Evaluation of the Medicare Diabetes Prevention Program

Second Evaluation Report | Deliverable #14

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RTI INTERNATIONAL

EVALUATION OF THE MEDICARE DIABETES PREVENTION PROGRAM (MDPP)

SECOND EVALUATION REPORT

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ABBREVIATIONS USED

BENE_ID	Unique beneficiary identifier used in the Medicare claims
CCW	Chronic Conditions Data Warehouse
CDC	Centers for Disease Control and Prevention
CMMI	Centers for Medicare and Medicaid Innovation
CMS	Centers for Medicare & Medicaid Services
COVID-19	Coronavirus disease 2019
DPP	Diabetes prevention program
DPRP	Diabetes Prevention Recognition Program: CDC program that sets standards for DPP suppliers
ED	Emergency department
FFS	Fee-for-service
HCPCS	Healthcare Common Procedure Coding System
HEDIS	Healthcare Effectiveness Data and Information Set
HICN	Medicare Health Insurance Claim Number
ICD-10	International Classification of Diseases, 10th Revision
MA	Medicare Advantage
MBI	Medicare Beneficiary Identifier
MDPP	Medicare Diabetes Prevention Program
National DPP	National Diabetes Prevention Program
Original DPP	Diabetes Prevention Program clinical trial that provided evidence to support later DPP initiatives, including the NDPP and MDPP
PA	Physical activity
PBPM	Per beneficiary per month
PCP	Primary care provider
PECOS	Provider Enrollment, Chain, and Ownership System
WL	Weight loss
Y-USA	YMCA of the USA
Y-USA DPP	YMCA of the USA Diabetes Prevention Program—model test of a DPP serving Medicare beneficiaries; provided evidence supporting creation of the MDPP

EXECUTIVE SUMMARY

The purpose of this second evaluation report is to provide information from the Evaluation of the Medicare Diabetes Prevention Program (MDPP). The MDPP began serving Medicare beneficiaries on April 1, 2018, and RTI International was selected to evaluate the program in September 2018. The first evaluation report was finalized in March 2021, based on data through December 31, 2019 (https://innovation.cms.gov/data-and-reports/2021/mdpp-firstannevalrpt). This report uses cumulative data on the program from April 1, 2018, through December 31, 2021.

This report provides information on the following:

- Supplier and beneficiary participation in the MDPP
- Weight loss among MDPP participants
- The impact of the program on Medicare expenditures

The evaluation is designed to examine whether MDPP participation results in weight loss, lower Medicare expenditures, and improved health outcomes (e.g., fewer cases of diabetes). Our results show that MDPP beneficiaries lose weight while participating in the program. Preliminary analysis indicates that Medicare expenditures are not significantly different for MDPP participants than for similar beneficiaries in a comparison group. This finding may change as more beneficiaries participate in the program and as the time since beneficiaries started the program increases. Currently, it is too early and there are not a sufficient number of participants to answer whether participation improves health outcomes.[1] As beneficiary enrollment in the program increases, the evaluation will continue to address these issues in subsequent evaluation reports.

Key Evaluation Questions and Evidence to Date

1. Do MDDP beneficiaries lose weight?
   Yes
2. Does MDPP participation reduce Medicare expenditures?
   There is no evidence at this point that participation significantly changes Medicare expenditures.
3. Do MDPP beneficiaries enjoy improved health outcomes (e.g., lower incidence of diabetes)?
   It is too early, and there are not enough participants to answer this question.

ES.1 Background

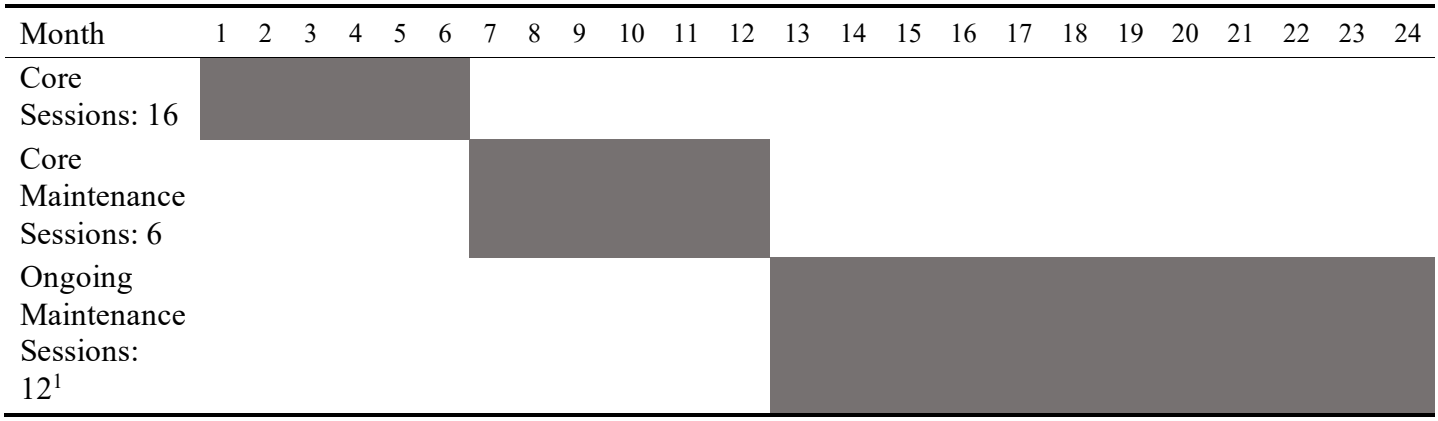
On April 1, 2018, Medicare began offering beneficiaries the MDPP, an evidence-based approach to delay or prevent type 2 diabetes. The MDPP was the first preventive service model tested by the Center for Medicare and Medicaid Innovation (CMMI) that was approved as a Medicare-covered service for fee-for-service (FFS) and Medicare Advantage (MA) beneficiaries.

[1] We estimate that we need at least 3 years of follow-up after participation to detect a difference in diabetes incidence between 1,000 MDPP beneficiaries and 1,000 members of a comparison group. As described later in the report, we do not yet have enough MDPP beneficiaries with at least 3 years of follow-up data.

The MDPP is a lifestyle-change intervention targeting weight loss and exercise in people who are overweight or obese and are at high risk of developing type 2 diabetes. It covers 16 core sessions during the first 6 months and six monthly core maintenance sessions during months 7–12 (**Figure ES-1**). Beneficiaries starting the program prior to January 1, 2022, were eligible to receive up to 12 monthly ongoing maintenance sessions during months 13–24 (if the beneficiary met weight-loss targets during the first 12 months); the program was shortened to 1 year for beneficiaries starting the program on or after January 1, 2022.

Figure ES-1.
Timeline for Participating in the MDPP

For participants achieving 5% weight loss during the first 12 months.



[1] No longer required for participants starting on/after January 1, 2022

Medicare FFS and MA beneficiaries are eligible to receive MDPP services if they are overweight or obese, have prediabetes documented by a clinical laboratory test, have not been previously diagnosed with diabetes or end-stage renal disease, and have not previously received MDPP services.

To participate as an MDPP supplier, organizations must (1) have preliminary or full recognition from the Centers for Disease Control and Prevention's (CDC's) Diabetes Prevention Recognition Program (DPRP) and (2) be enrolled in Medicare. Suppliers must meet a series of other provisions to prevent fraud and abuse. Reimbursement of suppliers is based on performance, as measured by the number of sessions attended, and amount of weight lost by beneficiaries.

ES.1.1 Program Changes

The design of the program has undergone three major changes; the first two were rule changes in response to the COVID-19 public health emergency (PHE). The program was originally designed to be delivered in-person, with only limited virtual (e.g., online) make-up sessions allowed. As PHE-related shutdowns took effect in March 2020, the Centers for Medicare & Medicaid Services (CMS) quickly issued a rule allowing MDPP suppliers to offer sessions virtually through videoconferences or online. Suppliers and beneficiaries were also permitted to pause the program and resume later. The second rule change, effective on January 1,

2021, allowed the first session of the program to be delivered virtually and authorized virtual weight measurements.

The third major change, effective January 1, 2022, is aimed at increasing participation in the MDPP by suppliers and beneficiaries. Originally, the MDPP included a second year of services for beneficiaries who achieved weight loss goals in Year 1 of the program. The change shortened the program to 1 year of services and redistributed Year 2 payments to Year 1. The change to one year aligned the MDPP with the length of the closely related National Diabetes Prevention Program (National DPP).

ES.2 Supplier and Beneficiary Participation

ES.2.1 Suppliers

MDPP suppliers employ lifestyle coaches who lead sessions and teach participants how to choose healthy foods, lose weight, and exercise more. The MDPP began in April 2018 with eight enrolled MDPP suppliers. The number of suppliers has gradually increased to 305 suppliers providing services in 1,059 locations (as of January 2022). Increasing supplier enrollment continues to be a priority for the program. MDPP suppliers include health systems, health plans, health departments, YMCAs, foundations, and other health care or community organizations.

Because beneficiaries must attend 16 in-person class sessions during the core MDPP curriculum, beneficiaries who live closer to an MDPP supplier may find it easier to access the program. As of December 31, 2021, 97% of MDPP beneficiaries lived within 25 miles of an MDPP supplier. Access to suppliers has improved with the increase in MDPP suppliers since the First Evaluation Report (when there were 196 MDPP suppliers). However, 39% of all Medicare beneficiaries still live more than 25 miles from the nearest MDPP supplier location, so increasing access to suppliers remains a priority of the program.

Key numbers related to suppliers (as of 12/31/2021):

- **305** MDPP suppliers
- **1,059** MDPP supplier locations
- **97%** of MDPP beneficiaries live within 25 miles of an MDPP supplier
- **39%** of all Medicare beneficiaries live more than 25 miles from an MDPP supplier

ES.2.2 Beneficiary Participation and Attendance

Beneficiary participation in the MDPP has grown gradually as the number of suppliers has increased. Between April 2018 and December 31, 2021, 4,848 Medicare beneficiaries participated in the MDPP, including 2,325 FFS beneficiaries and 2,523 MA beneficiaries.

Of the 3,771 MDPP beneficiaries for whom there are detailed demographic, session attendance, weight loss, and physical activity data, approximately 68% fall

between the ages of 65 and 74, 77% are white, and 75% are female. Primary care providers, specialists, or other health care professionals account for 41% of referrals to the MDPP, which is consistent with reports from the MDPP suppliers we interviewed.

On average, MDPP beneficiaries attended 17 sessions (one more than the number of Core Sessions and five fewer than the total of 22 classes offered in the first year), and the average length of enrollment was almost 8 months. These averages include beneficiaries who may be partway through the program.[2]

Key numbers related to beneficiary participation:

- Between April 2018 and December 2021, the MDPP served 4,848 FFS and MA beneficiaries.
- On average, beneficiaries attended 17 sessions and were in the program for 8 months.

ES.2.3. COVID-19 Effects on Supplier and Beneficiary Participation

The COVID-19 PHE has had significant effects on supplier and beneficiary participation in the MDPP. The MDPP was originally designed for in-person delivery, but suppliers, beneficiaries, and CMS quickly recognized that in-person sessions were unsafe during a pandemic. CMS allowed suppliers and beneficiaries to pause and later resume sessions and permitted suppliers to offer sessions virtually. Most suppliers opted to offer a type of virtual delivery known as distance learning, wherein a lifestyle coach leads sessions in one location and beneficiaries attend via telephone or videoconference from their homes.

Some beneficiaries dropped out after the PHE began, but most continued after pauses of varying lengths. New enrollment dropped to nearly zero early in the PHE and has slowly recovered since then. As of December 31, 2021, most sessions were delivered virtually, although some suppliers offered a mix of virtual and in-person delivery.

ES.3 Weight Loss and Physical Activity

ES.3.1 Weight Loss

MDPP beneficiaries lost an average of 5.1% of their body weight. Of the 3,618 beneficiaries who attended at least two sessions, 53% met the 5% weight-loss goal for the program and 24.6% met the 9% weight-loss goal. Weight loss is positively related to number of sessions attended and time in the program.

The observed weight loss for MDPP participants is comparable to or slightly more favorable than results for persons aged 65 or older in previous DPPs. Because we

[2] Averages include all beneficiary sessions through December 2021. Beneficiaries will be at different stages of the program; some may have just started.

lack weight data for a comparison group, we cannot definitively conclude that the program caused the observed weight loss.

Key numbers related to weight loss:

- **5.1%** average weight loss among those with two or more weigh-ins
- **53%** of beneficiaries met the 5% weight-loss goal

Weight loss is positively related to number of sessions attended.

ES.3.2 Physical Activity

After the program begins to emphasize physical activity (at session 5), the percentage of beneficiaries who reported meeting the 150-minute per-week goal for physical activity ranged from 61% to 75%.

ES.3.3 COVID-19 Effects

To evaluate the effects of the COVID-19 PHE on recorded weight loss, we compared cohorts of beneficiaries starting the MDPP in January or February 2019, 2020, and 2021. The 2020 cohort started the program before the COVID-19 PHE and then experienced the effects of the PHE shutdowns beginning in March 2020. The 2020 cohort had significantly lower recorded weight loss (5.0%) than the 2019 (5.8%) and 2021 (6.1%) cohorts. However, this difference largely reflects the number of sessions beneficiaries attended; overall, beneficiaries in 2020 dropped out at a much higher rate than in the other years. Beneficiaries in the 2020 cohort who continued in or paused and resumed the program lost similar amounts of weight as those in the 2019 and 2021 cohorts.

ES.4 The Impact of the MDPP on Medicare Expenditures and Diabetes Incidence

The goal of the MDPP is to help Medicare beneficiaries achieve weight loss and better health outcomes, with the expectation that, with better health, beneficiaries will need fewer expensive health care services, leading to reductions in the total cost of care. Medicare claims data regarding weight loss align with weight loss findings from DPRP data. As of December 2021, 49% of the 1,588 Medicare FFS beneficiaries with an MDPP claim achieved at least 5% weight loss. Medicare FFS payments totaled $349,327 for MDPP services (i.e., payments to MDPP suppliers for session attendance and meeting weight loss goals) from April 1, 2018, through December 31, 2021.

ES.4.1 Medicare Expenditures

To assess the impact of the MDPP on Medicare FFS spending, we compared the change in per beneficiary per month (PBPM) expenditures before and after enrolling in the MDPP for Medicare FFS MDPP beneficiaries and a matched comparison group. The change in expenditures before and after MDPP enrollment is not statistically significantly different between the MDPP and comparison groups. It is important to note that the sample size of participants is still relatively small and that detecting differences in total spending before and after participating in the program is challenging with smaller sample sizes. Although it is likely too early to detect savings from program participation, savings may accrue in later years if the MDPP is successful in delaying onset of diabetes and its concomitant health complications.

ES.4.2 Diabetes Incidence

The MDPP pathway to better health and lower costs assumes that weight loss will lead to absolute reductions in diabetes incidence. It is too early to assess diabetes incidence using Medicare claims data due to the relatively small number of enrollees who can be followed for more than 1 year after MDPP participation.[3]

Key numbers on spending and diabetes incidence:

- **1,588** unique FFS beneficiaries with a reimbursable MDPP claim
- **$349,327** in MDPP FFS payments
- No significant change in Medicare expenditures before and after MDPP participation for MDPP beneficiaries relative to a matched comparison group of beneficiaries
- Too early to detect whether MDPP reduces incidence of diabetes

ES.5 Summary

Since the first Evaluation Report, the number of suppliers and beneficiaries enrolled in the MDPP has increased from 2,248 to 4,848 beneficiaries (**Table ES-1**). However, beneficiary enrollment was clearly slowed by the COVID-19 PHE, with new enrollment plummeting close to zero in March, April, and May 2020. CMS quickly changed its rules in response to the PHE to allow suppliers to offer virtual MDPP sessions via videoconference or online, and many—but not all—suppliers and beneficiaries resumed sessions after pauses of varying duration. CMS further allowed suppliers to offer first sessions and weight measurements virtually beginning in January 2021.

[3] In a different study, the incidence rate of diabetes for older adults with prediabetes was estimated as 5.3% per year (Koyama et al., 2022). If the MDPP is successful at reducing incidence, participants will experience an incidence rate lower than 5.3%. We estimate that we will need at least 3 years of follow-up after participation to detect a difference in diabetes incidence between 1,000 MDPP beneficiaries and 1,000 members of a comparison group.

Table ES-1.
Key MDPP outcomes to date

Variable	Outcome	Data source	Data through
Supplier Participation and Beneficiary Access			
MDPP suppliers	305	Supplier Enrollment Summary	1/7/22
MDPP supplier locations	1059	Supplier Enrollment Summary	1/7/22
MDPP beneficiaries living within 25 miles of an MDPP supplier	97%	Supplier Crosswalk; Medicare claims	12/31/21
Percentage of all Medicare beneficiaries living more than 25 miles from an MDPP supplier	39%	Medicare claims	12/31/21
Beneficiary Participation			
MDPP beneficiaries (FFS and MA)	4,848	Supplier Crosswalk	12/31/21
Average number of sessions attended	17	DPRP	12/31/21
Average weight loss	5.1%	DPRP	12/31/21
MDPP Impact			
FFS PBPM expenditures*	Statistically insignificant	Medicare claims	12/31/21
Diabetes incidence	Insufficient sample size	Medicare claims	12/31/21
MDPP Claims			
FFS MDPP paid claims	5,730	Medicare claims	12/31/21
FFS MDPP payments	$349,327	Medicare claims	12/31/21

*Expenditures include payment for MDPP sessions

Overall, the average weight loss was 5.1% for MDPP beneficiaries since the program began in April 2018. This result is the same as the 5.1% reported in the first Evaluation Report and exceeds the program's weight loss goal of 5%. More than half (53%) of participants met the 5% goal, and 24% met a 9% goal. The numbers were even higher for participants attending at least 9 sessions: 64% met the 5% goal and 30% met the 9% goal.

For this report, we compared Medicare expenditures for MDPP FFS beneficiaries to expenditures for a comparison group of FFS beneficiaries with similar characteristics. We found no significant differences between the groups, although the expenditures for MDPP beneficiaries include payments for MDPP services. As of December 2021, the number of MDPP beneficiaries is too small and not enough time has elapsed to estimate whether participating in the MDPP reduces the incidence of diabetes.

ES.5.1 The MDPP and Population Health

One of the long-term goals of the MDPP is to improve the population health of Medicare beneficiaries by lowering the incidence and prevalence of diabetes. Population health focuses on the health status of a group rather than only on the health of individual patients. The impact of an

intervention on population health depends on two factors: the intervention's impact on individual participants, and the intervention's reach (the share of eligible patients who receive the intervention). As noted, we do not yet have sufficient sample size or enough time to determine whether the MDPP lowers the incidence of diabetes or other long-term health outcomes for individual participants (the first factor).

Looking at the second factor, the reach of the MDPP has been limited. An estimated 16 million Americans aged 65 or older are eligible for the MDPP. However, fewer than 5,000 beneficiaries have participated in the MDPP as of December 2021. Because the MDPP has had limited reach, its overall impact on population health has also been limited. Increasing the reach of the MDPP will be necessary to increase the program's overall effect on population health.

ES.5.2 Next Steps

CMS recognizes the importance of increasing supplier and beneficiary participation in the program. Effective January 1, 2022, CMS reduced the length of the program for new participants from 2 years to 1 year, aligning the program with the length of the National DPP. At the same time, CMS redistributed Year 2 payments to Year 1, increasing the incentives for suppliers to participate in the MDPP. CMS has also sought to identify best practices for increasing beneficiary participation in the MDPP by the Medicare population in general and by vulnerable populations in particular.

It is too early to tell whether these changes will significantly increase the rate of participation in the MDPP. The COVID-19 PHE is likely to continue to affect MDPP enrollment in the near future; enrollment may also be affected if the PHE ends and the program reverts to in-person delivery.

The evaluation will continue until March 2025. We will continue to evaluate the program's effects on participation, attendance, and weight loss. We will expand our analysis of expenditures and utilization as the sample size increases and the duration since enrollment becomes longer, allowing for subgroup analyses and analyses of rarer events. The greater sample size and longer duration will also permit us to examine the impact of the MDPP on diabetes incidence and other long-term outcomes.

1. INTRODUCTION

The purpose of this second evaluation report is to provide results from the ongoing Evaluation of the Medicare Diabetes Prevention Program (MDPP). The MDPP began serving Medicare beneficiaries on April 1, 2018, and RTI International was selected to evaluate the program in September 2018. The evaluation will run through March 2025. The report provides information on supplier and beneficiary participation in the MDPP and current evidence on three key evaluation questions:

- Do beneficiaries participating in the MDPP lose weight?
- Does participation in the MDPP lower Medicare expenditures?
- Does participation in the MDPP improve health outcomes (i.e., preventing diabetes onset and subsequent complications)?

Unless otherwise stated, this report is based on data from April 1, 2018, through December 31, 2021. The previous evaluation report is available at https://innovation.cms.gov/data-and-reports/2021/mdpp-firstannevalrpt and focused on data through December 31, 2019.

Our results indicate that MDPP participation is associated with meaningful weight loss. Overall, beneficiary enrollment in the MDPP has been lower than expected, limiting our ability to clearly answer the research questions about expenditures and health outcomes. Preliminary analyses indicate that Medicare expenditures for MDPP beneficiaries are not significantly different than expenditures for a comparison group of similar Medicare beneficiaries. This result could change as the sample size increases and the length of time since beginning the program increases. Because of the nature of diabetes onset (only a fraction of those at risk progress each year) and the low number of participants, it is too early to determine whether participation leads to improved health outcomes. The evaluation will address these questions in subsequent evaluation reports as beneficiary enrollment in the program increases. The larger sample size will allow us to perform additional analyses comparing outcomes for MDPP beneficiaries with those for a comparison group of non-participants with similar characteristics.

In the remainder of this section, we briefly describe the MDPP and the key research questions for its evaluation. We then describe the three major beneficiary-level data sources on MDPP beneficiaries. We also discuss how the MDPP and evaluation have been affected by the COVID-19 public health emergency (PHE).

Subsequent sections of the report follow a logical order. In Section 2, we describe supplier and beneficiary participation, which determine the overall reach of the MDPP. The following sections address the three research questions: Section 3 (weight loss) and Section 4 (Medicare expenditures and diabetes incidence). Section 5 summarizes findings, assesses the MDPP as a population health strategy, and outlines future steps in the evaluation.

1.1. The Medicare Diabetes Prevention Program

On April 1, 2018, Medicare began offering beneficiaries the MDPP, an evidence-based approach to delay or prevent type 2 diabetes, one of the most common, burdensome, and costly

diseases affecting Medicare beneficiaries. The MDPP was the first preventive service model tested by the Center for Medicare and Medicaid Innovation (CMMI) that was expanded as a Medicare-covered service for fee-for-service (FFS) and Medicare Advantage (MA) beneficiaries.

The MDPP is a lifestyle intervention targeting weight loss and exercise in persons who are at high risk of developing diabetes. Medicare FFS or MA beneficiaries are eligible to receive MDPP services if they are overweight or obese, have prediabetes documented by a clinical laboratory test, have not been previously diagnosed with diabetes or end-stage renal disease, and have not previously received MDPP services.

The MDPP was originally designed as a 2-year program covering three types of services (**Table 1**):

- at least 16 **core sessions** in the first 6 months
- monthly **core maintenance sessions** in months 7–12
- monthly **ongoing maintenance sessions** in months 13–24 for beneficiaries meeting attendance and weight loss goals in year 1

As discussed below, the program has been shortened to 1 year for beneficiaries starting the program in 2022.

Table 1.
MDPP program structure

The program includes at least 16 sessions in the first 6 months, followed by monthly sessions thereafter.

Time Since Beneficiary Enrollment		Session Name	Frequency	Number of Sessions
Year 1	Months 1–6	Core sessions	No more than once per week	At least 16
	Months 7–12	Core maintenance sessions	Monthly	At least 6
Year 2*	Months 13–24	Ongoing maintenance sessions**	Monthly	At least 12

*Year 2 has been dropped for beneficiaries starting the program on or after January 1, 2022.
**Beneficiaries must meet attendance and weight-loss goals to be eligible to continue to attend ongoing maintenance sessions in Year 2.

The MDPP core sessions focus on changing eating habits and encouraging physical activity. The core maintenance and ongoing maintenance sessions provide additional strategies for maintaining weight loss. Prior to the COVID-19 PHE, sessions were required to be delivered in person, although limited virtual (e.g., online) makeup sessions were allowed. As discussed below, the Centers for Medicare &Medicaid Services (CMS) loosened the in-person requirement in response to the COVID-19 PHE.

The sessions are led by lifestyle coaches who, in some cases, provide supplementary support to participants between sessions via email, text, or telephone. An important component of the in-person sessions is a weigh-in, allowing the participant and supplier to track weight loss

over time. The curriculum begins to emphasize tracking physical activity around session 5. Participants self-report minutes of physical activity to the supplier.

To participate as an MDPP supplier, organizations must first have preliminary or full recognition from the Centers for Disease Control and Prevention's (CDC's) Diabetes Prevention Recognition Program (DPRP). To achieve preliminary recognition, an organization must have provided diabetes prevention services for at least 12 months and have at least 60% of participants attend at least nine sessions in months 1–6 and at least three sessions in months 7–12. For full recognition, the supplier's participants must have an average weight loss of 5% and meet standards for reporting physical activity. Thus, the suppliers who enroll in the MDPP will already have experience providing diabetes prevention services and will have demonstrated that their participants attend classes and achieve weight loss.

In addition to DPRP recognition, suppliers must enroll in Medicare, and meet a series of other provisions designed to prevent fraud and abuse before they become an MDPP supplier. Not all eligible DPRP-recognized suppliers enroll in the MDPP (see **Section 2**).

Medicare FFS reimbursement of suppliers is based on performance, as measured by the number of sessions attended and amount of weight lost by participants. In 2021, a supplier could receive up to $704 ($705 in 2022) per beneficiary if all performance targets (attendance and weight loss) were met. The reimbursement schedule and performance standards are described in greater detail in **Appendix A.** .

The MDPP is based in part on the landmark Diabetes Prevention Program clinical trial (hereafter called the *original DPP* to distinguish it from the MDPP and other diabetes prevention programs), which found that type 2 diabetes could be prevented (or at least delayed) by a lifestyle intervention targeting weight loss and exercise in people who are overweight or obese and at high risk of developing diabetes. The trial was stopped early, after 3-year follow-up data showed that the lifestyle intervention reduced the risk of diabetes onset by 58% relative to a placebo intervention (Knowler et al., 2002). The MDPP is also based on evidence from the evaluation of the YMCA of the USA Diabetes Prevention Program (Y-USA DPP), which tested whether participants in the program had lower Medicare expenditures and utilization than a comparison group selected through propensity score matching. The evaluation found that the Y-USA DPP significantly reduced expenditures and utilization (Alva, Hoerger, Jeyaraman, Amico, & Rojas-Smith, 2017; Rojas Smith et al., 2017a) On average, participants lost about 4.6% of their baseline body weight. The evaluation did not measure whether the program reduced diabetes onset; however, weight loss was the major determinant of risk reduction in the original DPP (Hamman et al., 2006).

The MDPP is closely affiliated with—but distinct from—the National Diabetes Prevention Program (National DPP). The National DPP was established in 2010 under CDC leadership to facilitate a partnership of public and private organizations working to prevent or delay type 2 diabetes. The National DPP raises awareness of prediabetes and diabetes prevention among patients and health care providers and encourages private- and public-sector employers and insurers to support diabetes prevention. CDC has developed curricula for the National DPP, sets DPRP standards, and collects participant data from DPRP-recognized suppliers. These roles

help set the standards for the MDPP. For the evaluation of the MDPP, CDC provides an extract of the DPRP data that contains key information on participants covered by the MDPP.

1.2. Changes to the MDPP to Address the COVID-19 PHE and Increase Supplier and Beneficiary Participation

CMS has made three major changes to the MDPP since its launch on April 1, 2018 (**Table 2**). The first two changes, prompted by the COVID-19 PHE, allowed virtual delivery of the program in place of in-person sessions. The third change was designed to increase participation by suppliers and beneficiaries by waiving supplier enrollment fees, eliminating the second year of the program for new beneficiaries, and redistributing second-year reimbursement rates to the first year of the program.

Table 2.
Major changes to the MDPP

Date of Rule Change	Key Provisions
March 30, 2020	• MDPP suppliers and beneficiaries may pause or delay classes
	• Once-in-lifetime participation by beneficiaries is waived
	• Most 5% weight-loss and attendance requirements for maintenance sessions are dropped
	• Sessions (except for the first) may be conducted virtually
January 1, 2021	• Beneficiaries can receive the first session virtually
	• Beneficiaries who receive program virtually during the PHE may continue virtually after the PHE ends
	• In-person weigh-ins no longer required; virtual weigh-ins allowed
January 1, 2022	• Supplier enrollment fees are waived
	• Second year ongoing maintenance periods are eliminated
	• Second year reimbursement redistributed to first year attendance goals

Under the third change that eliminated the second year of the program, the maximum potential reimbursement for Year 1 of the program increased from $494 to $705. The reimbursement for achieving all Year 1 attendance performance goals increased from $203 to $455, and payments for meeting all Year 1 weight-loss performance goals totaled $250. The redistribution of reimbursement rates caused by the third change is shown in **Appendix Table A-1**.

1.3. Research Questions

The objective of CMS evaluations is to determine whether the model being tested is successful. For the MDPP model, that means answering three main research questions:

Does MDPP participation result in weight reduction?

Does MDPP participation lead to lower health care expenditures for Medicare FFS beneficiaries (both before and net of program payments)?

Does MDPP participation lead to improved health outcomes?

Adjunct questions further explore the relationship between participation and outcomes:

Does the percentage of MDPP beneficiaries achieving, and then maintaining, 5% weight loss differ by number of sessions attended, supplier recognition status, or type of supplier?

Is the MDPP more effective among certain demographic groups?

Does MDPP participation lead to medical utilization changes?

Were any changes in medical utilization or costs related to reported weight loss, completion of the MDPP, or length of time in the program?

Are any markers of progression to diabetes present? Does the program appear to prevent or delay the incidence or onset of diabetes?

1.4. Logic Model of the MDPP

Figure 1 presents the logic model for the MDPP, which also provides a useful framework for evaluating the MDPP and answering the main evaluation research questions. Development of the logic model begins with the problem that the MDPP is designed to address: many Medicare beneficiaries have prediabetes and are at risk of developing diabetes, a serious and costly health condition. The goal of the MDPP is to prevent type 2 diabetes in Medicare beneficiaries with prediabetes, thereby improving their health and reducing Medicare expenditures. Given this problem statement and goal, the logic model relates how program inputs and resources support program activities that lead to measurable program outputs that in turn lead to short-term and long-term outcomes that achieve the program's goals. Below, we describe the key components of the MDPP logic model and discuss implications for the evaluation.

Inputs/Resources: The MDPP builds on inputs and resources that are provided by CDC, CMS, suppliers, health care providers, and beneficiaries. These inputs and resources include the MDPP curriculum developed by CDC, the DPRP administered by CDC that recognizes suppliers, organizations (and personnel) who are interested in becoming MDPP suppliers (and coaches), Medicare beneficiaries with prediabetes who are interested in participating in the program, beneficiary referrals to the program from health care providers and other sources, and supplier enrollment and reimbursement systems administered by CMS. The evaluation does not explicitly examine these inputs and resources, but they provide the foundation for the program.

Activities: A key program activity is enrolling suppliers in the MDPP, which requires that suppliers first have preliminary or full DPRP recognition with CDC and then enroll as a

Medicare provider. Once enrolled, suppliers provide in-person MDPP services to beneficiaries, including at least 16 core sessions in months 1–6, six monthly core maintenance sessions in months 7–12, and (for beneficiaries starting the MDPP before January 1, 2022) monthly ongoing maintenance sessions in months 13–24. Because beneficiaries are expected to attend many in-person sessions, beneficiaries must have access to nearby suppliers. Thus, for a large number of beneficiaries to participate in the program there needs to be a sufficient number of MDPP suppliers. The evaluation is monitoring the number of suppliers and beneficiary access to see whether these necessary conditions are met. Beneficiary enrollment is also an obvious necessary requirement for the program to be successful: if few beneficiaries enroll, the overall effect of the program on diabetes incidence and Medicare expenditures will be limited. Thus, the evaluation is measuring beneficiary enrollment.

Outputs: The direct outputs measured by the program and considered by the evaluation include session attendance, weight measured during in-person sessions, physical activity reported by beneficiaries, and Medicare claims for attendance and weight loss.

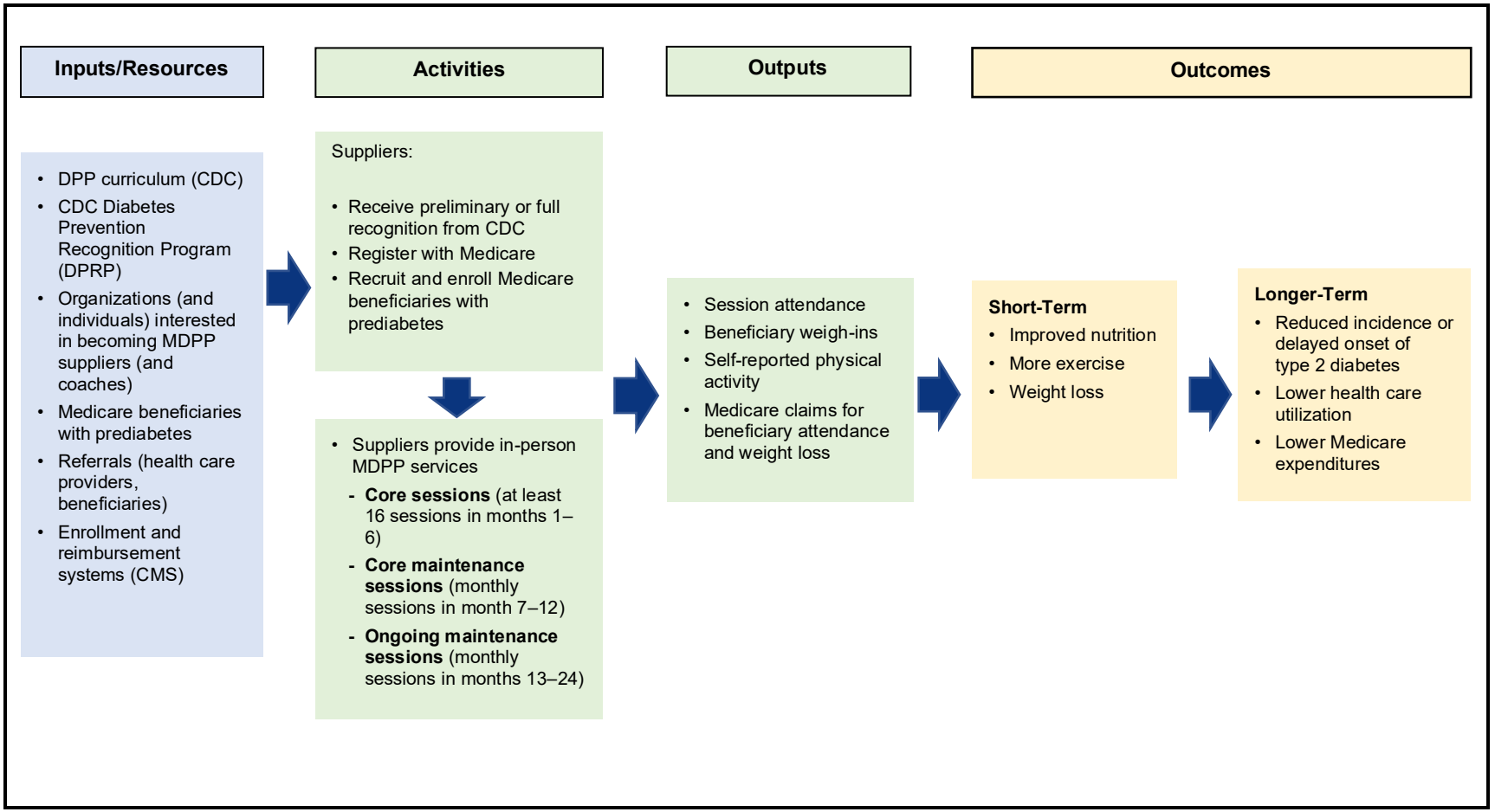
Short-Term Outcomes: Attending MDPP sessions is expected to lead in the short-term to behavioral changes—improved nutrition and increased physical activity—that in turn lead to beneficiary weight loss. In the evaluation, we observe weight loss and self-reported physical activity; although we do not observe nutrition, its impact will contribute to participants' weight loss. We can measure and evaluate these short-term outcomes within a year after a beneficiary enrolls in the MDPP. Weight loss is likely to be the most important short-term outcome variable for the evaluation; in the original DPP clinical trial, weight loss was the most important factor associated with reductions in the probability of developing diabetes (Hamman, et al., 2006). Therefore, examining whether MDPP participants lose weight is the first main research question for the evaluation.

Longer-Term Outcomes: Longer-term outcomes, which may not be observable until at least 1 year after an individual begins participation in the program, include cases of diabetes prevented, and lower Medicare utilization and expenditures because diabetes care (provider visits, diabetes medications, and treatments for diabetes complications) is averted. These potential longer-term outcomes form the basis for the second and third main evaluation research questions: Does MDPP participation lead to lower health care expenditures? Does MDPP participation lead to improved health outcomes (fewer cases of diabetes)?

Each step in the logic model helps determine whether the next step will be successful and whether the MDPP will ultimately achieve its goals. For example, if few suppliers are willing to provide MDPP services (activities not conducted) or if eligible beneficiaries choose not to enroll (activity not achieved), the program will have limited reach and impact on outcomes. For the evaluation, we monitor supplier enrollment and beneficiary participation to see whether these necessary conditions for program success are met. Similarly, we are measuring outcomes at different time horizons. Although we may not immediately be able to observe longer-term effects, the short-term outcomes will provide important clues about the likely longer-term outcomes. If the short-term outcomes are positive (e.g., beneficiaries lose weight), the long-term outcomes are more likely to be achieved. On the other hand, if we do not observe improvements in the short-term outcomes, improvements in the longer-term outcomes are less likely.

Figure 1.
Logic model for the Medicare Diabetes Prevention Program

The logic model illustrates how the MDPP is expected to reach its goals; the evaluation will assess how the program implements its activities and whether it produces its expected outputs and outcomes.



1.5. Key Data Sources

1.5.1. MDPP Beneficiaries

The evaluation use three key data sources for beneficiary-level data on MDPP beneficiaries (**Table 3**):

- Supplier Crosswalk data submitted by MDPP suppliers
- DPRP data from CDC
- Medicare claims and enrollment information

The data sources provide different information and have differing reporting schedules. Because of the differing reporting periods, information on a beneficiary in one data source cannot always or immediately be linked with data on the same beneficiary from the other data sources. Understanding this limitation is important for interpreting the beneficiary-level results we present in this report.

Table 3.
Key data sources for beneficiary-level data on MDPP participants
The three datasets provide complementary data that can be linked through the Supplier Crosswalk

Variable	Supplier Crosswalk	DPRP	Medicare Claims and Enrollment Data (FFS beneficiaries only)
Purpose	Identify MDPP beneficiaries and provide link between DPRP and Medicare claims and enrollment data	Provide data on demographics, session attendance, weight loss, and physical activity	Identify payments for MDPP services and measures beneficiary utilization and expenditures
Populations included	All enrolled MDPP participants	All enrolled MDPP participants	Medicare FFS
Data included in this report	April 1, 2018, through December 31, 2021	April 1, 2018, through December 31, 2021	Approved claims through December 31, 2021

MDPP Enrollee Identification: The Supplier Crosswalk

The Supplier Crosswalk contains the information used to identify which beneficiaries are enrolled in the MDPP. It plays a crucial role in linking the information on session attendance and weight loss from DPRP data and information about MDPP payments and other health care utilization from the Medicare FFS claims data. The Supplier Crosswalk also provides our best estimates of the number of Medicare beneficiaries who have participated in the MDPP to date.

> The Supplier Crosswalk links the DPRP and Medicare claims data and provides the best estimate of the total number of MDPP beneficiaries.

For details on linkage between datasets, see **Appendix B**.

Supplier Crosswalk data are collected quarterly on January 15, April 15, July 15, and October 15. The last included Crosswalk, from January 15, 2022, includes data through December 31, 2021.

MDPP Program Information: The DPRP Data

Suppliers are required to submit detailed beneficiary information to the CDC every 6 months. This information includes the supplier's CDC organization code, CDC participant code, expected payer, date of service, session number, starting weight, weight loss from baseline, physical activity minutes, and beneficiary demographics.

DPRP data provide information on demographics, session attendance, weight loss, and physical activity for MDPP beneficiaries.

Many suppliers recognized by the DPRP have not enrolled in the MDPP, and MDPP suppliers may serve both MDPP beneficiaries and participants covered by other payers. For purposes of the MDPP evaluation, CDC provides an extract from the DPRP database that includes (1) participants with Medicare listed as the payment source, and (2) other participants aged 65 or older.

Session attendance, weight loss, and physical activity represent output and short-term outcomes of the MDPP. Although the Medicare claims provide some information on session attendance and limited weight-loss information for FFS beneficiaries, they provide less information than the DPRP data on weight loss and no information on physical activity. Additionally, the DPRP data provide the only information on attendance, weight loss, and physical activity for MA beneficiaries. Thus, the DPRP dataset provides key information to address the evaluation's research questions.

This report includes DPRP data from April 1, 2018, through December 31, 2021.

Medicare Claims and Enrollment Data

Medicare data contains demographic and enrollment data for each Medicare beneficiary and utilization, claims, and allowed charges for FFS beneficiaries for the MDPP and other Medicare services. These data for an FFS beneficiary can be linked to the Supplier Crosswalk, and the linked Medicare claims–Supplier Crosswalk can then be linked to the DPRP data.

Medicare claims data provide Medicare utilization and expenditures information for FFS beneficiaries participating in the MDPP.

Importantly, these data provide estimates of actual claims and payments for MDPP services provided to FFS beneficiaries, as well as demographic and enrollment characteristics to include as explanatory variables in analyses. We use claims information to determine whether MDPP participation leads to lower health care expenditures for Medicare FFS beneficiaries (both before and net of direct MDPP payments). Later in the evaluation, we will use claims data to examine whether MDPP participation prevents or delays the onset of diabetes.

This report includes Medicare claims approved as of December 31, 2021.

Impact of Reporting Schedules

As described in the First Evaluation Report (at https://innovation.cms.gov/data-and-reports/2021/mdpp-firstannevalrpt) and **Appendix B,** the reporting schedules differ between data sources. Therefore, we cannot always or immediately link data for the same beneficiary across data sources. It is possible for a new MDPP beneficiary to appear in any one of the datasets before they appear in the other datasets. **Appendix B** provides examples that help illustrate this point. The differences in reporting schedules among datasets mean that the number of MDPP beneficiaries included in analyses will vary depending on which data source provides the best information for the analysis.

1.5.2. Supplier Data Sources

The key data source for the number and location of MDPP suppliers is the Supplier Enrollment Summary, compiled by CMS. The data set includes Medicare supplier identifiers, CDC DPRP supplier identifiers, and locations for all MDPP suppliers. To complement the quantitative supplier data, we have interviewed participating MDPP suppliers to understand how they implemented the MDPP, responded to the COVID-19 PHE, and recruited and enrolled beneficiaries.

1.6. Effects of the COVID-19 Pandemic on the MDPP

The COVID-19 PHE has had important effects on the MDPP. As an in-person program, the MDPP was immediately curtailed by social distancing and stay-at-home orders. CMS responded by allowing suppliers and beneficiaries to pause and then resume or restart sessions (see **Section 1.2**). CMS also permitted suppliers to offer virtual sessions in place of in-person sessions. These changes may have directly affected program outcomes, including attendance and weight loss. The COVID-19 PHE may also have had an independent effect on Medicare expenditures and utilization as all beneficiaries (both MDPP and non-MDPP participants) postponed medical care during the worst of the PHE.

In this report, we integrate evidence on COVID-19 effects in each section. For example, in the section on weight loss, we talk about weight loss overall and then we examine whether weight loss was different during the COVID-19 period.

2. PARTICIPATION IN THE MDPP

This section focuses on MDPP participation by suppliers and beneficiaries. Supplier participation is a necessary first step for beneficiaries to participate in the program. Because the MDPP was designed to be delivered through a series of in-person classes, beneficiaries may prefer to enroll and visit nearby MDPP suppliers that are convenient. Although the PHE allowed for virtual delivery of the program, MDPP suppliers must still be approved to provide in-person delivery. We discuss the current number of Medicare-enrolled MDPP suppliers and how that has changed since the program's launch. We also describe how MDPP suppliers modified their operations to serve Medicare beneficiaries during the PHE, including delivering the program virtually (primarily through distance learning platforms such as Zoom).

We then discuss beneficiary participation in the MDPP, including enrollment into the program, beneficiary referral sources, and enrollment motivation. We provide beneficiary demographics and present results regarding attendance and program retention. We also address the PHE's impact on beneficiary participation in the MDPP, including whether beneficiaries dropped, paused, or continued the program virtually.

Key Findings

Suppliers

- As of January 7, 2022, 305 MDPP suppliers were offering services at 1,059 locations.
- The number of suppliers enrolled in the MDPP grew from 196 in March 2020 to 305 in December 2021. Monthly growth in the number of suppliers has continued steadily, but at a somewhat slower rate than in the first 2 years of the program.
- Twenty-seven percent of MDPP-eligible suppliers (those with full or preliminary recognition from CDC's DPRP) have enrolled as MDPP suppliers.
- As of January 2022, four states lack an MDPP supplier (compared with 7 states in March 2020), and some metro areas that did not previously have access (e.g., Atlanta) had a supplier enroll by 2022.
- Local access to MDPP suppliers is important: 97% of MDPP beneficiaries live within 25 miles of their supplier's nearest location.
- However, only 61% of all Medicare beneficiaries lived within 25 miles of the nearest MDPP supplier (December 2021), indicating that 39% did not have convenient access to attend in-person MDPP classes.

Beneficiaries

- From April 2018 through December 2021, 4,848 Medicare beneficiaries (2,325 FFS and 2,523 MA) participated in the MDPP.

- Approximately 75% of MDPP beneficiaries are women, 68% are between the ages of 65 and 74, over 75% are white, and 84% are non-Hispanic. In general, the demographic characteristics of MDPP FFS and MA beneficiaries are similar.
- On average, beneficiaries attended 17 sessions (22 sessions are offered in the first year of the program) and the average days enrolled in the program for beneficiaries is 232 days, approximately 7–8 months. On average, FFS beneficiaries have longer enrollment (265 days) than MA beneficiaries (200 days) and have attended more sessions (19 versus 15 sessions).

COVID Effects

- At the start of the COVID-19 PHE, suppliers halted in-person sessions; after pauses of varying lengths, most resumed by offering virtual sessions via teleconference or online.
- Some beneficiaries dropped out of the program, but many resumed attending virtually after a pause of more than 30 days.
- The percentage of virtual sessions increased from less than 1% prior to March 2020 to 92% in April 2020. The overall percentage of virtual sessions still exceeded 50% through December 2021.
- New patient enrollment dropped dramatically in the early months of the PHE.

2.1. MDPP Suppliers

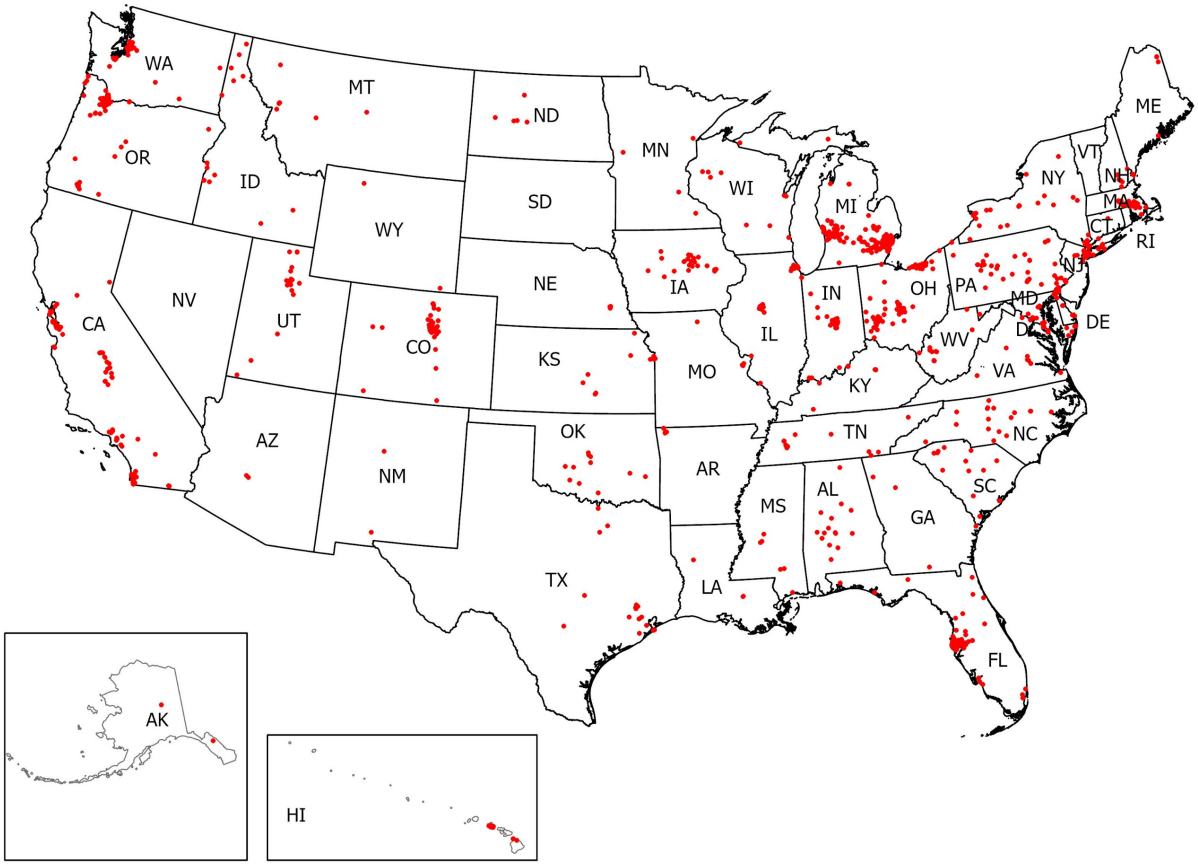
In this section, we distinguish between MDPP supplier organizations and supplier locations. Examples of MDPP supplier organizations include health systems, health plans, health departments, YMCAs, foundations, and other health care or community organizations. Supplier organizations can provide MDPP services at more than one location, and these locations are listed in the online MDPP Supplier Map (https://innovation.cms.gov/initiatives/medicare-diabetes-prevention-program/mdpp-map.html) that Medicare beneficiaries can use to locate nearby MDPP suppliers. Supplier enrollment data were drawn from supplier enrollment summaries periodically provided by CMS. The latest supplier enrollment data used in this report are from January 7, 2022.

2.1.1. MDPP Supplier Enrollment

As of January 7, 2022, the Supplier Enrollment Summary indicated that there are 322 approved or previously approved MDPP supplier organizations with 1,059 supplier locations across the United States. Supplier locations are mapped in **Figure 2**. Among the 322 suppliers, 17 suppliers were not listed as "approved" or did not have "full" or "preliminary" recognition from CDC, leaving 305 active suppliers. Many MDPP supplier locations are clustered around large urban areas (e.g., Boston, Denver, Detroit, Seattle, New York City), with far fewer supplier locations in rural areas. Four states (Nevada, Rhode Island, South Dakota, and

Vermont) still have no MDPP supplier locations. Three states (Alabama, New Mexico, Wyoming) previously lacked an MDPP supplier location in March 2020 but have since gained at least one supplier. Likewise, some large urban areas that lacked an MDPP supplier in 2020 had at least one by 2022 (e.g., the Atlanta metro area).

Figure 2.
Map of MDPP supplier locations across the United States (N = 1,059)
Access to MDPP suppliers varies widely, with four states having no MDPP suppliers



Note: This figure includes some deactivated suppliers (17 supplier organizations and their associated locations were not listed as "approved" or did not have "full" or "preliminary" recognition from CDC as of the January 7, 2022, enrollment summary).
Data Source: Supplier Enrollment Summary, January 7, 2022

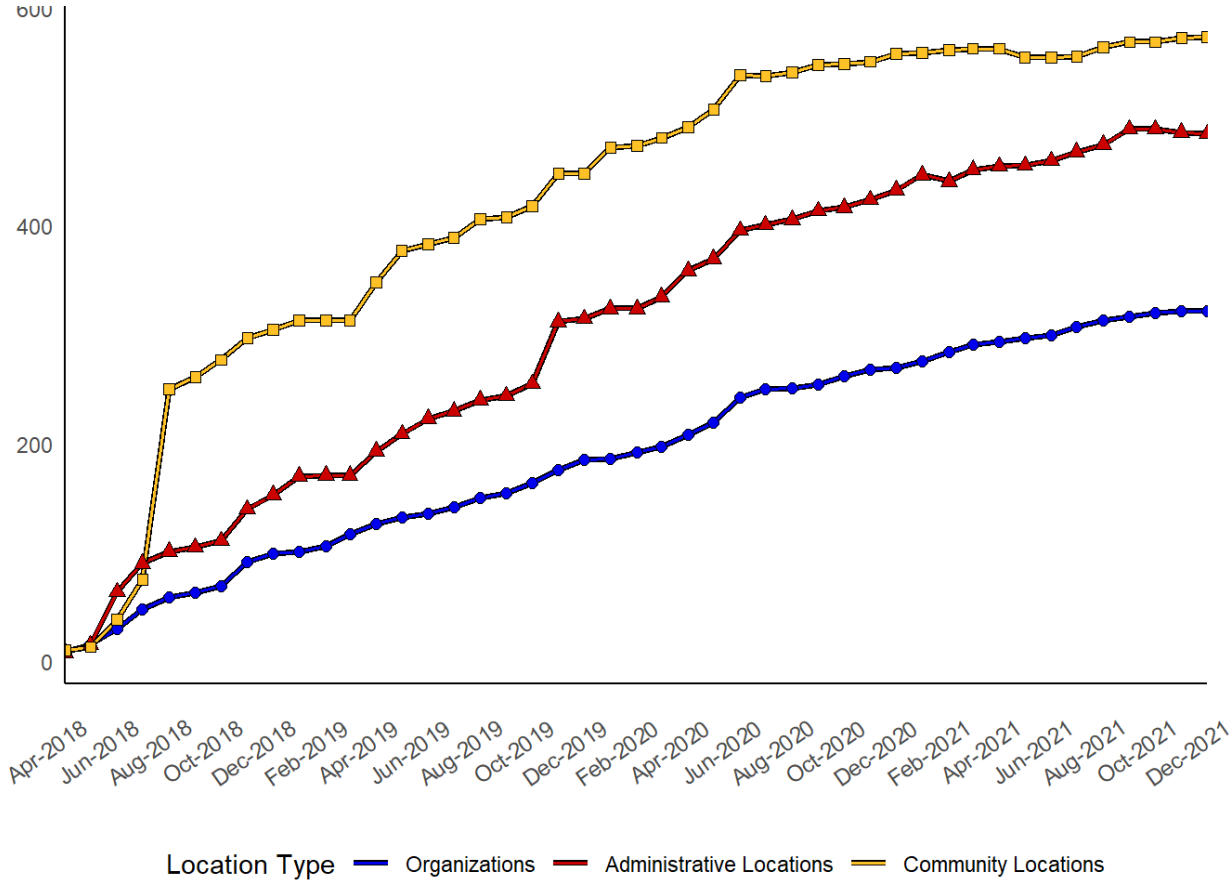
2.1.2. Increase in MDPP Suppliers Over Time

Despite the shortage of MDPP supplier locations in some states and rural areas, beneficiary access to the MDPP continues to improve. Over the first 2 years of the program (April 2018 to April 2020), suppliers and locations were added rapidly, with an average of eight MDPP supplier organizations and 35 supplier locations enrolling each month. In March 2020, there were 816 supplier locations. In the 21 months since, the rate of increase in new suppliers and locations has slowed but remained steady, with an average of six MDPP supplier

organizations and 10 supplier locations added each month. As of December 2021, there were 1,059 MDPP supplier locations (i.e., administrative and community locations) across the United States, nearly a 30% increase since March 2020. **Figure 3** shows the number of organizations and locations enrolled each month according to the Medicare Enrollment Summary file as of January 7, 2022. The figure distinguishes between administrative and community locations, which are counted separately by CMS; however, the distinction is less important for beneficiaries because MDPP suppliers can provide services at either administrative or community locations.[4]

Figure 3.
Number of MDPP supplier organizations and locations over time

The number of suppliers and locations continues to increase, but at a slower rate than in the program's first two years.



Note: This figure includes some deactivated suppliers (17 supplier organizations and their associated locations were not listed as "approved" or did not have "full" or "preliminary" recognition from CDC as of the January 7, 2022, enrollment summary).
Data Source: Supplier Enrollment Summaries, CMS (latest summary: January 7, 2022).

[4] Each MDPP supplier must have at least one administrative location (some list more than one), which is the physical location(s) associated with a supplier's operations. Suppliers may furnish services in the administrative location, but it is not required. Suppliers are not required to list separate community locations, but many do.

2.1.3. Supplier Reach

As of January 7, 2022, 27% of eligible DPRP suppliers have enrolled in the MDPP. The reach of a health care program can be measured by the percentage of eligible suppliers or beneficiaries who participate in the program (Glasgow, Vogt, & Boles, 1999). **Table 4** shows the reach of the MDPP with respect to eligible suppliers. Suppliers may only enroll in the MDPP if they have first achieved preliminary or full recognition from CDC's DPRP by providing diabetes prevention services for at least 1 year and by meeting performance standards. Reach has increased from 2% in the first month of the MDPP to 18% after 1 year, 22% after year 2, and up to 27% as of December 2021.

Table 4.
Supplier reach
27% of eligible DPRP suppliers have enrolled in the MDPP

Month	Suppliers with Preliminary or Full DPRP Recognition	MDPP-Enrolled Suppliers	Percentage Enrolled
April 2018	431	8	2%
April 2019	686	126	18%
April 2020	927	208	22%
April 2021	1,087	294	27%
December 2021	1,210	322	27%

Note: This table includes some deactivated suppliers (17 supplier organizations and their associated locations were not listed as "approved" or did not have "full" or "preliminary" recognition from CDC as of the January 7, 2022, enrollment summary).
Data Source: Supplier Enrollment Summaries, CMS (latest summary: January 7, 2022).

Among the 322 MDDP-enrolled suppliers, 305 suppliers were listed as "approved" as of January 7, 2022. Most of these suppliers (77%, N=235) had full DPRP recognition from CDC, whereas the remainder had preliminary recognition status (23%, N=70). Of the 305 approved MDPP suppliers, 133 have submitted claims or crosswalk data indicating they have served MDPP beneficiaries. On average, these suppliers served 34 beneficiaries. The largest supplier, a health plan, has served 493 MDPP beneficiaries. Of the suppliers that have served FFS MDPP beneficiaries, as of December 2021, 56 % have submitted a claim to CMS for the MDPP services.[5]

2.1.4. Supplier-Level Impact of COVID-19

The COVID-19 PHE directly affected the way that suppliers delivered the MDPP. The program was intended to be offered in person, but suppliers, beneficiaries, and CMS recognized that in-person sessions were dangerous during the PHE. Suppliers halted or paused in-person sessions and moved to provide classes virtually through video- or teleconferencing or online. Whereas CMS uses the generic term *virtual delivery*, CDC's DPRP distinguishes between

[5] CMS only receives claims data for beneficiaries enrolled in FFS Medicare.

two types of virtual sessions: distance learning and online delivery. In distance learning, a lifestyle coach leads sessions in one location and participants call or videoconference into the sessions from other locations. For online delivery, participants log into course sessions via computer, tablet, or smart phone at their convenience; the sessions are not led live by a lifestyle coach, but the coach is available to answer questions by phone or email at least once a week. Most of the suppliers we interviewed moved to distance learning during the PHE; in DPRP data, most virtual sessions were listed as distance learning, not as online.

To better understand the impact the PHE had at the supplier level, we examined the percentage of beneficiaries who dropped out or paused within each supplier. We compared supplier activity in 2020 to the same time periods in 2019 and 2021 to examine differences over time, focusing on beneficiaries being served in January and February. In 2020, 32% of suppliers had more than half of the MDPP beneficiaries who attended sessions in January and February (before the PHE) drop out, and 22% of suppliers had more than half of their MDPP beneficiaries pause for at least 30 days. The year earlier, (2019), only 2% of suppliers had more than half of their MDPP beneficiaries drop out, and 8% of suppliers had more than half of their beneficiaries pause. The comparable percentages of suppliers for 2021 were 21% and 8%.

Although most of the suppliers we interviewed (6 of 8) as part of a study on the impacts of the PHE on suppliers noted that they resumed or continued delivering MDPP sessions, there were initial issues with beneficiary attrition due to changes in the delivery modality. For example, one supplier noted that several Medicare patients dropped out upon the initial shift to distance learning delivery at the start of the PHE due to fear of security issues with Zoom or a lack of internet access, and another supplier noted that Medicare beneficiaries dropped out of the program due to issues connecting through and using digital technology.

So, the biggest challenge, then, was first making sure that our participants had the technology. – Program Administrator

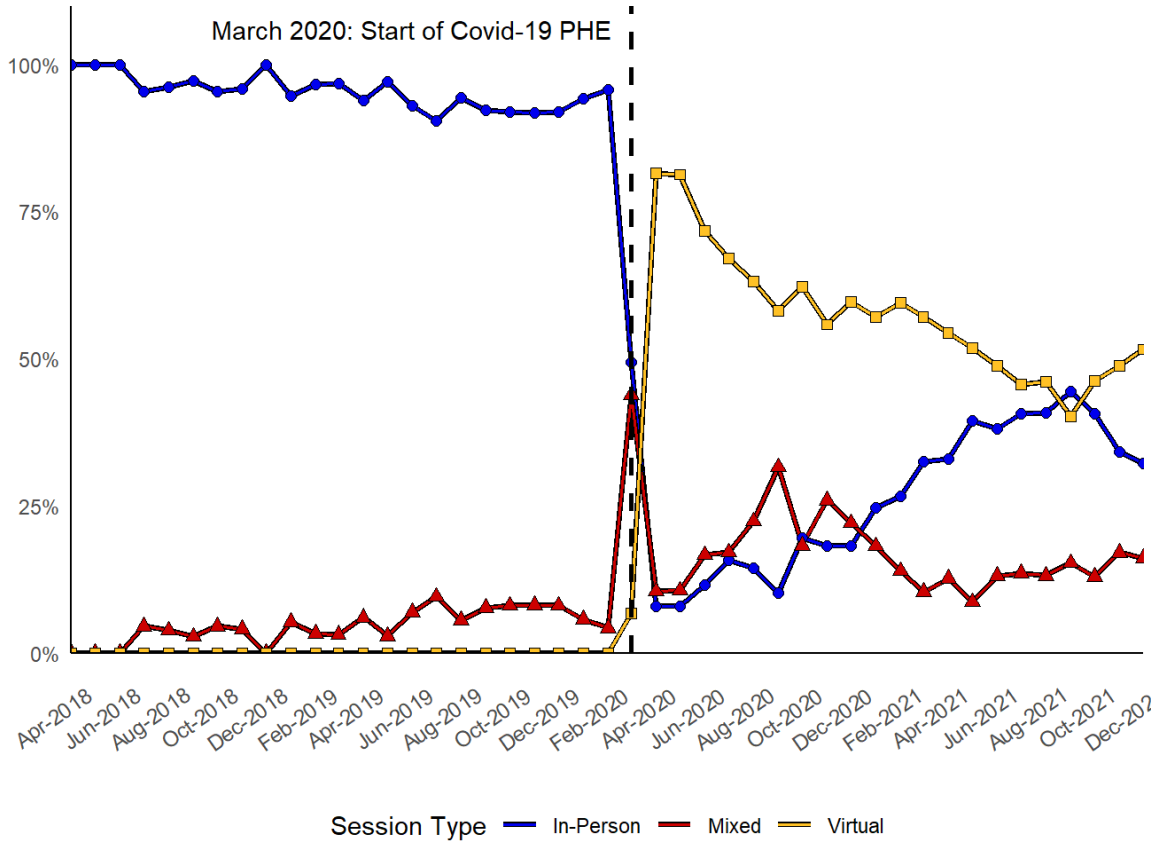
I had to call people because of the fear of security issues that came along with the Zoom and I had a couple people drop because of lack of understanding the technology. – Program Administrator

Of the eight suppliers interviewed, most (N=5) reported temporarily pausing MDPP sessions at the start of the PHE in March 2020. These suppliers resumed MDPP delivery by shifting to a distance learning platform like Zoom. The duration of the pauses varied considerably; one supplier reported only a 2-week gap between pausing in-person sessions to distance delivery, whereas another supplier reported a pause of a few months. Suppliers with a longer pause duration noted that they used that time to figure out how to get started with offering the sessions via long distance delivery, including understanding which software platform to use. Two suppliers noted that the delivery of sessions was still on hold in October 2021 due to a decrease in staff during the PHE.

Another impact of the COVID-19 PHE was the shift of beneficiaries who remained in the program to distance learning sessions. Prior to March 2020, sessions were not permitted to be virtual, except for a small number of makeup sessions. Because of the PHE, CMS allowed

classes to either be online or be delivered through distance learning modalities after March 30, 2020. **Figure 4** shows the change over time of delivery mode at the supplier level. In this and subsequent figures, we highlight March 2020 as the month in which the first major stay-at-home orders were issued in response to COVID-19.[6] We categorized each supplier for each month based on whether their sessions offered were (1) completely in person; (2) completely virtual (either distance learning or online); or (3) a mix of in-person and distance/online sessions. As expected, based on MDPP requirements, over 90% of suppliers delivered all their sessions in-person through February 2020. Several suppliers did offer virtual make up sessions. Beginning in April 2020, however, 82% of suppliers delivered all of their sessions virtually, and less than 10% delivered them all in-person. The percentage of suppliers that delivered all their sessions virtually declined from 82% in April 2020 to 40% in September 2021. The percentage of suppliers offering classes entirely through distance learning or online platforms increased slightly starting in September 2021 to 52% of suppliers in December 2021, which coincides with a spike in COVID-19 cases.

Figure 4.
Percentage of suppliers delivering sessions all in-person, all virtually, or mixed mode



Data Source: DPRP and MRPP Crosswalk Data (April 2018-December 2021).

[6] The COVID-19 PHE was officially declared on January 31, 2020.

During interviews with suppliers that switched to distance learning delivery, program staff reported that having access to an existing platform, such as HIPAA-compliant Zoom or WebEx, eased the transition to distance delivery. In addition, having lifestyle coaches who were familiar with the platform or who were technologically savvy and able to train themselves and other lifestyle coaches to effectively use the platform facilitated a smoother transition from in-person to distance delivery.

I definitely had to work with some coaches, a little bit more in regards to equipping them to use Zoom and how to you know, share information on their screen or share the materials or how do we get the materials to the individuals". – Program Administrator

Suppliers also reported challenges around staff capacity, handling the increased administrative burden associated with offering classes virtually, and maintaining curriculum fidelity in a virtual environment. Five suppliers reported staffing challenges. One supplier reported losing seven of its eight employees, leaving one employee who was not trained as a lifestyle coach and therefore had to pause all program delivery. Two suppliers reported that virtual delivery typically works best with two lifestyle coaches—one facilitating the class and another troubleshooting any technical challenges and monitoring the group chat. Some suppliers, however, may not have enough lifestyle coaches on staff to support this model. Two suppliers also noted that some lifestyle coaches needed additional training to feel comfortable using the platform.

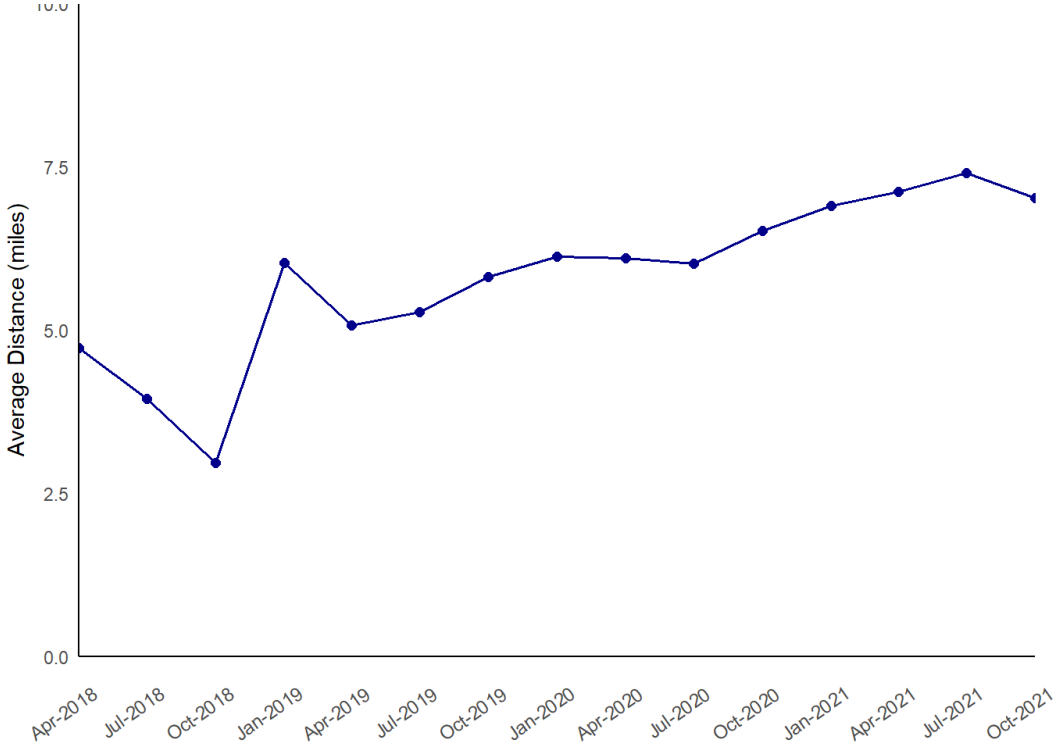
We asked the eight suppliers we interviewed about their plans for delivering the MDPP in the future and what they would do differently to implement the program post -PHE. All eight reported they plan to continue offering distance learning or a mixed version of the program as a delivery option and wanted to offer these options to Medicare beneficiaries if reimbursement rules will allow them to do so. In addition, three of the eight suppliers reported they also plan to have an all in-person delivery option. One supplier had plans to poll potential participants to find out which delivery type they are most interested in before assigning them to a cohort.

2.1.5. Beneficiary Access to MDPP Suppliers

The distance between a Medicare beneficiary and the nearest MDPP supplier is an important factor in determining which beneficiaries access the program. Using county and zip code information for supplier locations and FFS MDPP beneficiaries who were included in the Supplier Crosswalk, we estimated that 97% of participants travel less than 25 miles to receive services. Access to local MDPP suppliers provides convenience and reduces travel costs for beneficiaries, who are expected to attend 16 in-person weekly core MDPP sessions and monthly in-person maintenance sessions. Over time, the average distance to the nearest MDPP supplier has increased gradually (**Figure 5**). In the second quarter of 2019, the average distance traveled to an MDPP supplier was about 5 miles. In the more than two years since then, the average distance traveled has increased to about 7 miles in the fourth quarter of 2021. The steadily increasing distance trend appears to begin with participants enrolling in the third quarter of 2019, before the start of the COVID-19 PHE in March 2020. Nevertheless, the largest average

distances traveled are for people who enrolled in the MDPP after the PHE started. This finding may reflect the fact that more beneficiaries attended virtual programs, where the supplier's location was further from their homes, on average.

Figure 5.
Average distance (in miles) to nearest supplier among MDPP beneficiaries



Data Source: RTI analysis of Supplier Enrollment Summaries and Supplier Crosswalk.

The finding that most MDPP participants visit local suppliers has implications for expanding access to the MDPP. In an earlier evaluation analysis, we found that 59% of all Medicare beneficiaries lived more than 25 miles from an MDPP supplier location. At the time of the study (May 2019), there were 586 MDPP supplier locations. The number of supplier locations has since increased to 1,059, and access to a local MDPP supplier has improved; still, 39% of all Medicare beneficiaries live more than 25 miles from the nearest MDPP location. The up-to-date map in Figure 2 shows that Medicare beneficiaries in large areas of the country do not have nearby MDPP locations. Recruiting suppliers in these areas will improve beneficiary access.

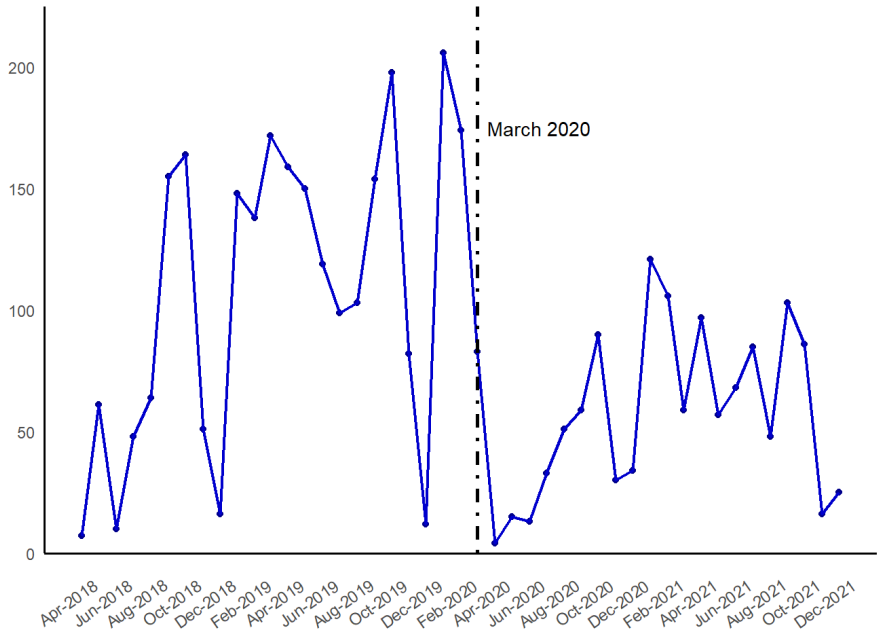
2.2. MDPP Beneficiaries

Suppliers reported 4,848 beneficiaries served by the MDPP through the end of December 2021, including 2,325 FFS beneficiaries and 2,523 MA beneficiaries.

2.2.1. Enrollment

As shown in **Figure 6**, the recruitment of new beneficiaries into the program varied by month. The largest number of beneficiaries tended to enroll in January and February, and the smallest enrollment numbers occur toward the end of the calendar year. January 2020 had the highest single month of new enrollment, with 206 beneficiaries enrolling. As seen in Figure 6, a significant decline in enrollment occurred beginning in March 2020, corresponding to the start of the PHE; only four beneficiaries enrolled in April 2020. Recent enrollment efforts have contributed to a slow increase in the number of beneficiaries enrolling each month since the start of the PHE, but it is still below the monthly average prior to March 2020; 121 beneficiaries enrolled in January 2021.

Figure 6.
New beneficiaries attending first MDPP session, monthly average



Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

2.2.2. Demographics of Beneficiaries

Of the 4,848 beneficiaries who suppliers reported had participated in the MDPP through the end of December 2021, we matched 3,771 to CDC DPRP data. Of these, 1,877 were Medicare FFS beneficiaries (49.8%) and 1,894 were MA beneficiaries (50.2%). Based on the DPRP data, approximately 75% of MDPP beneficiaries are women, 68% fall between the ages of 65 and 74, over 75% are white, and 84% are non-Hispanic (**Table 5**). Slightly more than half of the beneficiaries have some college education (51.0%). Overall, MDPP participants are younger and more likely to be female than the Medicare population as a whole. The demographics of FFS and MA MDPP beneficiaries are generally similar (**Appendix Table C-1**).

The high proportion of non-Hispanic white women in the MDPP mirrors participation in the National DPP, which includes participants at CDC-recognized suppliers covered by all

payers (Ely et al., 2017). In the National DPP analysis, which includes all ages, 80% of beneficiaries were female, 24% were older than 65, 14% were Black, and 10% were Hispanic. Demographic data were not available, however, for the 65 or older cohort specifically.

Table 5.
MDPP participant demographics by subgroup

	MDPP Participants		Medicare Beneficiaries with Part B	
Subgroup	Frequency	Percentage	Frequency	Percentage
Sex				
Female	2824	74.9%	32,507,477	55.4%
Male	930	24.7%	26,149,292	44.6%
Not Reported	17	0.4%	n/a	n/a
Age Group				
< 65	286	7.6%	7,391,296	12.6%
65–69	1415	37.5%	14,014,098	23.9%
70–74	1162	30.8%	14,147,391	24.1%
75–79	647	17.2%	10,130,463	17.3%
> 79	261	6.9%	12,973,511	22.1%
Race[1]				
White	2889	76.6%	43,022,170	73.4%
Black	391	10.4%	6,133,726	10.5%
Unknown	406	10.8%	1,145,635	2.0%
Asian and Native Hawaiian/Pacific Islander	72	1.9%	2,074,968	3.5%
American Indian	23	0.6%	229,392	0.4%
Ethnicity				
Not Hispanic or Latino	3169	84.0%	53,090,257	90.5%
Hispanic or Latino	329	8.7%	5,566,502	9.5%
Ethnicity not reported	273	7.2%	NA	NA
Education Status[3]				
Some college	1922	51.0%	NA	NA
Less than college	497	13.2%	NA	NA
Education not reported	1352	35.9%	NA	NA

MDPP beneficiaries are compared to all Medicare beneficiaries who had Part B enrollment in 2021; Part B enrollment is required for MDPP participation.
[1] Beneficiaries may select more than one race; therefore, the totals may exceed 100%.
[3] Education status is not available in Medicare enrollment data.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021). Medicare enrollment data in 2021.
NA= Not available.

Referral Source

The primary referral source for all beneficiaries in the MDPP is a health care provider (41.2%). This funding was corroborated in our interviews with suppliers. In examining the

differences between FFS and MA, more FFS beneficiaries (48.2%) than MA beneficiaries (34.3%) reported primary care provider or specialist as their referral source, although a higher percentage of MA beneficiaries did not report a referral source (**Table 6**).

Table 6.
Referral source for current MDPP participants

	Overall		FFS		MA	
Referral Source	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Primary care provider/office or specialist	1554	41.2%	905	48.2%	649	34.3%
Non-primary care health professional	203	5.4%	119	6.3%	84	4.4%
Not reported	610	16.2%	118	6.3%	492	26.0%
Other	1404	37.2%	735	39.2%	669	35.3%

Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021). Other sources include self-referral, insurance company, media efforts such as radio, newspaper, billboard, poster/flyer, TV, internet ads, and social media platforms such as Twitter or Facebook, or community events/organizations.

Six of the 10 suppliers we interviewed prior to the PHE reported using provider referrals—including cold-calling primary care physician and alternative practitioner offices—or word-of-mouth as their main source of recruitment. In addition to health care provider referrals, four suppliers also mentioned recruiting beneficiaries in the community, either by participating in community events—such as community screening events—or partnering with community organizations for recruitment. During the PHE, recruitment strategies had to change for many suppliers, due to physician offices being closed, in-person office visits being severely limited, and community events being cancelled. Although one supplier said their word-of-mouth recruitment remained the same during the PHE (as their program had a waitlist prior to the PHE and recruitment never changed for them due to high demand), most suppliers perceived the pivot to be a challenge. For example, one supplier stated that recruitment dropped dramatically to about one-third of what it was prior to the PHE, largely because of recruitment sources being closed. Another supplier described their recruitment from physician referrals coming to a standstill, with almost no referrals reported from April 2020 to October 2020.

…Recruiting is totally different in a virtual environment…You know where people gather, they don't gather anymore, so you didn't have Senior Centers, you didn't even have doctors' offices because they were only taking COVID patients, and so a lot of those sources dried up. – Program Administrator

Most suppliers addressed recruitment challenges by using listservs, intranet announcements, Microsoft Teams group announcements, radio ads, emails, fliers, newsletters, presentations at virtual meetings, marketing ads on waiting room tv monitors, and social media to market their programs. One supplier has resumed visiting some doctors' offices and also led two community screening events, with two more events planned. Another supplier mentioned

allocating funds to hire a development coordinator, who is responsible for actively recruiting and marketing their program.

Enrollment motivation

A question about beneficiary "enrollment motivation" was added to the DPRP data beginning in May 2021 to provide additional context to referral source; therefore, the sample size is smaller (N=1,562) than that of the full DPRP matched sample (**Table 7**). Based on 6 months of data (May 2021 through December 2021), the primary source of enrollment motivation was health care professionals (N=667; 42.7%)—this was similar for both the FFS (N=411; 43.0%) and MA beneficiaries (N=256; 42.2%). Blood test results were the second most common enrollment motivation (N=282; 18.0%), followed by community-based organizations (N=279; 17.9%), for both FFS and MA beneficiaries.

Table 7.
Enrollment motivation for current MDPP participants

	Overall		FFS		MA	
Enrollment Motivation	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Health care professional	667	42.7%	411	43.0%	256	42.2%
Blood test results	282	18.0%	155	16.2%	127	21.0%
Community based organization	279	17.9%	198	20.7%	81	13.4%
Prediabetes risk test	106	6.8%	52	5.4%	54	8.9%
Media advertisements	84	5.4%	55	5.8%	29	4.8%
Family or friends	68	4.3%	45	4.7%	23	3.8%
Health insurance plan	46	2.9%	21	2.2%	25	4.1%
Participated in National DPP LCP	16	1.0%	8	0.8%	8	1.3%
Employer or employer's wellness plan	14	0.9%	11	1.1%	3	0.5%

Data Source: DPRP and MRPP Crosswalk Data (May 2021 through December 2021).

2.2.3. Attendance

On average, beneficiaries attended 17 sessions (**Table 8**), meaning the average participant completed the core phase of the program (N=16) and continued into the maintenance phase of the program. The average includes some beneficiaries who recently entered the program and would therefore be only partway through the 22-session Year 1 curriculum. Days enrolled is calculated on the individual beneficiary level. It is based on the beneficiary's first and last session attended and is an important assessment of retention (i.e., how long beneficiaries stay

actively engaged in the program). The average days enrolled in the program for beneficiaries is 232 days, approximately 7–8 months. On average, FFS beneficiaries have longer enrollment (265 days) and have attended more sessions (19) than MA beneficiaries (200 days; 15 sessions).

Table 8.
Average number of sessions and days enrolled by subset

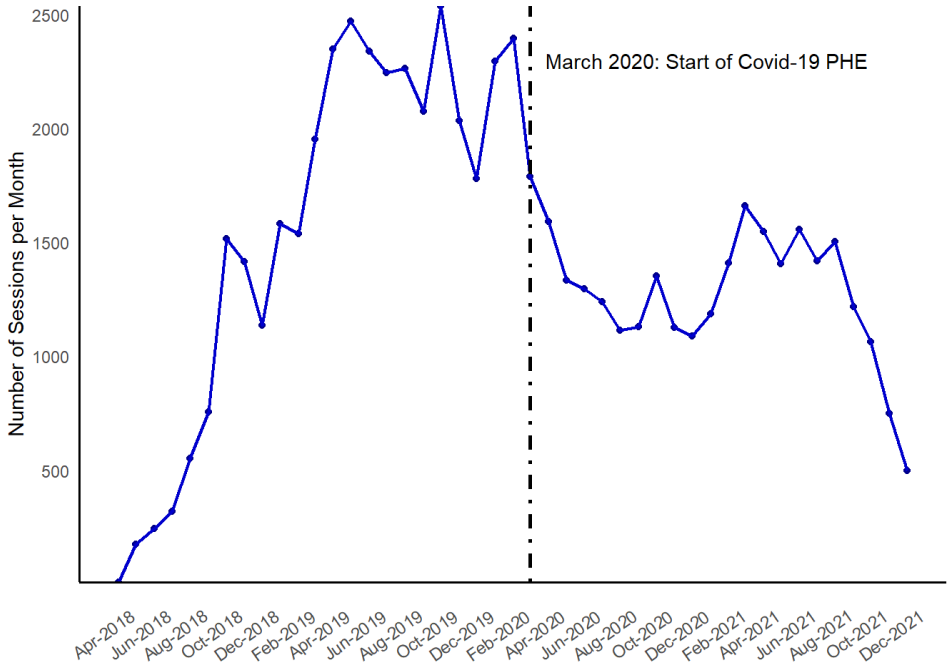
Subgroup	Sample Size	Days Enrolled	Sessions Attended
All Beneficiaries	3771	232.1	17.0
FFS	1877	264.9	18.8
MA	1894	199.6	15.3
Race/Ethnicity[1]			
Non-Hispanic White	2769	240.1	17.5
Hispanic	329	251.2	17.2
Black	391	197.4	15.5

[1] Remaining racial and ethnic groups sample size is too small to accurately present attendance.
Note: Time Since First Class measures the time from the participant's first session to the latest session offered by the organization where the person attended their classes.
Data Source: DPRP and MRPP Crosswalk Data (April 2018-December 2021).

To promote retention, suppliers noted that they tried to make the program accessible to Medicare beneficiaries by scheduling class times and selecting locations to best meet beneficiaries' needs. They also reported that they would try to find ways to involve family members in the program to foster support for lifestyle changes; connect beneficiaries to support programs to address issues such as access to safe places to exercise and healthy foods; and provide support tools, such as measuring cups, cookbooks, and kitchen scales, at strategic times during the course to keep beneficiaries engaged. Suppliers also noted that they provided flexible one-on-one make-up sessions to ensure beneficiaries stay engaged and do not fall behind. Several suppliers noted the importance of checking in with beneficiaries after they have missed a class and working with them to make up the session.

Since the inception of the program in April 2018, the number of sessions per month initially increased steadily, reaching a maximum of 2,537 sessions in October 2019 (see **Figure 7**). However, beginning in March 2020 (n=1,781) and coinciding with the first PHE shutdowns, the number of sessions declined substantially to a low of 1,088 sessions in December 2020 before increasing to a peak of 1,661 sessions in March 2021. The lower number of sessions in the fourth quarter of 2021 is due to data reporting timelines and will likely increase with future data submissions.

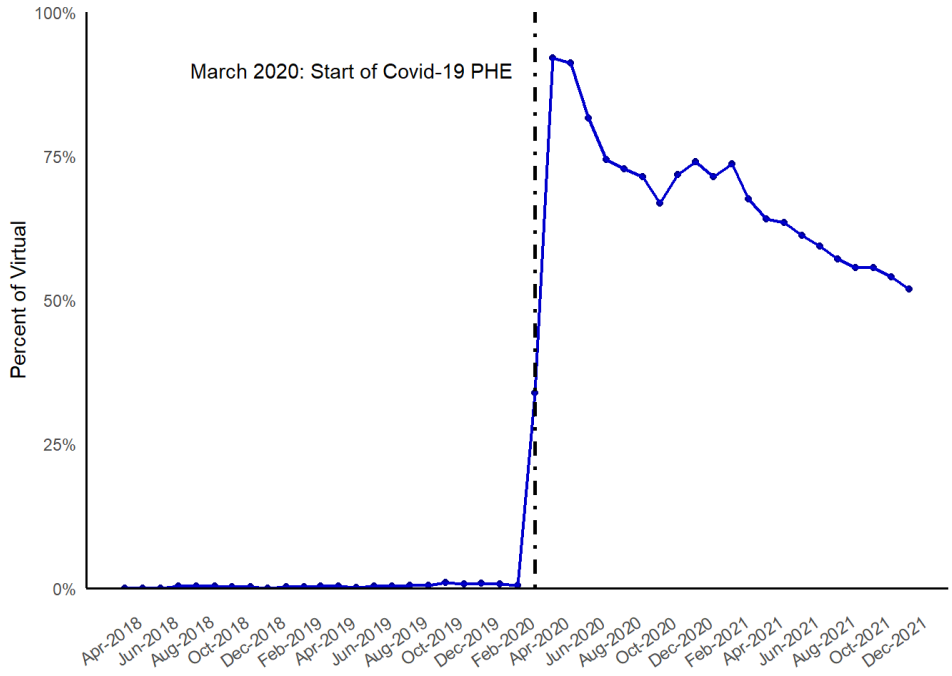
Figure 7.
Total number of sessions attended per month



Data Source: DPRP and MRPP Crosswalk Data (April 2018-December 2021).

The percentage of virtual sessions increased (**Figure 8**) from less than 1% prior to March 2020 and the PHE to 92% in April 2020. Virtual sessions prior to the PHE were limited to makeup sessions. Thereafter, the percentage of virtual sessions declined, but the overall percentage still exceeded 50% through December 2021. As previously noted, almost all of the virtual sessions were listed as distance learning in DPRP data. The suppliers we interviewed that had transitioned to distance learning delivery reported that many participants, including Medicare beneficiaries, experienced challenges making the switch to a virtual platform. Some beneficiaries had limited digital literacy or had concerns about the safety and security of participating in sessions via a web-based platform such as Zoom. Program staff reported providing detailed instruction sheets, training, and technical assistance to participants to help increase their skills and comfort with engaging in a virtual platform. Three suppliers noted that their participants also faced specific technology access issues, as several participants did not have a computer or tablet, some lacked a stable internet connection, and some did not have an email address. One supplier received a grant to supply all participants with a tablet pre-loaded with the necessary applications and a data plan to be able to participate without an internet connection.

Figure 8.
Percentage of sessions delivered virtually



Data Source: DPRP and MRPP Crosswalk Data (April 2018-December 2021).

Aside from the technical challenges of transitioning to virtual delivery, two suppliers also discussed the toll of the PHE on Medicare beneficiaries who are particularly vulnerable to severe illness from COVID-19 and may be experiencing higher levels of stress, boredom, or both, which can lead to more emotional eating and weight gain. Program staff reported integrating elements about stress management throughout the course to help address this concern.

Although suppliers consistently reported that the engagement and connection among participants tends to be stronger for in-person cohorts, two suppliers noted that a benefit of moving to distance learning delivery was that it reduced participation barriers. For example, by eliminating the need to travel, distance delivery can increase access to the program for individuals who lack transportation or live great distances from the nearest MDPP supplier.

There were still a few people who were like "I've never used Zoom" and so luckily our telehealth department did come up with some really nice screenshots and step-by-step instructions for logging on. – Program Administrator

I feel like I'm spending a lot more time talking about finding different ways of handling boredom, finding different ways of handling stress outside of food. – Lifestyle Coach

Suppliers had mixed responses as to whether they thought Medicare beneficiaries preferred distance learning or in-person delivery of the MDPP. Respondents noted that there are different benefits and tradeoffs to having distance learning, mixed, and in-person options for the MDPP. For example, in-person delivery allows for greater opportunities for group cohesion, whereas distance learning delivery better enables suppliers to expand their reach by addressing barriers such as transportation and scheduling. One supplier noted that they intend to keep a distance learning option for Medicare beneficiaries even if Medicare does not reimburse them for the sessions. Over the course of delivering the program during the PHE, they have discovered that beneficiaries have gotten more used to the virtual format and have better attendance than when they delivered the program in-person pre-PHE.

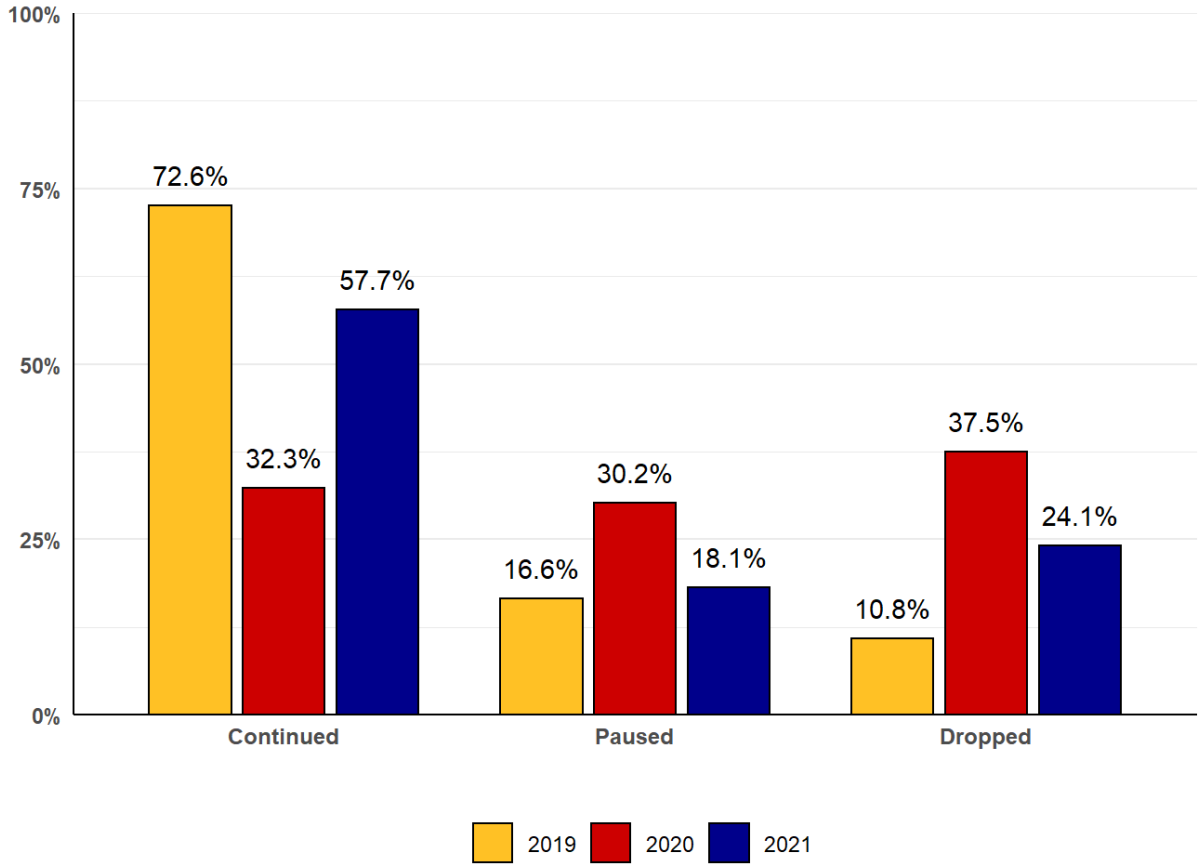
2.3. COVID-19 Impact on Beneficiary Enrollment/Attendance

An in-person program such as the MDPP is expected to be impacted by the COVID-19 PHE shutdowns that took place in March 2020. We examined beneficiary activity for three subgroups of beneficiaries who had their first session between January and February 2019, 2020, and 2021. We wanted to compare activity for those who were actively engaged in the program before any impact of the PHE (2019 cohort), those who enrolled prior to the PHE but who were impacted by the PHE (2020 cohort), and those who enrolled during the PHE (2021 cohort).

We created measures for the possible beneficiary activities for those who had their first session in each of the first 2 months of the 3 years 2019 (N=282), 2020 (N=371), and 2021 (N=221). First, we defined a pause as at least a 30-day gap between sessions and resuming classes prior to the end of the respective calendar year. Next, we defined a drop-out as stopping sessions completely and not resuming before the end of the respective calendar year. Finally, we defined continuing classes as never pausing or stopping sessions through the end of the respective calendar year. Data were examined through December 2021. There may be other reasons (besides COVID-19) that beneficiaries pause or drop out of the program. Therefore, we compared pauses, drop-outs, and continuing classes from the same periods in 2019, 2020, and 2021.

In 2019, 72.6% of beneficiaries continued the program without any significant interruptions, whereas in 2020, only 32.3% of beneficiaries continued the program without interruption; in 2021, that percentage rose to 57.7% of beneficiaries. **Figure 9** shows that more dropouts and pauses occurred in 2020 than in 2019 or 2021. For example, 37.5% of MDPP beneficiaries dropped out of the program completely in 2020, compared to just 10.8% in 2019 and 24.1% in 2021. In addition, 30.2% of beneficiaries had at least a 30-day pause in sessions in 2020, compared with 16.6% during the same period in 2019 and 18.1% in 2021. The impact of PHE-related dropouts and pauses on weight loss is discussed in the next section.

Figure 9.
Percentage of beneficiaries who continued, dropped, or paused, in 2019, 2020, and 2021



Note: Inclusion criteria included anyone with their first MDPP session in January–February 2019, January–February 2020, and January–February 2021. Drops were defined as those who stopped attending after February of the respective year and had no additional sessions through the end of December 2019, 2020, and 2021, respectively. Pauses were defined as those with at least a 30-day gap in sessions after February of the respective year who resumed sessions before the end of December 2019, 2020, and 2021 respectively. Continuation was defined as those who did not drop out or pause during the year. These categories are mutually exclusive. Percentages may not add to 100% due to rounding.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

3. DO MDPP PARTICIPANTS LOSE WEIGHT AND MEET PHYSICAL ACTIVITY GOALS?

Key Findings

- Overall, among all participants, the average weight loss was 5.1% of starting body weight.
- Over half of participants (53%) achieved 5% weight loss and nearly 25% achieved 9% weight loss.
- Weight loss is highly correlated with the number of sessions attended/ duration in the program; the relationship is nearly linear.
- The percentage of beneficiaries who reported meeting the physical activity goal rose to 62% by session 6, 72% by session 16, and 75% by session 22.

COVID-19 Effects

- Participants who started the program in early 2020 before the COVID-19 PHE in March 2020 lost less weight than participants who started during the early months of 2019 or 2021. The difference was driven primarily by the higher drop-out rate in 2020 that coincided with the start of the PHE.
- When examining those who continued sessions through the entire cohort period, weight loss is very similar between the 2019 cohort (6.4%), 2020 cohort (6.5%), and 2021 cohort (6.4%).

3.1. Overall

A critical goal of the MDPP is beneficiary weight loss; the program aims to achieve at least 5% weight loss. This section provides an overview of MDPP participants' weight loss over the course of the program.

3.1.1. Summary Statistics for Weight Change Among Beneficiaries

The MDPP continued to achieve weight loss among its participants. Overall, among all participants with at least 2 sessions, the average weight loss was 5.1% of starting body weight (**Table 9**). The average starting weight for all participants was 205 lbs. Those enrolled in Medicare FFS lost 5.5% of their starting weight compared to those in MA plans who lost 4.6% of their starting weight. Part of this difference in weight loss is explained by the difference in average number of sessions attended among FFS beneficiaries (19 sessions) compared to MA beneficiaries (16 sessions).

Table 9.
Weight change among MDPP participants by subgroup

Subgroup	Sample Size	Average Weight Change (lbs.)	Average Weight Change (%)	Sessions Attended
All Beneficiaries	3618	−10.5	−5.1%	17.7
FFS	1838	−11.4	−5.5%	19.2
MA	1780	−9.5	−4.6%	16.2
Race/Ethnicity[1]				
Non-Hispanic White	2679	−10.9	−5.3%	18.0
Hispanic	316	−11.4	−5.5%	17.9
Black	363	−8.6	−4.1%	16.6
Time Since First Class				
0–3 Months	304	−4.7	−2.3%	6.4
4–6 Months	208	−9.4	−4.5%	13.9
7–9 Months	252	−11.1	−5.4%	16.9
10–12 Months	276	−12.1	−5.9%	20.1
12 + Months	2578	−11.0	−5.3%	19.2
Enrollment				
Enrollment from physician	1514	−11.3	−5.4%	18.7
All other enrollment sources	2104	−9.8	−4.8%	17.0
Education				
Some college	1871	−11.5	−5.6%	19.2
No college	477	−9.7	−4.7%	18.2
Education level not reported	1270	−9.3	−4.5%	15.3
Sex[2]				
Female	2720	−9.7	−4.9%	17.6
Male	881	−12.9	−5.6%	18.1
BMI				
BMI at First Session < 30	1127	−8.9	−5.2%	18.0
BMI at First Session ≥ 30	2491	−11.2	−5.0%	17.6

[1] Remaining racial and ethnic groups sample size is too small to accurately present weight loss. Hispanic and Black are not mutually exclusive designations.
[2] Sample size for non-reported sex is too small to accurately present weight loss.
Note: Time since first class measures the time from the participant's first session to the latest session offered by the organization where the person attended their classes. All participants were required to have at least two measured sessions. The sample size of 3618 excludes 151 participants who only attended one session.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

Weight loss was also examined across several subgroups. Participants who identified as non-Hispanic white lost a similar amount of weight as those who identified as Hispanic (5.3% v. 5.5%). Black participants experienced lower levels of weight loss (4.1%) and attended fewer sessions (17) on average than non-Hispanic white participants (18) and Hispanic participants (18), although the sample sizes are small.

As expected, there is a relationship between time since first class and weight loss. Weight loss increased over time through the first 12 months of the program. In addition, there is a higher percentage of weight loss among those referred from a health care provider (5.4%) than among those who were referred from other sources (4.8%), and those referred from a health care provider attended more sessions on average (19) than those enrolling from another source (17).

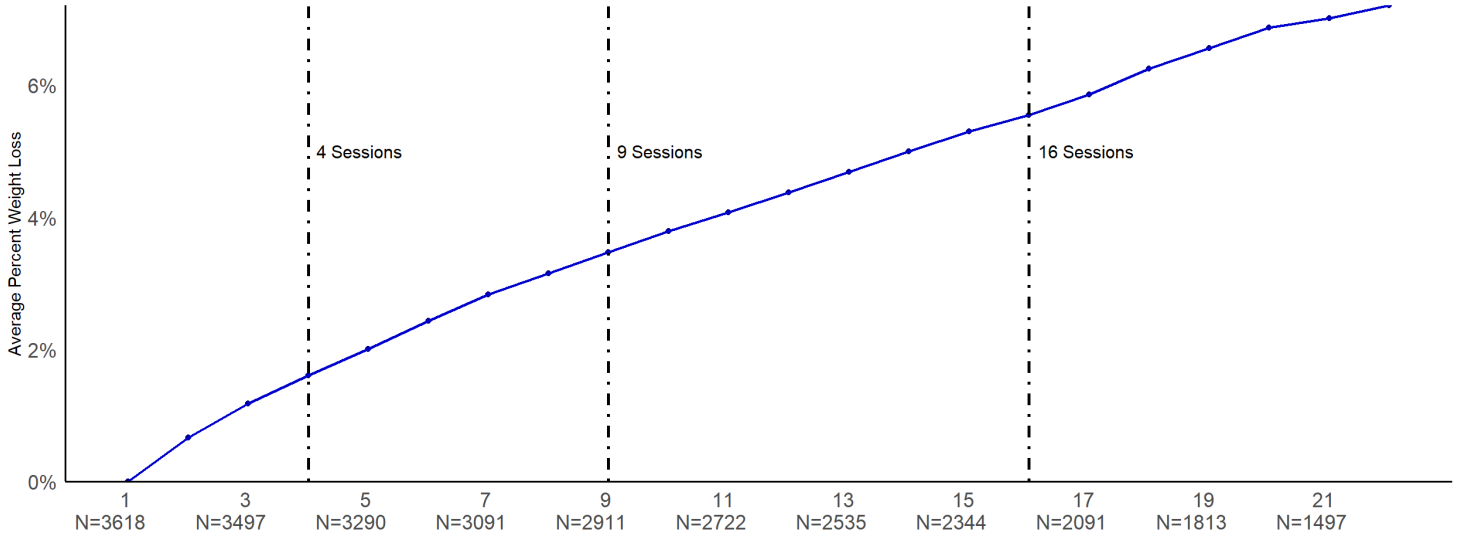
Participants with some college education lost 5.6% of their starting weight (19 sessions attended), whereas those with no college or education not reported lost 4.7% (18 sessions) and 4.5% (15 sessions) of their starting weight, respectively.

Male participants (5.6%) experienced higher weight loss than female participants (4.9%) with similar session attendance, 18 sessions, between the two groups. Those with a starting BMI greater than or equal to 30 lost a similar percentage of their body weight (5.0%) as those with a starting BMI less than 30 (5.2%) and attended a similar number of sessions (18).

3.1.2. Weight Loss by Number of Sessions Attended

Weight loss is highly correlated with session attendance. As shown in **Figure 10**, there is a nearly linear relationship between session attendance and weight loss; those attending more sessions lost more weight on average. Alternatively, this might reflect that beneficiaries who remain in the program are more successful in losing weight. The figure shows the cumulative sample size by number of sessions attended. The sample size falls as the number of sessions increases, partly because not all beneficiaries continue in the program and partly because some beneficiaries have not been in the program long enough to reach that session. We present average weight loss at the key attendance benchmarks for MDPP performance payments (4 and 9 sessions attended) and at 16 sessions, which corresponds to the number of core sessions in the MDPP. By session 4, the average weight loss was 1.6% of starting body weight; by session 9, the average weight loss was 3.5% of starting body weight; and by the end of the core sessions, session 16, the average weight loss was 5.6% of starting body weight. This finding is important because performance goal payments in months 7–12, the core maintenance sessions, are higher if the person has achieved at least 5% weight loss.

Figure 10.
Weight change by number of sessions attended



Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

Although there is a clear relationship between weight loss and the number of sessions attended, we cannot say that the relationship is causal in the sense that attending more classes leads to (i.e., causes) more weight loss. The causality could run in the opposite direction, with beneficiaries who lost more weight in the early sessions choosing to attend more sessions and those who did not lose weight becoming discouraged and deciding to stop attending sessions.

3.1.3. Summary Statistics for Achieving Weight Loss Goals

The MDPP explicitly incentivizes the achievement of at least 5% or 9% weight loss from the starting weight with performance payment payments to suppliers. For participants starting prior to 2022, the performance payments for at least 5% and at least 9% weight loss were $169 and $26 per participant.

Overall, over half of participants (53%) achieved at least 5% weight loss and 25% achieved at least 9% weight loss. Among FFS beneficiaries, 58.4% achieved the 5% goal and 28% met the 9% goal, as opposed to 47.4% of MA beneficiaries achieving 5% and 21.1% achieving 9% weight loss. A similar percentage of non-Hispanic white participants and Hispanic participants achieved at least 5% and 9% weight loss, whereas Black participants were less successful at reaching the weight loss goals (**Table 10**). Analyses of approved FFS MDPP claims showed similar results; almost half (49%) of the 1,588 beneficiaries who had an MDPP claim had a claim for achieving at least 5% and/or 9% weight loss.

Table 10.
Percentage of participants achieving weight loss goals (5%/9%) by subgroup

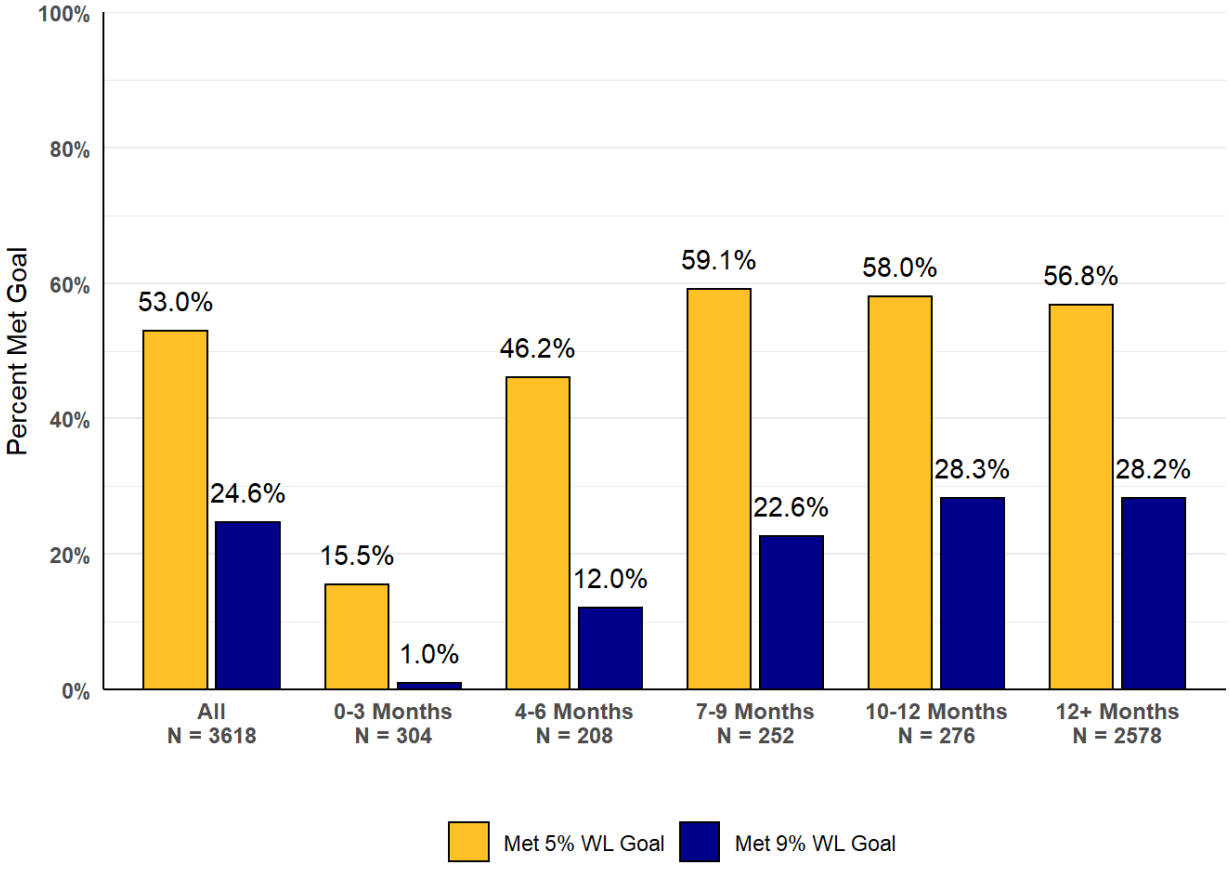
Subgroup	Sample Size	Met 5% WL Goal	Met 9% WL Goal
All	3618	53.0%	24.6%
FFS	1838	58.4%	28.0%
MA	1780	47.4%	21.1%
Race/Ethnicity[1]			
Non-Hispanic White	2679	55.5%	26.2%
Black	363	42.1%	18.7%
Hispanic	316	55.4%	27.5%
Time Since First Class			
0–3 Months	304	15.5%	1.0%
4–6 Months	208	46.2%	12.0%
7–9 Months	252	59.1%	22.6%
10–12 Months	276	58.0%	28.3%
12 + Months	2578	56.8%	28.2%
Session Count ≥ 9	2911	63.8%	30.3%
Enrollment			
Enrollment from physician	1514	55.5%	27.1%
All other enrollment sources	2104	51.1%	22.9%
Education			
Some college	1871	57.6%	28.1%
No college	477	51.8%	24.9%
Education level not reported	1270	46.7%	19.4%
Sex[2]			
Female	2720	51.8%	22.9%
Male	881	57.1%	30.0%
BMI			
BMI at First Session <= 30	1127	56.3%	26.2%
BMI at First Session > 30	2491	51.5%	23.9%

[1] Remaining racial and ethnic groups sample size is too small to accurately present weight loss. Hispanic and Black are not mutually exclusive designations.
[2] Sample size for non-reported sex is too small to accurately present weight loss.
Note: Time since first class measures the time from the participant's first session to the latest session offered by the organization where the person attended their classes. All participants were required to have at least two measured sessions. The sample size of 3618 excludes 151 participants who only attended one session.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

Those enrolled in the program for a longer duration of time were more likely to meet the weight loss goals (**Figure 11**); 64% of those who attended at least 9 sessions achieved at least 5% weight loss during the program, and 30% achieved at least 9% weight loss.

Participants who enrolled in the MDPP from a physician referral achieved at least 5% and 9% weight loss (56% and 27%) more often than those enrolled from a different source (51% and 23%). Those with some college education (58% and 28%) achieved the 5% and 9% weight loss goals more frequently than those without any college education (52% and 25%) or those not reporting their education status (47% and 19%). Male participants achieved the 5% and 9% weight loss goals (54% and 28%) at a higher frequency than female participants (50% and 22%).

Figure 11.
Percentage of MDPP participants meeting the 5% and 9% weight loss goals, overall and by time since first class.



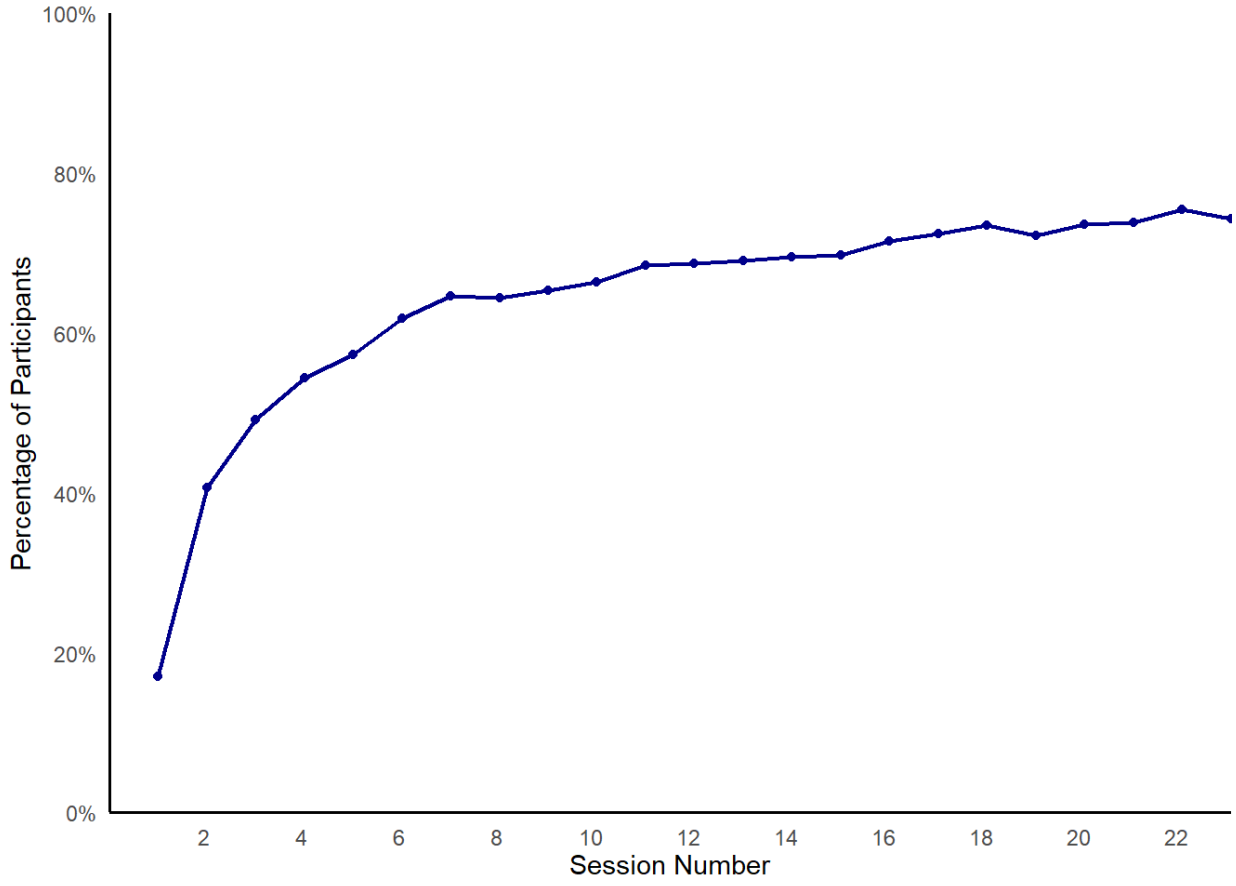
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

3.1.4. Physical Activity

As part of the MDPP curriculum, coaches instruct beneficiaries to track how many physical activity minutes are completed each week of the program. These data are self-reported by the beneficiaries. The CDC curriculum emphasizes recording physical activity minutes beginning in session 5, and the program's goal is for beneficiaries to achieve at least 150 minutes of physical activity per week.

At session 1, 17% of beneficiaries met the physical activity goal of 150 minutes. The percentage of beneficiaries meeting the physical activity goal rose to 62% by session 6, 72% by session 16, and 75% by session 22. **Figure 12** presents the percentage of beneficiaries who self-reported more than 150 minutes of physical activity per week.

Figure 12.
Percentage of MDPP participants who self-reported meeting the physical activity goal



Data Source: DPRP and MRPP Crosswalk Data (April 2018-December 2021).

3.2. Impact of COVID-19 on Weight Loss

Because of the unexpected changes in the program over the past several years due to the COVID-19 PHE, we present analyses looking at weight loss during three different time periods. First, we look at weight loss for MDPP beneficiaries who started the program in January or February 2019 and look out through the end of December 2019. These participants were not impacted by COVID-19 and had at least 10 months of follow-up from their first session. Second, we look at those who started the MDPP in January or February 2020, before the PHE, and look through the end of December 2020. This group was significantly impacted from the PHE as the height of shutdowns was in 2020. Finally, we looked at the cohort starting the MDPP in January or February 2021 and looked out through December 2021. This group started during the PHE and experienced fewer shutdowns than the 2020 cohort.

3.2.1. Weight Loss by Session by 2019, 2020, and 2021 Cohorts

Table 11 presents the average weight loss for the 2019 cohort (5.8%), 2020 cohort (5.0%), and 2021 cohort (6.1%). There is a significant difference in weight loss between the 2020 cohort relative to the other two cohorts (2019: $p < .05$, 2021: $p < .05$) However, this difference largely reflects the number of sessions MDPP beneficiaries attended. As can be seen in row 3 of Table 11, 107 (29%) participants dropped out of the program in the 2020 cohort whereas 30 (11%) and 12 (5%) beneficiaries dropped in the 2019 and 2021 cohorts, respectively. Due to the high percentage of dropouts in 2020 and their low weight loss on average (1.9%), the overall weight loss for the 2020 cohort is lower. When examining those who continued sessions through the entire cohort period, weight loss is very similar between the 2019 cohort (6.4%), 2020 cohort (6.5%), and 2021 cohort (6.4%). Among the 76 beneficiaries in the 2020 cohort who paused and resumed sessions, the average weight loss was still over 5%; very few beneficiaries paused in 2019 and 2021.

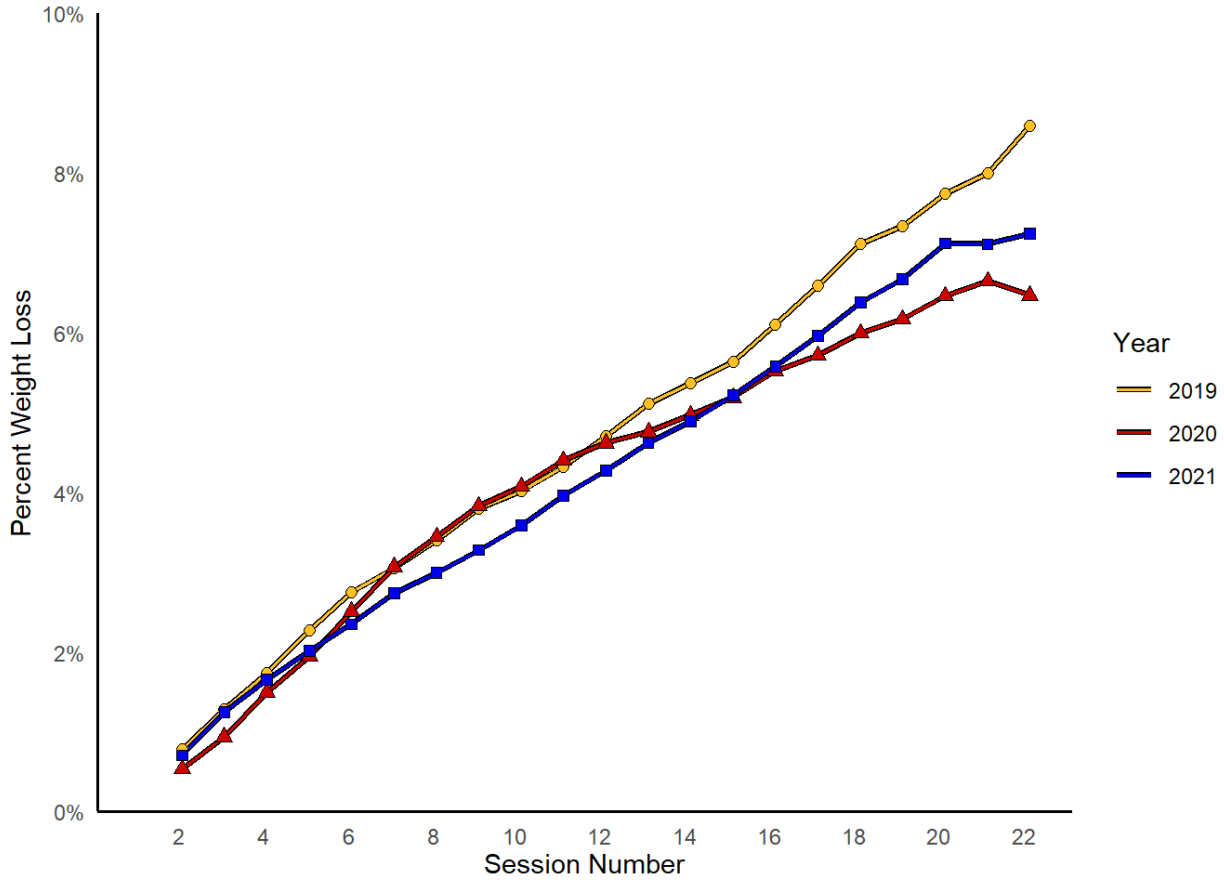
Table 11.
Average weight change for participants starting the MDPP in early 2019, 2020 and 2021.

	2019 Cohort (Jan/Feb–Dec 2019)			2020 Cohort (Jan/Feb–Dec 2020)			2021 Cohort (Jan/Feb–Dec 2021)		
Status	Average Weight Change %	Average Number of Sessions	Sample Size	Average Weight Change %	Average Number of Sessions	Sample Size	Average Weight Change %	Average Number of Sessions	Sample Size
Overall	−5.8%	17.6	282	−5.0%	16.8	371	−6.1%	19.3	221
Paused	−7.3%	16.0	7	−5.4%	17.6	76	−1.2%	11.5	4
Dropped	−0.6%	4.1	30	−1.9%	5.3	107	−1.9%	4.5	12
Continued	−6.4%	19.3	245	−6.5%	23.0	188	−6.4%	20.4	205

Notes: Each of the cohorts includes any participant whose first MDPP session occurred in January or February of the respective cohort year. All outcomes are created using sessions through December of the respective cohort year. Pauses were defined as a gap greater than 30 days between sessions and then resuming sessions, drops were those who stopped going to sessions after February of the respective year and did not resume sessions, and continues are those who did not pause or drop during the year.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

Figure 13 plots the overall weight loss between the three cohorts across sessions 1 through 22. There is some separation between the groups, especially later in the program, but all three groups show a very strong linear relationship between weight loss and sessions attendance, with more sessions attended associated with greater weight loss.

Figure 13.
Weight change by session, 2019, 2020 and 2021 cohorts



Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

3.3. Discussion

3.3.1. Comparison to Other Studies

Although the MDPP is the first widespread Medicare-funded DPP, it is not the first DPP to include Medicare beneficiaries. Using data collected from Medicare suppliers on weight loss and session attendance for beneficiaries during their first year in the MDPP, we compared MDPP results with those of the Y-USA DPP, which received a Health Care Innovation Award to implement its program for Medicare beneficiaries across 17 YMCA sites (Rojas Smith, et al., 2017a). The same inclusion criteria that were used for the Y-USA analyses were applied to MDPP beneficiaries for this analysis, reducing the MDPP sample size to 2,393 to only include beneficiaries who had attended at least two sessions in 12 or more months.

The average weight change was 5.5% in the MDPP sample vs 4.6% in the Y-USA DPP sample. The starting weight was slightly higher among MDPP beneficiaries than among YUSA DPP participants (**Table 12**). It appears that MDPP beneficiaries experience weight loss that is greater than or equal to participants in the Y-USA DPP.

Table 12.
Y-USA DPP and MDPP weight change comparison

The weight change among MDPP beneficiaries was slightly higher than the Y-USA DPP sample.

Subgroup	Sample size	Weight at first session (lbs.) Avg	Weight change (lbs.) Avg	Weight change (%) Avg
Y-USA DPP	7,832	200.3	−9.3	−4.6
MDPP	2,393	202.3	−11.2	−5.5

Note: Y-USA DPP weight change was calculated for those 65 and older attending at least one session during a 12-month period from June 2011 through June 2016. MDPP weight change was calculated for those 65 and older attending at least two sessions during a 12-month period from April 2018 until December 2021.
Data Source: RTI analysis of Supplier Crosswalk data; DPRP data; Source Y-USA DPP: (Rojas Smith, et al., 2017a)

4. DOES MDPP PARTICIPATION HAVE AN IMPACT ON MEDICARE SPENDING OR DIABETES INCIDENCE?

Key Findings:

- At the time of this analysis, there was no statistically significant difference in Medicare FFS spending between MDPP beneficiaries and comparison group beneficiaries. Results may change as more beneficiaries enroll in the program and MDPP beneficiaries are followed for more time after MDPP participation.
- It is too early and there are not enough participants to assess whether the program impacts diabetes incidence.

The goal of the MDPP is to help Medicare beneficiaries achieve weight loss and better health outcomes, with the expectation that, with better health, beneficiaries will need fewer expensive health care services, leading to reductions in the total cost of care. After 4 years of program operation, enough Medicare FFS enrollees have enrolled in the program to begin exploring whether the MDPP is meeting the goal of lowering costs. This report presents preliminary estimates of the impacts of the MDPP on Medicare FFS spending over the 3-year period after MDPP enrollment; future reports will also examine select measures of health care utilization.

4.1. FFS Medicare Spending

To assess the impact of the MDPP on Medicare FFS spending, we compared the change in Medicare spending before and after enrolling in the MDPP for Medicare FFS MDPP beneficiaries and a matched comparison group. The comparison group provides an estimate of what would have happened to spending for MDPP beneficiaries in the absence of MDPP services to address diabetes prevention and weight loss. To be eligible for the comparison group, beneficiaries must have had at least one claim with a diagnosis (primary or secondary) of prediabetes and must have resided in a 25-mile radius of an MDPP supplier or in the same county as a supplier to account for the influence of proximity to MDPP services on the likelihood of enrolling in MDPP.

Each MDPP beneficiary was matched to a comparison group beneficiary who resided in the same geographic area as the MDPP beneficiary. The matching process is described in greater detail in **Appendix D**. The resulting comparison group beneficiaries were similar to MDPP participants in age, sex, race, number of chronic conditions, health risk (i.e., Hierarchical Condition Category score), several characteristics of Medicare enrollment, and distance in miles to an MDPP supplier. MDPP beneficiaries and their matched comparison group also had lower costs, as measured by cost estimates in the year before program enrollment, than the average Medicare beneficiary. Before enrolling in the MDPP, average Medicare spending per year for MDPP FFS beneficiaries without diabetes is $6,032 as opposed to an average spending of about

$10,000 per year for Medicare FFS beneficiaries.[7] Many of the sociodemographic characteristics of MDPP beneficiaries and their matched comparisons are associated with incurring fewer costs. For example, MDPP beneficiaries are more likely to be white, be female, and have fewer chronic conditions and are less likely to be enrolled in Medicare due to disability or be dually enrolled in Medicare and Medicaid relative to all other Medicare FFS beneficiaries 9.[8]

Overview of Analytic Methods

Details of the analytic approach can be found in **Appendix E**.

Time Period: 3 years before MDPP enrollment and up to 3 years after enrollment

Sample: 2,159 Medicare FFS beneficiaries and 2,159 Medicare FFS comparison group members selected through propensity score matching

Outcome: Medicare FFS spending PBPM, inclusive of Medicare payments made for attending MDPP classes and meeting weight loss goals

Regression Approach: Difference-in-difference (D-in-D) regression modeling that compares the change in spending before and after MDPP enrollment for the MDPP group with changes in spending for a comparison group

Early findings indicate that participation in the MDPP does not significantly change Medicare expenditures. Before enrolling in the MDPP, average Medicare PBPM spending was $574 for MDPP participants and $585 for comparison beneficiaries. Over the first three years of the MDPP, average Medicare FFS spending, which includes the MDPP payments made to suppliers, increased by $20 PBPM (3.5%) more than spending for comparison beneficiaries increased, but as shown in **Table 13,** this change was not statistically significant (p=0.70).

Results over the first three years of the MDPP may obscure trends in spending on a yearly basis. For example, there could be more robust changes in spending immediately after enrolling in the MDPP as participants put into practice the diet and physical activity lessons learned in MDPP. Therefore, we also examined changes in spending one year after MDPP enrollment, two years after enrollment, and three years after enrollment. In these yearly analyses, Medicare spending did not differ significantly between the MDPP participants and the comparison beneficiaries (**Table 13**).

[7] Average FFS spending estimates for Medicare FFS beneficiaries can be found at Kaiser Family Foundation State Health Facts, Medicare Spending per Beneficiary, https://www.kff.org/medicare/state-indicator/per-beneficiary.

[8] Authors' analyses of Medicare claims data were used to compare sociodemographic characteristics of MDPP FFS beneficiaries with those of all other Medicare FFS beneficiaries.

Table 13
Medicare Parts A and B spending: Estimated impacts on Medicare spending (dollars per beneficiary per month)

Period	MDPP Group	Comparison Group	Difference in Spending (MDPP-Comparison)	Difference-in-Difference Estimate (90% CI)	Percent Change	p-value
Baseline Period	$574	$585	$-11	--	--	--
MDPP Intervention Period						
Year 1	$620	$653	$-32	$−21 ($−97, $55)	−3.7%	0.65
Year 2	$605	$594	$11	$23 ($−53, $98)	4.0%	0.62
Year 3	$728	$632	$96	$108 ($−6, $221)	18.8%	0.12
Overall	$638	$630	$9	$20 ($−64, $104)	3.5%	0.70

Notes:
CI=confidence interval
Sample Size: Year 1: 4,318 beneficiaries (2,159 MDPP beneficiaries and 2,159 comparison beneficiaries); Year 2: 2,864 beneficiaries (1,447 MDPP beneficiaries and 1,417 comparison beneficiaries); Year 3: 1,879 beneficiaries (961 MDPP beneficiaries and 918 comparison beneficiaries); Across all 3 Years: 4,318 beneficiaries (2,159 MDPP beneficiaries and 2,159 comparison beneficiaries)
Interpretation: The D-in-D point estimate is the difference in spending in the intervention period minus the listed difference in spending in the baseline period; the baseline period includes the three years before a beneficiary started the program. Due to rounding, some D-in-D estimates may diverge by $1 from the listed difference in spending in the MDPP intervention period minus the difference in spending in the baseline period. For the intervention period, comparison group members were assigned a proxy program start date equal to the beginning of the calendar quarter in which their matched MDPP participant began the program. The percent change is the overall D-in-D estimate as a percentage of the MDPP group's mean baseline spending. A negative value of the D-in-D means the regression-adjusted D-in-D estimate corresponds to a greater decrease or a smaller increase in spending after MDPP enrollment for the MDPP group relative to the comparison group. A positive value means the regression-adjusted D-in-D estimate corresponds to a greater increase or a smaller decrease in spending after MDPP enrollment for the MDPP group relative to the comparison group. The overall D-in-D estimate is a weighted average of the Year 1, Year 2, and Year 3 D-in-D estimates, using the sample size in each year as the weighting variable.
Source: Regression-adjusted analyses of Medicare Part A and B claims data from April 1, 2015, through December 31, 2021.

Although the MDPP is intended for individuals without diabetes, there are individuals participating in the program who have Medicare claims with diabetes as a diagnosis code, and these individuals are more costly and have more chronic conditions and health risks than those without diabetes claims. To see whether the MDPP had a different impact on spending among those with and without diabetes, we examined changes in spending for these two groups separately. Those with diabetes may experience greater positive impacts, such as more physical activity and more weight loss, than those without diabetes, as they learn the tools for managing their health and chronic conditions. If this group experiences better health outcomes, they may also experience changes in spending because of improved health. However, results were similar to the overall sample. Spending did not differ significantly among MDPP participants with diabetes and comparison beneficiaries with diabetes or among MDPP participants without diabetes and comparison beneficiaries without diabetes (detailed results can be found in **Appendix F**).

The sample size of participants is still relatively small, and detecting differences in total spending before and after participating in the program is challenging with small sample sizes. Without any significant differences in spending, no definitive conclusions can be made about savings (or lack thereof) generated from the program net of MDPP supplier payments. Savings may accrue in later years if the MDPP is successful in reducing the incidence of diabetes and its concomitant health complications. Future evaluation reports will include more robust analyses of MDPP payments against potential savings under the assumption that the number of program enrollees will continue to grow and that more MDPP beneficiaries can be followed for longer periods of time, which will make identifying differences in spending easier.

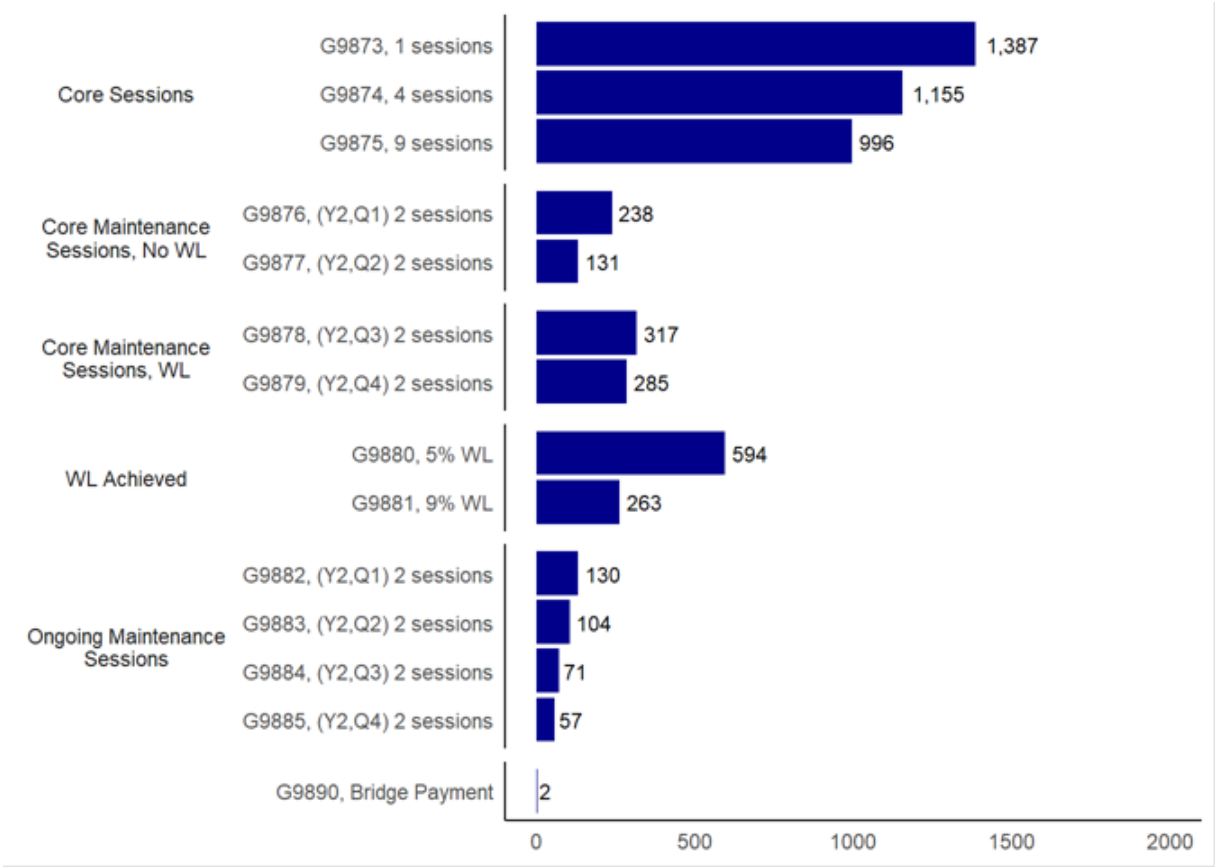
4.2. Claims for FFS MDPP Services

Because MDPP payments to suppliers are an integral component of program operations and are a critical factor in understanding program savings in future reports, we present an overview of claims for the MDPP approved by Medicare and paid to suppliers from April 2018 through December 2021. Medicare has approved 5,730 MDPP payable claims and reimbursed MDPP suppliers $349,327 for MDPP services provided to MDPP FFS beneficiaries. Most participants have not progressed to Year 2 of the program, so the payments were primarily incurred within the first year of MDPP participation.

As of December 31, 2021, CMS has paid MDPP suppliers $349,327 for MDPP services rendered to participants.

Figure 14 summarizes the number of MDPP payable claims for each MDPP service. More information about the MDPP payment structure and different MDPP sessions can be found in **Appendix A**.

Figure 14.
Number of paid MDPP FFS claims by MDPP service from April 1, 2018, through December 31, 2021



Notes:
Medicare has also approved 9,802 claims for attendance at non-payable DPP session (HCPCS G9891), which are not shown in this figure.
Source: Medicare claims from April 2018 through December 2021

A total of 1,588 MDPP FFS beneficiaries are associated with the claims submitted and approved by Medicare for MDPP services. Not all FFS beneficiaries enrolled in the MDPP as reported by suppliers have a Medicare claim for MDPP services. As of December 2021, an estimated 68% of the 2,325 FFS beneficiaries reported by suppliers in the crosswalk had an MDPP claim, suggesting that there are lags in supplier billing for MDPP services. Most paid claims (62%) are for core session attendance. Furthermore, 63% of the Medicare beneficiaries with an MDPP claim have attended nine core sessions. The first eight sessions of the DPP core curriculum teach the fundamentals of healthy eating and weight loss, whereas the last eight focus on the challenges maintaining motivation and how to overcome those challenges, so attendance at nine sessions suggests that beneficiaries have been exposed to the key program content to support them in their weight loss journey (Diabetes Prevention Program (DPP) Research Group, 2002).

The number of claims for 5% or 9% weight loss achieved has steadily increased over time, and as of December 2021, 49% of the 1,588 beneficiaries with an MDPP claim have achieved 5% or 9% weight loss as measured by having a claim for weight loss achieved. According to the claims data, relatively few MDPP FFS beneficiaries have completed two full years of the program. Only 57 individuals have completed 2 years and maintained weight loss, as measured by having a claim for attending two ongoing maintenance sessions in months 21–24 of the program. Beginning with new enrollees in 2022, the MDPP will no longer include a second year of coverage.

4.3. MDPP Impact on Diabetes

As shown in the logic model in **Figure 1** in **Section 1**, the MDPP pathway to better health and lower costs assumes that weight loss will lead to absolute reductions in diabetes incidence, which, in the long-run, may reduce the incidence of diabetes-related complications. The incidence rate of diabetes for older adults with prediabetes was recently estimated as 5.3% per year (Koyama et al., 2022), so if the MDPP is successful at reducing incidence, MDPP beneficiaries should experience an incidence rate lower than 5.3% per year. However, it is still too early to assess diabetes incidence among participants using Medicare claims data. Among the 2,159 Medicare FFS beneficiaries enrolled in the MDPP (additional discussion of the sample size can be found in **Appendix E**), 1,776 did not have a diabetes claim in the 3 years before participating in the MDPP. Most of these participants (1,175) could be followed into Year 2 after MDPP enrollment, and only 775 participants could be followed into Year 3. These are fairly small sample sizes, and larger sample sizes are necessary in the first several years after program participation to investigate incidence.[9] We will examine the incidence of diabetes and related complications later in the evaluation.

[9] Based on the protocol for the original DPP trial, we anticipate needing at least 1,000 MDPP beneficiaries and 1,000 comparison group beneficiaries followed for 3 years after MDPP participation to assess diabetes incidence.

5. SUMMARY AND DISCUSSION

5.1. Summary

Since the launch of the MDPP in 2018, the number of suppliers and beneficiaries enrolled in the MDPP has consistently increased (**Table 14**). However, beneficiary enrollment was clearly slowed by the COVID-19 PHE, with new enrollment plummeting close to zero in March, April, and May 2020. CMS quickly changed its rules in response to the PHE to allow suppliers to offer virtual MDPP sessions via videoconference or online, and many—but not all—suppliers and beneficiaries resumed sessions after pauses of varying duration. CMS further allowed suppliers to offer first sessions and weight measurements virtually, beginning in January 2021.

Table 14.
Key variables, First Evaluation Report and Second Evaluation Report

Variable	First Evaluation Report	Second Evaluation Report
Data through	12/31/19	12/31/21
Enrolled Suppliers	196	305
Beneficiaries	2,248	4,848
Weight loss (average)	5.1%	5.1%
Impact on expenditures	Insufficient sample size, too early to tell	Preliminary: no significant difference relative to matched comparison group
Impact on diabetes incidence	Insufficient sample size, too early to tell	Insufficient sample size, too early to tell

Session attendance and weight loss for Medicare beneficiaries enrolling in January and February 2020 were lower than for cohorts starting in the same months in 2019 and 2021, but the reductions were primarily driven by beneficiaries who dropped out of the program during the PHE. For MDPP beneficiaries who continued in the program or resumed after a pause, session attendance and weight loss were nearly the same for the January–February 2020 cohort as for the corresponding 2019 and 2021 cohorts. The 2019 cohort attended in-person sessions (with limited virtual make-ups), whereas the 2020 cohort attended in-person sessions in January and February and almost exclusively attended virtual sessions thereafter. The 2021 cohort attended virtual sessions or a mixture of virtual and in-person sessions.

Overall, the average weight loss was 5.1% for all MDPP beneficiaries since the program began in April 2018, which exceeds the program's weight loss goal of 5%. More than half of participants (53%) met the 5% weight-loss goal, and 24% met a 9% weight-loss goal. The numbers were even higher for participants attending at least nine sessions: 64% met the 5% goal and 30% met the 9% goal. However, we cannot definitively conclude that the program caused the observed weight loss because we lack a comparison group with weight data.

As of December 2021, expenditures did not differ significantly between the MDPP FFS beneficiaries and a matched comparison group after enrollment. This result holds, even though the expenditures for MDPP beneficiaries include payments for MDPP services. We will continue

to estimate the impact of MDPP expenditures and other measures of utilization as the evaluation continues through 2025. The expenditure results may change as the sample size for MDPP beneficiaries increases or the duration since enrollment increases.

Currently, the number of MDPP beneficiaries is too small, and not enough time has elapsed to estimate whether participating in the MDPP reduces the onset of diabetes or lowers the probability of other long-term health outcomes. The weight loss results are promising because weight loss was associated with reductions in diabetes onset in the original DPP, but it is too early to determine whether similar reductions occur in the MDPP context.

5.2. The MDPP and Population Health

One of the long-term goals of the MDPP is to improve the population health of Medicare beneficiaries by lowering the incidence and prevalence of diabetes. Population health focuses on the health status of a group rather than only on the health of individual patients. The impact of an intervention on population health depends on two factors:

1. The intervention's impact on individual participants
2. The intervention's reach (the share of eligible patients who receive the intervention)

As noted in the previous section, there is not a sufficient sample size or enough time periods to determine whether the MDPP lowers the incidence of diabetes or other long-term health outcomes for individual participants (the first factor). However, the MDPP's association with weight loss is promising.

At this point, the reach of the MDPP has been very limited. An estimated 16 million Americans aged 65 or older are eligible for the MDPP (Lee, Warren, Liu, Foti, & Selvin, 2019). Fewer than 5,000 beneficiaries have participated in the MDPP as of December 2021. Because the MDPP has had limited reach, its overall impact on population health has also been limited. Increasing the reach of the MDPP will be necessary to increase the program's overall effect on population health.

5.3. Next Steps for the Program and for the Evaluation

CMS recognizes the importance of increasing supplier and beneficiary participation in the program. Effective January 1, 2022, CMS reduced the length of the program for new participants from 2 years to 1 year. At the same time, CMS redistributed Year 2 payments to Year 1. These changes aligned the MDPP with the 1-year length of the National DPP and increased expected revenue for suppliers because relatively few MDPP beneficiaries continued in the second year of the program. CMS has also sought to identify best practices for increasing participation in the MDPP by the Medicare population in general and by vulnerable populations in particular.

The evaluation will continue until March 2025. We will continue to evaluate the program's effects on participation, attendance, and weight loss. We will expand our analysis of expenditures and utilization as the sample size increases and the duration since enrollment becomes longer, allowing for subgroup analyses and analyses of rarer events. The greater sample

size and longer duration will also permit us to examine the impact of the MDPP on diabetes incidence and other long-term outcomes.

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APPENDIX A: CHANGES IN MDPP REIMBURSEMENT FOR BENEFICIARIES ENROLLING IN THE MDPP ON OR AFTER JANUARY 1, 2022

As described in Section 1.2, CMS eliminated the second year of the program for new beneficiaries starting the program on or after January 1, 2022, and redistributed second-year reimbursement rates to the first year of the program. The redistribution of reimbursement rates is shown in **Appendix Table A-1**.

Appendix Table A-1.
MDPP payment structure for newly enrolled beneficiaries

Payment Description	2021	2022
Core Sessions (Months 1–6)		
Attend one Core Session or Bridge Payment	$26	$35
Attend four Core Sessions	$52	$105
Attend nine core sessions	$95	$175
Core Maintenance (CM) Sessions (Months 7–12)		
Attend two CM sessions (no 5% WL) in CM Interval 1 (Months 7–9)	$15	$70
Attend two CM sessions (5% WL) in CM Interval 1 (Months 7–9)	$63	$93
Attend two CM sessions (no 5% WL) in CM Interval 2 (Months 10–12)	$15	$70
Attend two CM sessions (5% WL) in CM Interval 2 (Months 10–12)	$63	$93
5% WL achieved from baseline weight	$169	$169
9% WL achieved from baseline weight	$26	$35
Ongoing Maintenance Sessions (Months 12–24)*		
Attend two OM sessions in OM Interval 1 (Months 13–15)	$52	–
Attend two OM sessions in OM Interval 1 (Months 16–18)	$52	–
Attend two OM sessions in OM Interval 1 (Months 19–21)	$53	–
Attend two OM sessions in OM Interval 1 (Months 22–24)	$53	–
Subtotal Maximum Payment—Attendance Only	**$203**	**$455**
Total Maximum Payment	**$704**	**$705**

Source: Federal Register, 11/19/2021 https://www.federalregister.gov/documents/2021/11/19/2021-23972/medicare-program-cy-2022-payment-policies-under-the-physician-fee-schedule-and-other-changes-to-part and MDPP Expanded Model CY 2022 Payment Rates, https://innovation.cms.gov/media/document/mdpp-payment-rates-cy22
*Required continued 5% weight loss prior to the COVID-19 PHE.

APPENDIX B:
DATA SOURCES

Linkages between Datasets

The Supplier Crosswalk plays a key role in linking the Diabetes Prevention Recognition Program (DPRP) data and Medicare claims, which are retrieved from the Chronic Conditions Data Warehouse (CCW) data maintained by CMS (**Appendix Table B-1**). The Supplier Crosswalk includes the supplier's name; an organization code assigned by CDC; and—for each beneficiary—a CDC participant code (randomly assigned by the supplier to the beneficiary) and a variable indicating whether the beneficiary has Medicare fee-for-service (FFS) or Medicare Advantage (MA) coverage. For FFS beneficiaries, the supplier also submits a Medicare identifier (either a Health Insurance Claim Number [HICN] or Medicare Beneficiary Identifier [MBI]).

For the DPRP data, the key linkage variables are the organization code and the CDC participant code. The Supplier Crosswalk data can be linked to DPRP data through the combination of the CDC organization code and the CDC participant code.

For the Medicare claims, the linkage variable is a unique beneficiary identifier (BENE_ID) used in the CCW that is distinct from the MBI. MDPP suppliers submit claims information for FFS beneficiaries to Medicare Administrative Contractors; once the claims are processed, the resolved claims are stored in the CCW under the BENE_ID. The Medicare claims for a beneficiary can be linked from the BENE_ID to a crosswalk between the BENE_ID and the corresponding MBI, and then to the Supplier Crosswalk.

The linked Medicare claims–Supplier Crosswalk can then be linked to the DPRP data through a combination of the CDC organization code and the CDC participant code. Because the CCW only includes claims information for FFS beneficiaries, the linked DPRP–Medicare claims dataset is limited to FFS beneficiaries.

Reporting

Suppliers begin submitting the Supplier Crosswalk 6 months after the quarter in which they begin serving MDPP beneficiaries, so there is a lag before beneficiaries served by a newly enrolled MDPP supplier begin appearing in the Supplier Crosswalk. However, once a supplier begins reporting, they submit their Supplier Crosswalk every 3 months, which is more frequently than they submit their DPRP session-level data to CDC (every 6 months). The Supplier Crosswalk may also be more up to date than the Medicare claims because suppliers have up to 12 months after the date of service to submit claims for processing and payment. Moreover, the CCW only includes claims for FFS beneficiaries, so the Supplier Crosswalk provides a more-complete picture of the total number of FFS and MA beneficiaries served by the MDPP. Therefore, this report uses the Supplier Crosswalk as the source for the number of MDPP beneficiaries served to date.

Although, the Supplier Crosswalk provides the best estimate of the total number of MDPP beneficiaries, it does not provide information on beneficiaries' class attendance, dates of

service, program outcomes, MDPP claims, health care utilization, or Medicare expenditures. Those variables come from either the DPRP or Medicare claims data.

Appendix Table B-1.
Linkages between and reporting schedules for key beneficiary data sources

The three datasets provide complementary data that can be linked through the Supplier Crosswalk; however, their reporting schedules do not always align.

Variable	Supplier Crosswalk	DPRP	Medicare Claims and Enrollment Data (FFS beneficiaries only)
Purpose	Identify MDPP beneficiaries and provide link between DPRP and Medicare claims and enrollment data	Provide data on demographics, session attendance, weight loss, and physical activity	Identify payments for MDPP services and measures beneficiary utilization and expenditures
Populations included	All enrolled MDPP participants	All enrolled MDPP participants	Medicare FFS
Key information	Provider link: CDC organization code Beneficiary link: CDC participant code Beneficiary link: Medicare beneficiary identifier (FFS beneficiaries only) Participation	Provider link: CDC organization code Beneficiary link: CDC participant code Information on MDPP sessions: payer; dates of service; session; starting weight; weight loss; physical activity; demographics	Beneficiary link: Medicare beneficiary identifier Claims Information: demographics; enrollment information; utilization; claims; allowed charges
Reporting schedule	Suppliers begin submitting 6 months after the quarter in which they begin serving MDPP beneficiaries and submit quarterly thereafter. Every 3 months after first submission.	Suppliers submit to CDC every 6 months based on the date they receive DPRP recognition from CDC.	Suppliers submit claims within 12 months of date of service.
Expected lag after service is provided	Up to 9 months after first MDPP beneficiary served by supplier; up to 3 months after first submission	Up to 6 months	Up to 12 months
Data included in this report	April 1, 2018, through December 31, 2021	April 1, 2018, through December 31, 2021	Approved claims through December 31, 2021

Impact of Differences in Reporting Schedules on Receipt of Beneficiary Information

Because the reporting schedules differ between the Supplier Crosswalk, DPRP, and Medicare claims data sources, we cannot always or immediately link data for the same beneficiary across data sources. Examples help illustrate this point.

Suppose that Supplier A is approved by CDC on January 15, 2017. It then submits DPRP data to CDC starting in August 2017 (6 months after the first of the month after approval) and every 6 months thereafter (i.e., in February and August 2018, 2019, and so on). Suppose that Supplier A subsequently enrolls in the MDPP, receiving approval on April 12, 2019, and enrolling its first Medicare beneficiary, Beneficiary 1, on July 2, 2019. Supplier A will submit its first Supplier Crosswalk on April 15, 2020, 6 months after the quarter it served its first MDPP beneficiary. Supplier A can submit the first claim for Beneficiary 1 as late as July 1, 2020, 12 months after the first service.

Beneficiary 1 will first appear in the DPRP data that RTI receives from CDC on September 30, 2019. Beneficiary 1 will first appear in the Supplier Crosswalk submitted on April 15, 2020. Beneficiary 1 may not appear in Medicare claims data until July 1, 2020 (or even later because claims are not immediately processed and approved). Thus, Beneficiary 1 will appear in the DPRP data first, then the Supplier Crosswalk, and then the claims data. By the end of July or August 2020, Beneficiary 1 should appear in all three datasets.

Now consider a different beneficiary, Beneficiary 9, who first receives services from Supplier A on March 3, 2020. Beneficiary 9 will appear on the April 15, 2020, Supplier Crosswalk, but the beneficiary will not be included on the supplier's DPRP submission until August 2020 and will not be submitted by CDC to RTI until September 2020. The claims for this patient may not be submitted for processing until as late as March 2, 2021. Thus, unlike the previous case, Beneficiary 9 will appear in the Supplier Crosswalk first, then the DPRP data, and then the claims data.

A third example may occur because, although suppliers can submit MDPP claims up to 12 months after the date of service, they have an obvious incentive—payment—to submit them earlier. Thus, an MDPP beneficiary may appear in the Medicare claims data before appearing in the Supplier Crosswalk or DPRP data.

The differences in reporting schedules among datasets have several implications for interpreting the results we present in this report. First, the number of MDPP beneficiaries included in analyses will vary depending on which data source provides the best information for the analysis. Thus, our estimate of the number of MDPP beneficiaries in **Section 2** (4,848 beneficiaries) is based on Supplier Crosswalk data because new beneficiaries are most likely to appear in this data source first.

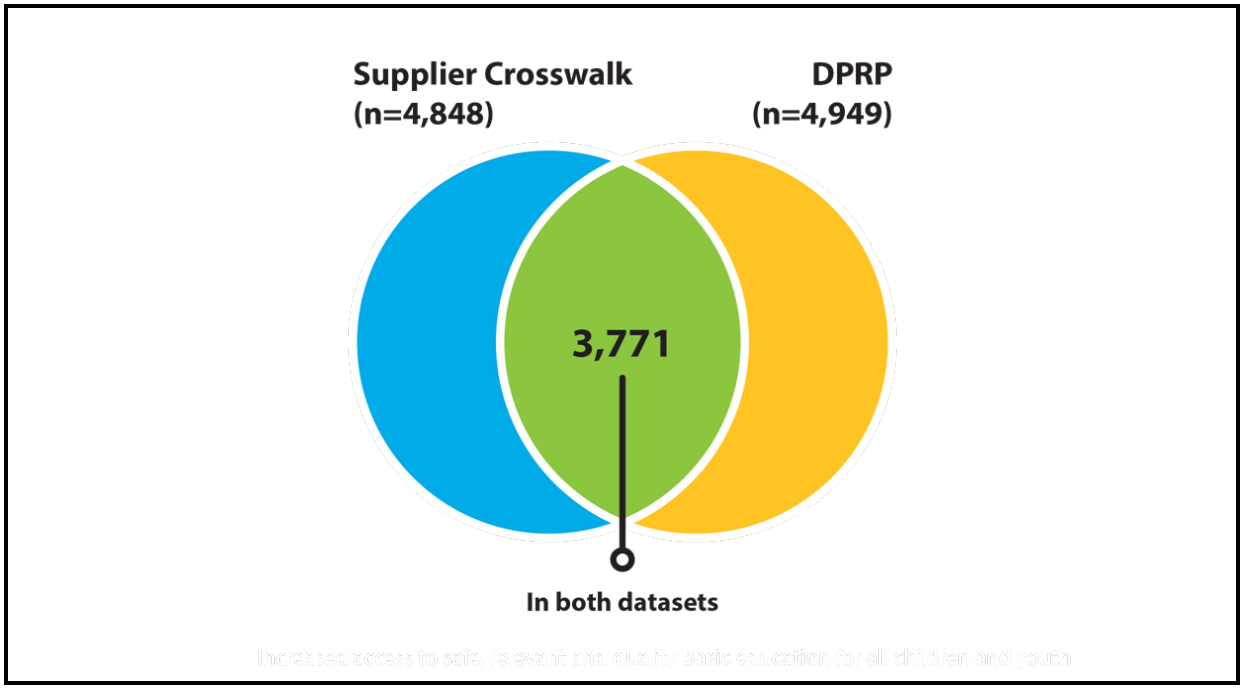
Second, when we present estimates on session attendance, weight loss, and physical activity based on DPRP data, we only report results for beneficiaries included in the DPRP **and** in the Supplier Crosswalk. We do not report results for beneficiaries included in the DPRP but not in the Supplier Crosswalk. We adopted this approach because the Supplier Crosswalk reports

only Medicare beneficiaries covered by the MDPP. In contrast, suppliers submit DPRP data for Medicare and privately insured participants, making it possible for payer status to be incorrectly entered. Therefore, the sample that is used to understand weight-loss outcomes contains 3,771 MDPP beneficiaries (**Appendix Figure B-1**) who appear in both the DPRP and the Supplier Crosswalk; 1,077 MDPP beneficiaries in the Supplier Crosswalk did not match to DPRP. However, they may be matched when we receive future DPRP data submissions.

Third, the analyses based on FFS claims from the Medicare claims data include fewer beneficiaries. This is partly because claims are only available for FFS beneficiaries and partly because not all MDPP FFS beneficiaries have had claims submitted and approved (as previously noted, claims can be submitted up to 12 months after the service date).

Fourth, we expect that most beneficiaries will eventually be included in all data sources for which they are eligible. MDPP FFS beneficiaries should be included in all three sources within 12 months, and MDPP MA beneficiaries should be included in both the Supplier Crosswalk and the DPRP data within 9 months of the first session.

Appendix Figure B-1.
Overlap between the Supplier Crosswalk and DPRP datasets

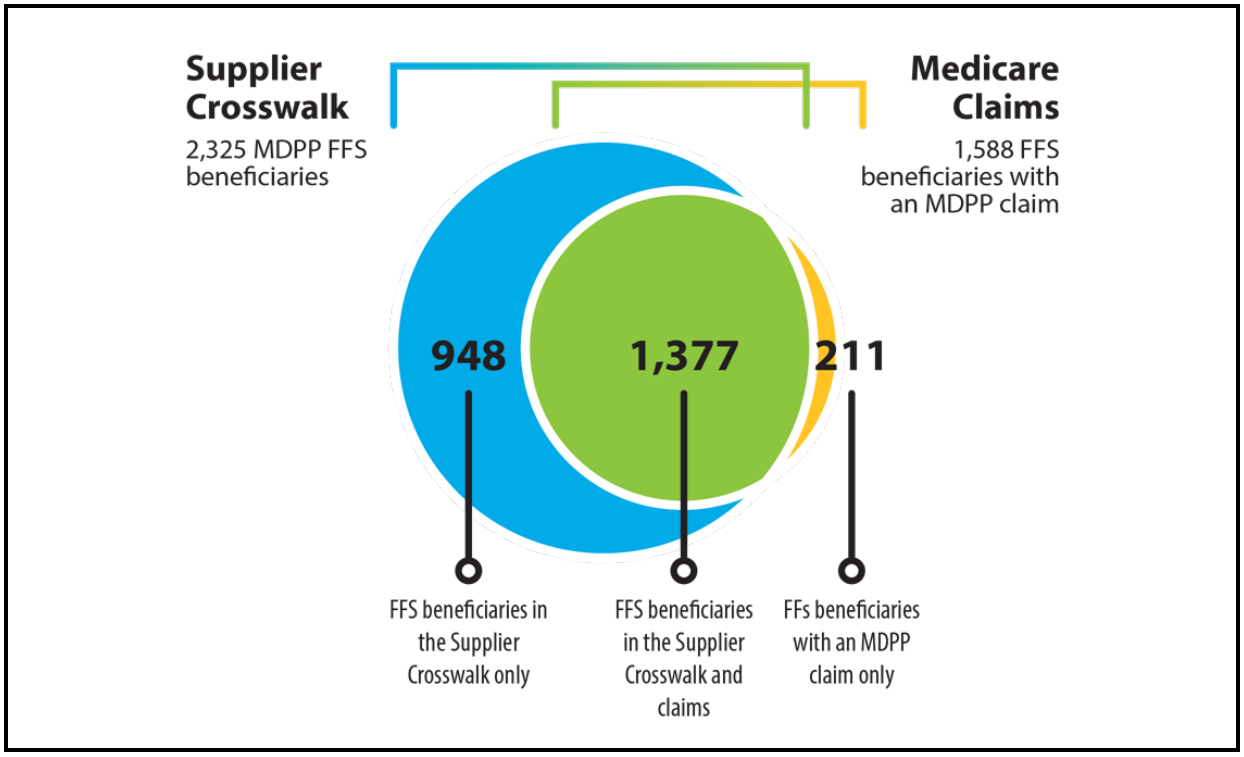


Data Source: RTI analysis of Supplier Crosswalk, DPRP, and Medicare claims datasets.

Some MDPP FFS beneficiaries identified by the Supplier Crosswalk do not have Medicare claims for MDPP services, and a few FFS beneficiaries with claims for MDPP services are not included in the Supplier Crosswalk. **Figure B-2** shows the overlap between the Supplier Crosswalk subsample of FFS beneficiaries and the claims sample (which only includes FFS claims), based on data as of December 31, 2019. Many beneficiaries are in only one of the two datasets. Of the 2,325 beneficiaries identified as FFS in the Supplier Crosswalk, 2,303 (99%)

matched to valid beneficiary IDs in enrollment data and 1,377 (59%) had MDPP claims in the Medicare claims dataset. On the other hand, 211 beneficiaries have MDPP claims in the Medicare claims dataset but are not yet in the Supplier Crosswalk.

Appendix Figure B-2.
Overlap between the Supplier Crosswalk FFS subsample and the Medicare claims dataset



Data Source: RTI analysis of Supplier Crosswalk, and Medicare claims datasets.

Note: Supplier Crosswalk numbers only include FFS beneficiaries with an identifier that could be matched to Medicare enrollment data. An additional 14 FFS beneficiaries in the Supplier Crosswalk had identifiers that could not be matched to Medicare enrollment data.

APPENDIX C:
MDPP FFS AND MA BENEFICIARY DEMOGRAPHICS

Appendix Table C-1.
MDPP participant demographics by subgroup

	Overall		FFS		MA	
Subgroup	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Sex						
Female	2824	74.9%	1416	75.4%	1408	74.3%
Male	930	24.7%	452	24.1%	478	25.2%
Not Reported	17	0.4%	9	0.5%	8	0.4%
Age Group						
< 65	286	7.6%	126	6.7%	159	8.4%
65–69	1415	37.5%	734	39.1%	681	36.0%
70–74	1162	30.8%	580	30.9%	582	30.7%
75–79	647	17.2%	304	16.2%	343	18.1%
> 79	261	6.9%	133	7.1%	116	6.1%
Race[1]						
White	2889	76.6%	1501	80.0%	1388	73.3%
Black	391	10.4%	178	9.5%	213	11.2%
Asian and Native Hawaiian or Pacific Islander	72	1.9%	40	2.2%	32	1.7%
American Indian	23	0.6%	9	0.5%	14	0.7%
Unknown	406	10.8%	157	8.4%	249	13.2%
Ethnicity						
Not Hispanic or Latino	3169	84.0%	1566	83.4%	1603	84.6%
Hispanic or Latino	329	8.7%	187	10.0%	142	7.5%
Ethnicity not reported	273	7.2%	124	6.6%	149	7.9%
Education Status						
Some college	1922	51.0%	1110	59.1%	812	42.9%
Less than college	497	13.2%	244	13.0%	253	13.4%
Education not reported	1352	35.9%	523	27.9%	829	43.8%

[1] Beneficiaries may select more than one race; therefore, the totals may exceed 100%.
Data Source: DPRP and MRPP Crosswalk Data (April 2018 through December 2021).

APPENDIX D: SELECTION OF COMPARISON GROUPS

The comparison group provides an estimate of what would have happened to MDPP beneficiary utilization and costs in the absence of the MDPP services. The comparison group has been designed to be as similar to the intervention group as possible on sociodemographic and clinical characteristics because these may account for unobserved, hard-to-measure characteristics that might otherwise lead to biased estimates of model effects (Cook, Shadish, & Wong, 2008). Having a strong, defensible comparison group is critical to the success of the evaluation. Therefore, we adopted an analytic approach that stratified the sample into multiple comparison groups to handle limitations in the data and differences in spending and health among the groups.

To select the comparison groups, we first narrowed the comparison group to people who would participate in the MDPP based upon two characteristics: prediabetes and proximity to an MDPP supplier. A diagnosis of prediabetes is a key qualifier for inclusion into the MDPP. We set an algorithm to identify whether a person had any diagnosis for prediabetes. Additionally, our analyses indicated that 89% of MDPP participants live in the same county as an MDPP supplier county, and 96% of MDPP participants live within 25 miles of the nearest supplier location. Thus, both the supplier county and the 25-mile radius around the supplier ZIP served as fitting geographic areas from which to draw the potential comparison group.[10] We then assigned individuals in the potential comparison group pseudo-entry dates for the MDPP. Each quarter, individuals in the comparison group were given the first day of that quarter as a pseudo-MDPP entry day.

We classified the MDPP group (N=2,159) and the potential comparison group into two different categories based upon the length of their enrollment in Medicare at the time of MDPP entry: Existing Medicare Enrollees (enrollment in Medicare longer than 12 months) and Recent Medicare Enrollees (enrollment in Medicare 12 months or less). **Appendix Figure D-1** illustrates these steps. We divided the groups because Recent Medicare Enrollees have not been enrolled in Medicare for enough time to define several variables we use in the overall match, such as Hierarchical Condition Category (HCC) score, number of chronic conditions, or number of Part B (Part D) months in the past year. Approximately 6% (123/2,159) of the MDPP sample are considered Recent Enrollees.

Next, we divided the Existing Enrollees group into those who did not have a diabetes claim in the past 3 years and those who did. Although MDPP participants should not have been previously diagnosed with diabetes (per MDPP eligibility criteria), we find that 18% of the MDPP sample had had a diabetes claim in the past 3 years before entry into the MDPP.[11] We ran

[10] The nearest supplier location reflects the closest supplier to the ZIP code listed on their Medicare address. It may not be the MDPP participant's location of choice because the CDC Organization Code does not identify the exact location of attendance.

[11] Because suppliers have no way to confirm whether a participant has had a previous diagnosis of diabetes, they rely on the participants to self-report whether they have not been diagnosed with diabetes. The claims algorithm

additional analyses on this group and found that MDPP participants with a previous diabetes claim were sicker (more chronic conditions and higher HCC scores) and had higher costs in the previous year than participants without a previous diabetes claim. The comparison group followed the same pattern; those with diabetes claims in the past 3 years were sicker and more expensive. Thus, we chose to stratify the propensity score model by this criterion.[12] We found that we achieved better covariate balance when we stratified by previous diabetes as opposed to simply controlling for diabetes in a model that included all individuals.

We then ran propensity score models on the three samples to estimate the propensity score, which represents the likelihood of participating in the MDPP. We ran the three probit models on the covariates listed in **Appendix Table D-1** with the probit model results presented in **Appendix Table D-2**.[13] Because the geographic location of the MDPP supplier affected participant travel time for the in-person program, we included distance to the closest MDPP supplier in the propensity score model. We considered including lagged outcome measures—in particular, the costs for the year prior to MDPP entry, the number of inpatient stays for the year prior to MDPP entry, and the number of emergency department visits for the prior year—as predictors in the probit model. Including lagged outcome variables in propensity score matching models is controversial (see for example, Daw and Hatfield (2018)). However, testing with them in the model did not change covariate balance measures for other covariates or for the lagged outcomes themselves. As a result, and given the controversy about including them in matching, we did not include the lagged outcome measures in our final propensity score estimates.

We ensured that a comparison group individual was matched with a treatment group individual from the same locality by conducting an exact match on geographic location. For example, an MDPP participant from the Raleigh, NC, area would be matched to the comparison group person from the Raleigh area with the closest propensity score to their own. The exact match on locality ensures that geographic-specific factors that could impact the outcomes could be assumed to impact both the MDPP participant and their matched comparison group similarly.

We matched the MDPP participants to the comparison group based on their propensity to participate in the MDPP program using 1:1 greedy matching, without replacement. Greedy matching selects an MDPP participant and then selects, as a match, the comparison group person whose propensity score is closest to that of the MDPP participant(Austin, 2009b, 2014). A caliper distance was added so we matched treated and untreated subjects only if the absolute difference in their propensity scores is within a prespecified maximal distance, known as the caliper (Austin, 2011). Once a comparison group person is matched with an MDPP participant,

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also does not have perfect specificity and sensitivity; it misses some people who truly have diabetes and falsely identifies some people who do not have diabetes.

[12]To be eligible for the comparison group with a previous diabetes claim, we still required that the individual had a claim with a prediabetes diagnosis and that the prediabetes diagnosis occurred after the diabetes diagnosis. Essentially, this assumption says that the most recent diagnosis is the most appropriate diagnosis. This assumption is necessary to ensure that the comparison group does not include individuals who clearly have diabetes at their pseudo entry date.

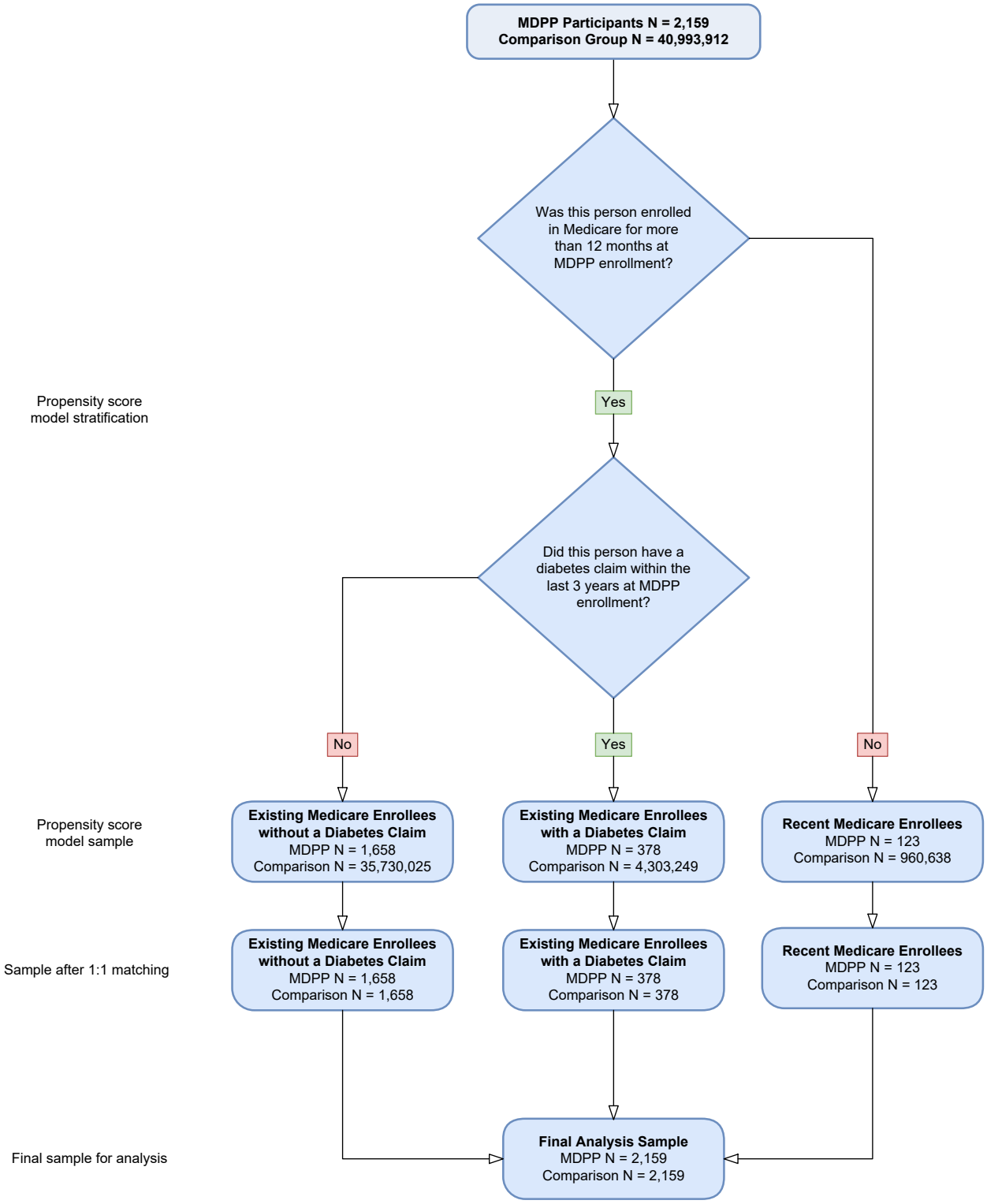
[13] Probit models were preferred over logit models because we achieved better convergence outcomes.

they are removed from future matching (once matched, they can no longer be matched). This is known as being matched without replacement. The matching literature indicates that there are few improvements in precision to be made in matching many-to-one, so we focused on 1:1 matching resulting in a comparison group of commensurate size to our MDPP sample (N=2,159) (Austin, 2010).

We successfully found unique matches for all 2,159 MDPP participants included in our analysis. Our success may be due to the relative size of the MDPP population versus the potential comparison group (2,159 versus 40,994,092). We believe these processes will remain robust to the inclusion of additional MDPP participants in the future.

The final step in selecting the comparison group was ensuring that we achieved balance on the covariates. We assessed balance using standardized differences, which are presented in **Appendix Tables D-3**, **D-4**, and **D-5**. Because standardized differences are not affected by sample size, they serve as the most accepted measure of covariate balance (Austin, 2009a). Heuristically, any standardized difference greater than 0.1 can be considered unbalanced (Zhang, Kim, Lonjon, Zhu, & written on behalf of A. M. E. Big-Data Clinical Trial Collaborative Group, 2019). The columns in Appendix Table D-1 entitled "Balance Achieved" indicate whether the standardized difference for that covariate fell below 0.1 for a particular match. Generally, most variables were balanced across the two samples resulting in a sample that was similar in terms of age, gender, health (number of chronic conditions; HCC score), insurance status, and distance to supplier. For existing Medicare enrollees without a diabetes claim, we achieved balance for all the variables included in the propensity score. We also show that we achieved good balance on the lagged outcome variables, which were not included in the propensity score. The match for existing enrollees with a diabetes claim did not balance on non-white, disability as the original reason for Medicare enrollment, and number of Part B months. The more parsimonious match of recent Medicare enrollees missed balance on non-white and number of dual eligible months. All variables from the propensity score estimation were included in our outcomes regression to control for possible differences for which matching did not control.

Appendix Figure D-1.
MDPP Claims Analysis Sample Selection Process



Appendix Table D-1.
Variables Included in the MDPP and Comparison Group Match

Variable	Description	Existing Medicare Enrollees (without diabetes)			Existing Medicare Enrollees (with diabetes)			Recent Medicare Enrollees		
		Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^
Geographic Area	Union of 25-mile radius from supplier and county supplier		✓	✓		✓	✓		✓	✓
Diabetes claim in the past 3 years	At least one inpatient diabetes claim or two outpatient claims in the past 3 years					✓				
Year and quarter of MDPP entry (or pseudo-entry)	Calendar year and quarter of enrollment in the program based on DPRP data, Medicare MDPP claims data, and supplier crosswalk data	✓	✓	✓	✓	✓	✓	✓	✓	✓
Age	Age as of the last day of the last quarter in the reporting period	✓		✓	✓		✓	✓		✓
Female	Indicator for gender	✓		✓	✓		✓	✓		✓
Non-white	Indicator for non-white	✓		✓	✓			✓		
Disability as original reason for Medicare entitlement	Indicator for the original reason for Medicare entitlement was for Disability insurance Benefits	✓		✓	✓			✓		✓

Variable	Description	Existing Medicare Enrollees (without diabetes)			Existing Medicare Enrollees (with diabetes)			Recent Medicare Enrollees		
		Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^
Hierarchical Condition Category (HCC) score	Medicare-developed risk scores used to adjust for differences in health status.	✓		✓	✓		✓			
Number of chronic conditions	Count of all chronic condition variables reported in the Medicare claims file in the last year	✓		✓	✓		✓			
Distance to closest MDPP supplier	Miles to the closest supplier location zip code that lies within either a 25-mile radius of an MDPP supplier zip code or the MDPP supplier's county	✓		✓	✓		✓			
Number of Part B months in the past year	Total number of months where the beneficiary was entitled to Part B in the last year.	✓		✓	✓		✓			
Number of Part D months in the past year	Total number of months where the beneficiary was entitled to Part D in the last year.	✓		✓	✓		✓			
Number of dually eligible months in the past year	Total number of months where the beneficiary was enrolled in Medicare and Medicaid in the last year.	✓		✓	✓		✓			

Variable	Description	Existing Medicare Enrollees (without diabetes)			Existing Medicare Enrollees (with diabetes)			Recent Medicare Enrollees		
		Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^	Included in Probit*	Exact Match+	Balance Achieved^
COVID-19 PHE indicator	Indicator for Medicare enrollment during or after Q2 2020.	✓		✓	✓		✓			
Year of FFS enrollment	Calendar year in the Medicare fee-for-service coverage start variable.	✓			✓			✓		✓
Part D coverage at enrollment	Indicator for Part D coverage began in the same month as Medicare coverage start							✓		✓
Dual coverage at enrollment	Indicator for dually enrolled in the same month as Medicare coverage start							✓		

Notes: * Variables estimated in the propensity score for each person in the Medicare sample. + Forced match on these variables in our selection of the comparison group. ^ The standardized difference is less than or equal to 0.10.

Appendix Table D-2.
Probit Regression Coefficients from the 3 Propensity Score Models

Variable	Existing Medicare Enrollees without a Diabetes Claim	Existing Medicare Enrollees with a Diabetes Claim	Recent Medicare Enrollees
Regression Coefficients			
Age	−0.015 ***	−0.013 ***	−0.006
Female	0.206 ***	0.281 ***	0.192 ***
Non-White	−0.092 ***	−0.069 **	−0.071
Original reason for enrollment in Medicare – Disabled	−0.174 ***	−0.134 ***	0.032
HCC risk score	−0.031 **	−0.002	
Number of chronic conditions	−0.007 ***	−0.021 ***	
Number of Part D months	−0.003 **	0.01 ***	
Number of dual eligible months	−0.027 ***	−0.052 ***	
Minimum distance to a supplier location	−0.026 ***	−0.022 ***	−0.033 ***
Number of Part B months	−0.028 ***	−0.039 ***	
Quarter 1	0.065 ***	0.061	0.249 ***
Quarter 2	−0.067 ***	−0.118 ***	0.057
Quarter 3	0.038 **	−0.005	0.133 **
2019	0.074 ***	−0.027	−0.033
2020	0.027	−0.07	−0.208 *
2021	0.195 ***	0.082	−0.024
Post-covid period	−0.241 ***	−0.259 ***	0.018
Constant	−2.301 ***	−2.048 ***	−3.192 ***
Counts			
MDPP	1,664	380	123
Comparison Group	35,730,044	4,303,438	960,610

Variable	Existing Medicare Enrollees without a Diabetes Claim	Existing Medicare Enrollees with a Diabetes Claim	Recent Medicare Enrollees
Model Fit			
Pseudo R^2	0.0542	0.0699	0.0525
Goodness of Fit			
LR chi^2	1977.77	549.36	128.69

Note: *** means statistically significant at the 1% level. ** means statistically significant at the 5% level. * means statistically significant at the 10% level.
Data Source: RTI analysis of Medicare claims.

Appendix Table D-3.
Existing Medicare Enrollees without a Diabetes Claim – Covariate Balance

Matched	Treated	Control	Standardized Percentage Bias	Percentage Reduction in Bias
Age				
Unmatched	70.3	73.3	−35.1	
Matched	70.3	70.5	−1.4	96
Female				
Unmatched	0.746	0.575	36.6	
Matched	0.746	0.728	3.8	89.8
Non-White				
Unmatched	0.146	0.189	−11.5	
Matched	0.146	0.114	8.6	25.2
Minimum distance to a supplier location				
Unmatched	5.76	10.47	−59.2	
Matched	5.76	5.41	4.4	92.5
Original reason for enrollment in Medicare—Disabled				
Unmatched	0.115	0.151	−10.5	
Matched	0.115	0.113	0.5	94.9
HCC risk score				
Unmatched	0.6671	0.8666	−30.7	
Matched	0.6671	0.6550	1.9	93.9
Number of chronic conditions				
Unmatched	4.1	5.4	−39.1	
Matched	4.1	4.1	−0.8	98
Number of Part B months				
Unmatched	11.5	11.9	−23.1	
Matched	11.5	11.6	−9.7	57.9
Number of Part D months				
Unmatched	8.2	8.9	−12.8	
Matched	8.2	8.3	−1.0	92.3
Number of Dual Eligible months				
Unmatched	0.6	1.7	−29.7	
Matched	0.6	0.7	−3.0	89.8
Number of Fee-For-Service months				
Unmatched	11.8	11.9	−5.6	
Matched	11.8	12.0	−9.8	−73

Matched	Treated	Control	Standardized Percentage Bias	Percentage Reduction in Bias
Lagged variables (not included in propensity score model)				
Last year ED visits				
Unmatched	0.28	0.335	−5.9	
Matched	0.28	0.3082	−3.0	48.8
Last year inpatient visits				
Unmatched	0.08	0.16	−17.3	
Matched	0.08	0.12	−9.7	43.7
Last year total cost				
Unmatched	6,032	8,613	−16.6	
Matched	6,032	6,783	−4.8	70.9

Data Source: RTI analysis of Medicare claims.

Appendix Table D-4.
Existing Medicare Enrollees with a Diabetes Claim—Covariate Balance

Matched	Treated	Control	Standardized Percentage Bias	Percentage Reduction in Bias
Age				
Unmatched	71.7	74.3	−32.5	
Matched	71.7	71.4	2.8	91.3
Female				
Unmatched	0.794	0.584	46.3	
Matched	0.794	0.773	4.7	89.9
Non−White				
Unmatched	0.193	0.262	−16.5	
Matched	0.193	0.112	19.0	−14.8
Minimum distance to a supplier location				
Unmatched	5.851	9.801	−49.4	
Matched	5.851	5.837	0.2	99.6
Original reason for enrollment in Medicare – Disabled				
Unmatched	0.127	0.192	−17.7	
Matched	0.127	0.164	−10.2	42.6
HCC risk score				
Unmatched	0.949	1.278	−35.3	
Matched	0.949	0.993	−4.7	86.7
Number of chronic conditions				
Unmatched	6.3	8.0	−47.4	
Matched	6.3	6.2	0.6	98.8
Number of Part B months				
Unmatched	11.8	12.0	−16.9	
Matched	11.8	11.9	−15.2	10.2
Number of Part D months				
Unmatched	9.5	9.3	5.0	
Matched	9.5	9.6	−2.3	54.6
Number of Dual Eligible months				
Unmatched	0.4	2.6	−58.0	
Matched	0.4	0.4	0.4	99.3
Number of fee-for service months				
Unmatched	11.98	11.92	9.3	
Matched	11.98	11.98	0.0	100

Matched	Treated	Control	Standardized Percentage Bias	Percentage Reduction in Bias
Lagged variables (not included in propensity score model)				
Last year ED visits				
Unmatched	0.34	0.47	−10.7	
Matched	0.34	0.44	−8.7	19.2
Last year inpatient visits				
Unmatched	0.16	0.26	−16.4	
Matched	0.16	0.22	−8.6	47.3
Last year total cost				
Unmatched	10,578	13,345	−12.0	
Matched	10,578	10,563	0.1	99.5

Data Source: RTI analysis of Medicare claims.

Appendix Table D-5.
Recent Medicare Enrollees – Covariate Balance

Matched	Treated	Control	Standardized Percentage Bias	Percentage Reduction in Bias
Age				
Unmatched	63.7	63.9	−5.6	
Matched	63.7	64.1	−9.1	−64.6
Female				
Unmatched	0.732	0.568	34.8	
Matched	0.732	0.699	6.9	80.2
Non-white				
Unmatched	0.220	0.271	−11.9	
Matched	0.220	0.146	17.0	−43.5
Minimum distance to a supplier location				
Unmatched	4.952	10.470	−75.2	
Matched	4.952	5.528	−7.8	89.6
Original reason for enrollment in Medicare—Disabled				
Unmatched	0.114	0.113	0.3	
Matched	0.114	0.106	2.6	−684.2
Dual Eligible at time of Medicare enrollment				
Unmatched	0.0650	0.1450	−26.3	
Matched	0.0650	0.0163	16.0	39
Part D status at enrollment				
Unmatched	0.5285	0.4754	10.6	
Matched	0.5285	0.5203	1.6	84.7

Data Source: RTI analysis of Medicare claims.

APPENDIX E: METHODS: MEDICARE FFS CLAIMS ANALYSIS

Data Sources

MDPP Supplier Crosswalk—MDPP suppliers submit a list of Medicare Beneficiary Identifiers (MBIs) for each FFS beneficiary who receives MDPP services. This crosswalk is updated quarterly and submitted to CMS and RTI. The April 15, 2022, Supplier Crosswalk contained the most-recent list of MDPP beneficiaries available for inclusion in this report.

Medicare data—We used Medicare Master Beneficiary Summary File, claims data, and chronic conditions file provided by CMS in the CCW. The Medicare data in the CCW include (1) denominator information, which indicates the number of beneficiaries alive; (2) enrollment information, which indicates the number of days that beneficiaries were enrolled in Medicare during the period; (3) the claims experience for each FFS beneficiary; and (4) indicators for whether FFS beneficiaries have common chronic conditions. We used both Part A and Part B claims to create claims-based outcome measures. We used Medicare data from April 1, 2015, through December 31, 2021.

DPRP dataset—We used the DPRP dataset to identify the MDPP enrollment date for MDPP beneficiaries. Enrollment start is defined as an MDPP beneficiary's first MDPP session date.

Data Linkage

The Supplier Crosswalk includes MDPP beneficiaries' Medicare Health Insurance Claim Number (HICN) or MBI. We used the CCW HICN/MBI to CCW BENE_ID crosswalks to assign each HICN/MBI its BENE_ID. We then linked the Supplier Crosswalk data to the Medicare claims data using the BENE_ID.

Analysis Time Period

The analysis included Medicare FFS claims from April 1, 2015, through December 31, 2021. The analysis period ended in December to allow for 4 months of claims run-out. Based on each beneficiary's start date (described below in *MDPP Start Date*), a beneficiary was assigned a specific pre-MDPP period, going back up to 3 years from the individual's start date, and a specific post-MDPP period, reflecting up to 3 years from the individual's start date. We follow beneficiaries for up to 3 years because few individuals have longer follow-up time. These would be individuals who enrolled after the MDPP launched in 2018, and enrollment in 2018 was relatively low. Some beneficiaries were enrolled in Medicare for the full 3 years of the pre-period and the full 3 years of the post-period. Others were only enrolled in Medicare FFS for a portion of the 3 years prior to their start date, and others were followed for less than 3 years after program enrollment.

Study Sample

A cumulative list of 2,303 MDPP FFS beneficiaries reported by MDPP suppliers in the April 15, 2022, Supplier Crosswalk was used as the starting point,[14] and 2,159 beneficiaries were ultimately included in the claims analysis because of several criteria imposed on the data. Beneficiaries who started the MDPP after December 31, 2021, were excluded. Additionally, some beneficiaries had no months in the analysis period in which they met the criteria of being alive, having Medicare Part B, and not being enrolled in MA.

MDPP Start Date

To determine each beneficiary's pre- and post-MDPP period, MDPP FFS beneficiaries were assigned a program start date based on their first MDPP session date as reported in the DPRP dataset. If an MDPP beneficiary did not yet have data in the DPRP, we assigned them a start date based on his/her first paid MDPP claim. If a beneficiary had neither DPRP data nor a MDPP claim at the time of this analysis, he/she was assigned a start date based on the when he/she first appeared in a Supplier Crosswalk; we assigned a start date as the first day of the reporting quarter associated with the Supplier Crosswalk. Of the 2,159 beneficiaries included in this analysis, 85% were assigned a start date based on DPRP data, 7% were assigned a start date based on the first paid MDPP claim, and 8% were assigned a start date based on the date of the Supplier Crosswalk in which they were first identified.

Comparison group members were assigned a proxy start date equal to the beginning of the calendar quarter in which their matched MDPP participant began the program.

Outcomes Measure Specifications

For this report, we modeled total expenditures before and after MDPP enrollment. We included Medicare payments in a specific year if the discharge or service date on the claim was during that 12-month period.

Total expenditures: We defined expenditures as FFS payments made by Medicare. This measure represents payment amounts from all inpatient and outpatient (facility and professional) claims (i.e., Part A and Part B), excluding member cost sharing and pharmacy component expenditures (i.e., Part D for Medicare). Total expenditures include any payments made for MDPP services. We first summed all expenditures for a beneficiary across the year and then divided by 12 months to generate a per beneficiary per month (PBPM) estimate of total costs for the beneficiary for the year. Eligibility fractions, discussed below in Regression Weights, down-weight PBPM estimates when the beneficiary did not have Medicare FFS and Part B coverage for the full 12 months of the year. We did not risk adjust or price standardize payments across geographic areas. We set negative payments on claims to zero.

[14] The Supplier Crosswalk included 22 MDPP FFS beneficiaries who did not have a valid Medicare beneficiary identifier. These beneficiaries are not included in the list of 2,303 beneficiaries.

Statistical Methods

We used a difference-in-difference (D-in-D) specification for the impact analyses. We modeled outcomes on a yearly basis, including 3 pre-MDPP years and 3 post-MDPP years.

Assessment of Parallel Pre-MDPP Trends. D-in-D models assume that the outcomes for the MDPP and comparison group follow a similar slope during the pre-MDPP period. To test the assumption that the MDPP group and the comparison group had parallel trends, we estimated a model with a linear trend during the pre-MDPP period (see equation E.1). We tested whether this trend differed for MDPP beneficiaries relative to comparison group beneficiaries.

$$Y_{ijt} = \alpha_0 + \beta_1 I_i + \alpha_1 t + \beta_2 I_i * t + \lambda X_{ij} + \varepsilon_{ijt}, \quad \text{(E.1)}$$

where

Y_{ijt} = total PBPM cost per year for the *i*-th beneficiary in the *j*-th group (MDPP or comparison), in quarter t

I_i = a 0,1 indicator (0 = comparison group, 1 = MDPP)

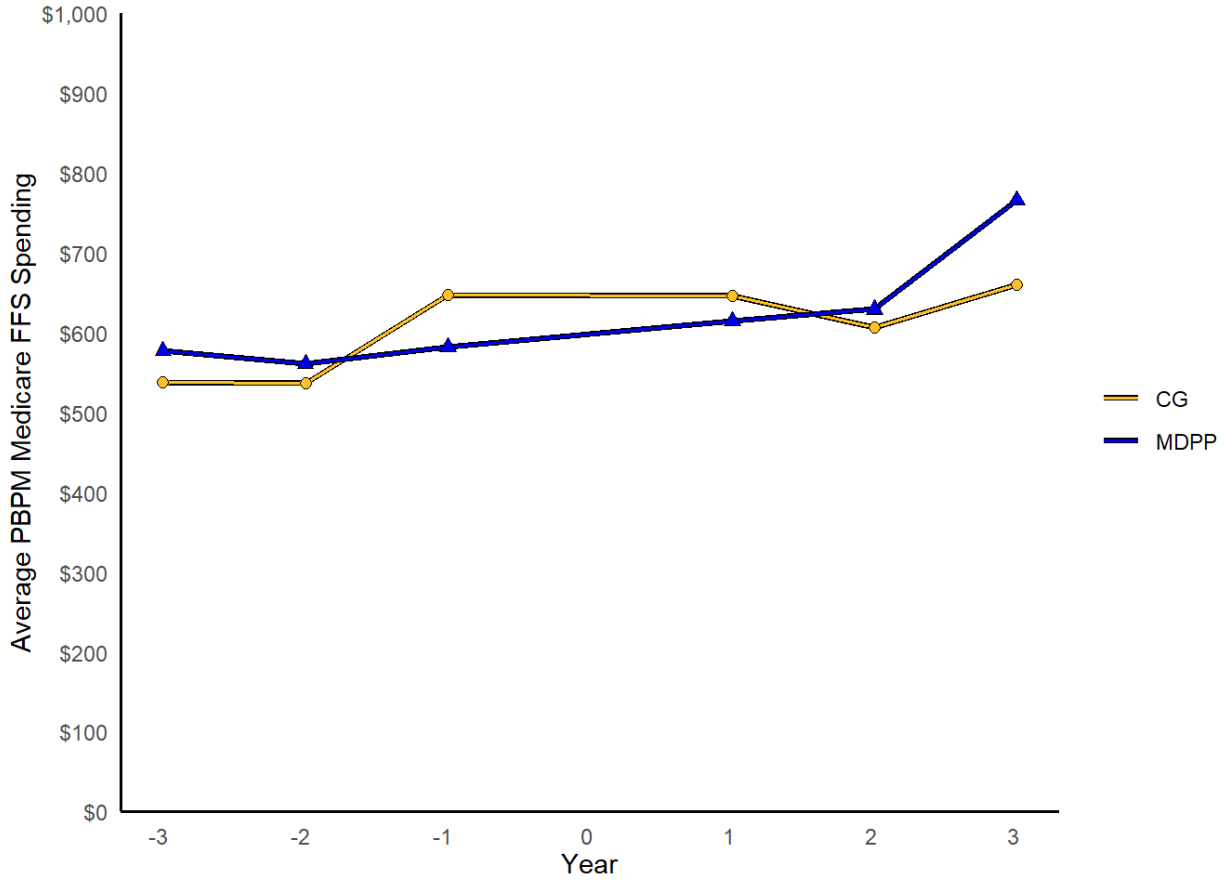
X_{ij} = a vector of beneficiary characteristics

t = a linear time trend ranging from 1 to 3

ε_{ijt} = error term

β_2 measures the difference in linear trends, and the *t*-statistic for this coefficient can be used to test the null hypothesis of equal pre-MDPP trends (β_2=0). Rejecting the null hypothesis would suggest that the assumption of equal trends underlying our D-in-D outcome models is not met. We found no statistically significant differences at the $p < .05$ level in pre-MDPP trends, but differences were detected at $p < .10$. We also visually examined the pre-MDPP trends as well, as shown in **Appendix Figure E-1**. Based on visual inspection and the fact that the conclusions of the statistical test varied based on the level of significance chosen, we modeled total PBPM expenditures assuming parallel trends.

Appendix Figure E-1.
Trends in total Medicare FFS PBPM expenditures



Data Source: RTI analysis of Medicare claims

D-in-D Model. The basic D-in-D specification we used is as follows:

$$Y_{ijt} = \alpha_0 + \beta_1 I_i + \theta P_{it} + \Sigma_t \alpha_{2,t} Q_t + \Sigma_k \gamma_k (I_i * Q_t * P_{it}) + \lambda X_i + \varepsilon_{it}, \quad \text{(E.2)}$$

where I_i (= 0, 1) denotes an intervention group indicator, P_{it} (= 0, 1) denotes an indicator that equals 1 if the beneficiary-year observation is a post-MDPP enrollment observation, Q_t (= 0, 1) denotes a set of period-specific indicators that equal 1 in each time period during the baseline and implementation periods, and X_j denotes a set of regression controls at the individual beneficiary level (indexed by i). γ_k is the average intervention effect during the post-demonstration period. This term is the D-in-D estimate and the primary variable of interest. This term reflects how the outcome changed between the pre-MDPP period and the post-MDPP period for the MDPP group relative to the change between the pre-MDPP period and the post-MDPP period for the comparison group. Expenditures were modeled using ordinary least squares with robust standard errors to account for the repeated measures within beneficiaries over time.

In these linear specifications, a negative value for the D-in-D estimate corresponds to less growth in expenditures over time for MDPP beneficiaries relative to comparison group beneficiaries, and a positive value corresponds to greater growth in expenditures over time for

MDPP beneficiaries relative to the comparison group. For this analysis, a negative value is preferable in that it suggests that program participation led to greater reductions in cost growth.

We applied the D-in-D model annually to examine changes in spending 1 year after MDPP enrollment, 2 years after enrollment, and 3 years after enrollment. From these yearly estimates, an overall D-in-D estimate was also derived as the weighted average of the Year 1, Year 2, and Year 3 D-in-D estimates, using the sample size in each year as the weighting variable.

Covariates. Although we matched MDPP beneficiaries with a comparison group member who was very similar (see **Appendix D, Selection of the Comparison Group** for more information), we included covariates in the D-in-D regression. Controlling for sociodemographic characteristics may produce more precise impact estimates (i.e., smaller standard errors and P-values) because covariate adjustment reduces the amount of unexplained variation in outcome measures (Hernandez, Steyerberg, & Habbema, 2004; Pocock, Clayton, & Stone, 2015). The model controlled for age, gender, race/ethnicity (i.e., non-white vs. white), distance in miles to the nearest MDPP supplier, number of chronic conditions as reported in Medicare claims in the year prior to enrollment, whether the beneficiary had a diagnosis of COVID-19 in the year, original Medicare enrollment due to disability, Medicare-Medicaid enrollment in the year prior to enrollment, enrollment in Medicare Part D in the year prior to enrollment, whether or not the beneficiary had recently enrolled in Medicare (i.e. within 12 months of enrollment into the MDPP or the comparison group), and whether or not the beneficiary had a Medicare FFS diabetes claim in the 3 years prior to MDPP enrollment.[15]

Regression Weights. The regression model included a person-specific weight equal to the beneficiary's eligibility fraction. Because some individuals were not enrolled in Medicare FFS or did not also have Part B coverage throughout the entirety of each year, we calculated eligibility fractions for each beneficiary. The eligibility fraction is defined as the total number of months the beneficiary was enrolled in FFS and had Part B coverage in each year divided by the total number of months in a year. For example, a beneficiary enrolled in Medicare FFS with Part B coverage for 6 months of a year has an eligibility fraction of 0.5 for that year. Eligibility fractions down weight observations for beneficiaries who are not eligible for the full year. Because there is greater uncertainty about the information, the observations exert less influence on the analyses.

[15] To identify individuals with diabetes claims, we followed the Chronic Conditions Data Warehouse algorithm, with one exception. The algorithm uses inpatient, outpatient, skilled nursing facility, and home health claims from the past 2 years to flag diabetes claims. In general, cases of diabetes are flagged when a minimum number of claims are found with ICD-10 diagnosis codes using the prefixes E08, E09, E10, E11, and E13. We followed the same algorithm but instead of looking back 2 years, we looked back 3 years.

APPENDIX F:
DETAILED REGRESSION RESULTS

Appendix Table F-1.
Difference-in-differences estimate for the total sample

Description	Baseline Year 3	Baseline Year 2	Baseline Year 1	Overall Baseline	MDPP Year 1	MDPP Year 2	MDPP Year 3	Overall MDPP
Number of beneficiaries								
Unique MDPP group beneficiaries	1,725	1,919	2,115	2,118	2,159	1,447	961	2,159
Unique comparison group beneficiaries	1,814	1,987	2,153	2,157	2,159	1,417	918	2,159
Total expenditures PBPM								
MDPP group covariates-adjusted mean	$542	$554	$625	$574	$620	$605	$728	$638
Comparison group covariates-adjusted mean	$553	$565	$636	$585	$653	$594	$632	$630
Difference in group means	($11)	($11)	($11)	($11)	($32)	$11	$96	$9
Difference-in-differences estimate	$0	$0	$0		($21)	$23	$108	$20
% difference-in-differences					-3.7	4.0	18.8	3.5
P-value					0.65	0.62	0.12	0.70

Data Source: RTI analysis of Medicare claims
Notes:
Interpretation: The D-in-D point estimate is the difference in spending the intervention period minus the difference in spending in the overall baseline period. The *% difference-in-differences* is the overall D-in-D estimate as a percentage of the MDPP intervention group's overall baseline spending (i.e., mean spending in the 3 years prior to participating in the MDPP). A negative value of the D-in-D means the regression-adjusted D-in-D estimate corresponds to a greater decrease or a smaller increase in spending after MDPP enrollment for the MDPP group relative to the comparison group. A positive value means the regression-adjusted D-in-D estimate corresponds to a greater increase or a smaller decrease in spending after MDPP enrollment for the MDPP group relative to the comparison group. The overall D-in-D estimate is a weighted average of the Year 1, Year 2, and Year 3 D-in-D estimates, using the sample size in each year as the weighting variable.

Appendix Table F-2.
Difference-in-differences estimate for those without a diabetes claim

Description	Baseline Year 3	Baseline Year 2	Baseline Year 1	Overall Baseline	MDPP Year 1	MDPP Year 2	MDPP Year 3	Overall MDPP
Number of beneficiaries								
Unique MDPP group beneficiaries	1,375	1,546	1,732	1,735	1,776	1,175	775	1,776
Unique comparison group beneficiaries	1,455	1,610	1,774	1,777	1,779	1,160	746	1,779
Total expenditures PBPM								
MDPP group covariates-adjusted mean	$466	$485	$567	$506	$575	$575	$650	$591
Comparison group covariates-adjusted mean	$471	$490	$572	$511	$645	$557	$594	$606
Difference in group means	($5)	($5)	($5)	($5)	($70)	$19	$56	($16)
Difference-in-differences estimate	$0	$0	$0		($64)	$24	$61	($10)
% difference-in-differences					-12.7	4.8	12.1	-2.0
P-value					0.20	0.60	0.36	0.85

Data Source: RTI analysis of Medicare claims
Interpretation: The D-in-D point estimate is the difference in spending the intervention period minus the difference in spending in the overall baseline period. The *% difference-in-differences* is the overall D-in-D estimate as a percentage of the MDPP intervention group's overall baseline spending (i.e., mean spending in the 3 years prior to participating in the MDPP). A negative value of the D-in-D means the regression-adjusted D-in-D estimate corresponds to a greater decrease or a smaller increase in spending after MDPP enrollment for the MDPP group relative to the comparison group. A positive value means the regression-adjusted D-in-D estimate corresponds to a greater increase or a smaller decrease in spending after MDPP enrollment for the MDPP group relative to the comparison group. The overall D-in-D estimate is a weighted average of the Year 1, Year 2, and Year 3 D-in-D estimates, using the sample size in each year as the weighting variable.

Appendix Table F-3.
Difference-in-differences estimate for those with a diabetes claim

Description	Baseline Year 3	Baseline Year 2	Baseline Year 1	Overall Baseline	MDPP Year 1	MDPP Year 2	MDPP Year 3	Overall MDPP
Number of beneficiaries								
Unique MDPP group beneficiaries	350	373	383	383	383	272	186	383
Unique comparison group beneficiaries	359	377	379	380	380	257	172	380
Total expenditures PBPM								
MDPP group covariates-adjusted mean	$854	$847	$875	$859	$829	$750	$1,087	$860
Comparison group covariates adjusted mean	$873	$865	$893	$877	$669	$770	$811	$733
Difference in group means	($19)	($19)	($19)	($19)	$159	($20)	$277	$127
Difference-in-difference estimate	$0	$0	$0		$178	($1)	$295	$146
% difference-in-differences					20.7	-0.1	34.4	17.0
P-value					0.13	0.99	0.18	0.31

Data Source: RTI analysis of Medicare claims
Interpretation: The D-in-D point estimate is the difference in spending the intervention period minus the difference in spending in the overall baseline period. The *% difference-in-differences* is the overall D-in-D estimate as a percentage of the MDPP intervention group's overall baseline spending (i.e., mean spending in the 3 years prior to participating in the MDPP). A negative value of the D-in-D means the regression-adjusted D-in-D estimate corresponds to a greater decrease or a smaller increase in spending after MDPP enrollment for the MDPP group relative to the comparison group. A positive value means the regression-adjusted D-in-D estimate corresponds to a greater increase or a smaller decrease in spending after MDPP enrollment for the MDPP group relative to the comparison group. The overall D-in-D estimate is a weighted average of the Year 1, Year 2, and Year 3 D-in-D estimates, using the sample size in each year as the weighting variable.