicare Advantage program provided by a single insurer, which may not be generalizable to all Medicare Advantage beneficiaries. The strengths of the study include a rigorous evaluation utilizing former patients of affiliated physicians (to control for differences in physicians' medical delivery styles and quality) and using multivariate models to adjust for case mix differences between those in the program and comparison members.

The results demonstrated that a model of personalized preventive care delivery can reduce spending among Medicare Advantage beneficiaries. As CMS continues to explore potential models to enhance the quality of medical delivery to seniors, improve patient satisfaction with

care, and reduce medical spending, an enhanced preventive care model should be considered. Population health management of senior populations requires not only programs to mitigate spending among high-risk/high-cost patients, but also programs that serve to enhance health and improve quality of life, helping seniors stay as healthy as possible as they age.

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