Get Fit with MA?
Estimating the Impact of Medicare Advantage on Physical Activity

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Abstract

Medicare Advantage (MA) plans are increasingly offer fitness benefits, yet the evidence on their causal impact remains limited. Using a regression discontinuity in difference in difference (RDDD) design using the age-65 Medicare eligibility threshold as an exogenous variation, this study provides the first quasi-experimental evidence on how MA enrollment affects seniors' physical activity. Using nationally representative survey data on workout behavior with insurance coverage information, we find that the discontinuity in vigorous workout days at age 65 is significantly larger for MA enrollees than for non-MA beneficiaries, who do not receive comparable fitness benefits. Robustness checks including placebo test and a donut-hole analysis yield consistent results. These findings emphasize that insurance plan features can determine healthy behaviors, providing relevant evidence for policy makers considering how benefit structures might promote healthy aging.

Keywords: Medicare Advantage, physical activity, fitness benefits, fuzzy regression discontinuity

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1 Introduction

As the U.S. population ages, promoting healthy behviors among seniors has become both a public health imperative and an economic necessity. Medicare already accounts for 21% national health expenditure and 10% of federal budget (Cubanski and Neuman (2023)), and these financial burden will only intensify as adults over 65 outnumber children under 18 for the first time by 2034 (U.S. Census Bureau (2018)). At the same time, even modest improvements in health behaviors at older ages can yield substantial returns in longevity and quality of life, ultimately lower health care utilization (Fries et al. (2011)). Physical activity is particularly promising as it is one of the most cost-effective interventions to promote healthy aging but it remains severely underutilized.

Physical inactivity remains pervasive across all ages worldwide, particularly among older adults.. More than 25% of those aged 65 and older report no leisure-time physical activity, and only 14% meet the 2018 Federal Physical Activity Guidelines for aerobic and muscle-strengthening exercise (CDC (2022)).These guidelines recommend at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week, along with muscle-strengthening activities. Adverse health outcomes associated with this physical inactiveness are severe as it significantly increase the risk of cardiovascular disease, diabetes, cognitive decline, musculoskeletal disorders (Warburton et al. (2006);Lee et al. (2012)), and falls which is the leading cause of injury-related death among seniors (Jiang and Wang (2022)). The economic burden is equally substantial, with medicare expenditures attributable to physical inactivity estimated at $117 billion annually in the U.S.(Carlson et al. (2015))

This physical inactivity crisis also reflects broader health inequities. Compliance with federal physical activity guidelines significantly varies across the regions and social economic status. 17% of older adults in the West meet the standard compared with just 12% in the South, and metropolitan seniors are considerably more active than those in non-metropolitan areas(Elgaddal and Kramarow (2024)). These disparities underline that physical activity is not only a medical challenge but also an equity issue, with structural barriers such as financial constraints, limited access to facilities, and lack of social support disproportionately affecting vulnerable populations.

Insurance benefit design offers one promising lever to address these barriers. Medicare Advantage(MA), the privately administered alternative to Traditional Medicare(TM), provides supplemental fitness benefits such as SilverSneakers, Renew Active, Silver&Fit that Traditional Medicare does not. These fitness programs provide free or subsidized gym memberships, groups exercise classes, often community-based fitness opportunities which directly reduce both financial and logistical barriers to exercise. As MA enrollment has been exponentially growing to cover more than half of Meidcare beneficiaries as of 2025 and is projected to reach 64% by 2033 KFF (2025), understanding whether these MA covered fitness benefits causally affect exercise behavior has become increasingly policy-relevant.

Existing evidence on the impact of these fitness programs is largely observational. Studies show that participants in the programs improve physical and emotional well-being, reduced functional impairment (Hamar et al. (2013)), decreased isolation and loneliness (Brady et al. (2018)), increased mobility and quality of life (Belza et al. (2006)), and lower inpatient admissions and self-reported healthcare costs(Nguyen et al. (2008)). However, these studies examine individuals who are already participating in the programs, raising concerns about the selection bias. That said, participants may differ systematically from the non-participants in ways that affect health outcomes (Newhouse (2014)). The critical question remains unanswered : Does enrollment in Medicare Advantage itself causally increase physical activity among older adults? Considering the high financial stakes and rapid MA expansion with supplemental fitness benefits, this question requires rigorous quasi-experimental evidence (Pinheiro et al. (2023))

This paper addresses these gaps by providing the first quasi-experimental evidence on whether Medicare Advantage causally increases physical activity among older adults. We use a Regression Discontinuity in Difference-in-Difference (RDDD) design that compares the discontinuities in workout behahavior at age 65 between MA enrollees and non-MA beneficiaries. This approach isolates the effect of MA covered fitness benefit by differencing out both universal age-65 shock such as retirement , and time-invariant selections into Medicare Advantage plans. Using Health and Retirement Study data from 2012 to 2022, we link self-reported vigorous physical activity to insurance enrollment histories and exploit the sharp discontinuity in Medicare eligibility at age 65

Our finding reveal that MA enrollment is associated with a statistically significant differential discontinuity of 4.7 percentage point increase in the probability of exercising daily, with particularly strong effect among female, non-White seniors, and individuals without college degree. However, these effects do not persist in the longer term, suggesting that the initial financial incentives trigger short-run behavioral response but may not sustain long-term habit formation. These results contribute to the literature in a way that they provide the first causal evidence linking insurance benefit design to preventive health behavior among seniors as well as underscore how supplemental fitness coverage reduce disparities in physical activity particularly for population facing higher structural and financial barriers to exercise.

2 Data

The main data source is from the Health and retirement Study (HRS) covering the years 2012 to 2022. The HRS is a nationally representative, longditudinal survey of adults that contains rich information on demographics, labor market status, self-reported health, and insurance coverage. For the analysis, we construct a precise measure of continuous age using survey year and month with individuals' birth year and month. Although HRS does not provide interview date, we can still calculate exact age in years and months, which is crucial for implementing the Regression Discontinuity in Difference-in-Differnece design, using age 65 (Medicare eligibility) as a running variable.

The primary outcome measures vigorous physical activity based on the HRS question: *"How often do you take part in sports or activities that are vigorous, such as running or jogging, swimming, cycling, aerobics or gym workout, tennis, or digging with a spade or shovel?"*. Respondents report in five levels : "Every day," "More than once a week," "Once a week," "One to three times a month," or "Hardly ever or never".

We construct a binary indicator that equals to 1 if the respondent reports exercising everyday and 0 otherwise. This threshold isolates individuals who consistently engage in vigorous exercise at the highest observable frequency, providing a conservative and policy-relevant measure of workout frequency. Daily vigorous activity represents the group most likely to comply with the federal Physical Activity Guideline. By using unequivocal and behaviorally distinct threshold available, our outcome capture a clean and interpretable measure of high intensity exercise that best aligns with the behavioral mechanisms linked with Medicare Advantage fitness benefits.

Further, we complement this binary outcome by using quasi-continuous and parsimonious recoding ("hardly ever or never" as 0; "once a week" as 1; "one to three times a month" as 1; "more than once a week" as 1; and "every day" as 7) for the robustness check to ensure the main specifications are not driven by the imposed binary cutoff.

2.1 Sample Construction and Summary Statistics

We define three mutually exclusive person level groups : (1) MA-only who is observed in Medicare Advantage at least once and never in Traditional Medicare across all survey waves, (2) TM-only who is observed in Traditional Medicare at least once and never in Medicare Advantage across all survey waves, (3) No-Medicare who is never observed in any Medicare plan across all survey waves. Non-MA group includes group 2 and 3. In addition, we exclude survey year 2020 from the main analysis as the outbreak of the COVID-19 pandemic in 2020 and government lockdown policy caused widespread disruptions in physical activity , access to gym, and health behaviors broadly, which is independent of Medicare coverage status. Including this year may blur the causal impact of Medicare Advantage enrollment with exercise behavior changes driven by the pandemic shock. The resulting summary statistics for the constructed samples are provided in Table 1.

Table 1: Baseline Characteristics by Medicare Advantage Status

	Non-MA (TM + No Medicare) N (%)	MA Only N (%)
Gender		
Male	2,955 (44.2%)	1,775 (39.3%)
Female	3,735 (55.8%)	2,739 (60.7%)
Race		
White	4,656 (69.9%)	2,666 (59.3%)
Black	1,222 (18.4%)	1,254 (27.9%)
Other	782 (11.7%)	573 (12.8%)
Hispanic		
Non-Hispanic	5,507 (82.5%)	3,614 (80.2%)
Hispanic	1,170 (17.5%)	894 (19.8%)
Education		
No college degree	4,261 (64.2%)	3,244 (72.5%)
College degree or higher	2,378 (35.8%)	1,232 (27.5%)
Physical Activity (Vigorous)		
More than once per week	1,783 (26.7%)	1,117 (24.8%)
Once per week	777 (11.7%)	545 (12.1%)
1–3 times per month	739 (11.1%)	484 (10.8%)
Hardly ever or never	3,155 (47.3%)	2,214 (49.2%)
Every day	213 (3.2%)	138 (3.1%)
Sample size		
Total observations	6,690	4,514

Notes: This table reports counts and column percentages for respondents ages 60–70 by Medicare Advantage (MA) enrollment status. Non-MA includes individuals enrolled in Traditional Medicare (TM) only and those not enrolled in Medicare

3 Empirical Strategy

A critical challenge in identifying the causal impact of Medicare Advantage on physical activity is endogeneity of MA enrollment and all other confounding shocks that happen at age 65. Individuals who choose MA over TM or no Medicare may systematically differ in their underlying health conditions, motivations for exercise, health preferences, and socioeconomic status. A naive comparison of mean workout days is contaminated by these confounders. To address this concern, we employ a Regression Discontinuity in Difference in Difference (RDDD) design that combines local identification from a regression discontinuity framewoek with difference-in-difference approach to isolate the causal impact of MA fitness benefits.

The regression discontinuity component exploits the sharp discontinuity in Medicare eligibility at age 65, which generates exogenous variation in insurance coverage. However, a simple RD specification comparing outcomes just above and below age 65 cannot isolate the effect of MA-specific fitness benefits for two reasons. First, numerous life events happen contemporaneously at Medicare eligibility such as retirement, Social Security benefits, shits in healthcare utilization , and broader changes in health behaviors or preferences. Furthermore, even among those newly eligible for Medicare at 65, enrollment in Medicare Advantage versus Traditional Medicare reflects individual choice and is thus endogenous. Wealthier, and more health-conscious individuals may be more likely to select into MA plans, which considerably confounds any direct comparison of workout frequencies between MA and non-MA individuals.

To isolate the effect of MA-specific fitness coverage, we use difference-in-difference specification that compares the differential of discontinuities in the probability of daily exercise at age 65 between MA and non-MA enrollees. The key insight is that the discontinuity for non-MA individuals captures baseline changes in daily exercise associated with Medicare eligibility and other age-65 life events, providing a counterfactual for what would have occurred among

MA enrollees absent the fitness benefits. The RDDD estimand is thus the difference in discontinuities : the jump in the probability of daily exercise minus the corresponding jump for non-MA enrollees. This specification relies on the assumption that in the absence of MA fitness benefits, the discontinuities in physical activity would be parallel among MA and non-MA groups which is an assumption that we empirically assess through pre-trend analysis.

Formally, the RDDD estimand captures the difference in discontinuities between MA and non-MA groups as follows :

$$\begin{aligned}\text{RDDD} = &\Big[E(Y \mid Age \downarrow 65,\ MA{=}1) - E(Y \mid Age \uparrow 65,\ MA{=}1)\Big] \\ &- \Big[E(Y \mid Age \downarrow 65,\ MA{=}0) - E(Y \mid Age \uparrow 65,\ MA{=}0)\Big]. \end{aligned} \tag{1}$$

This decomposition can be expressed as follows:

$$\begin{aligned}\Delta^{MA} &= \big(Workout^{MA}_{65,\text{post}} - Workout^{MA}_{65,\text{pre}}\big) \\ &= \underbrace{\text{Universal 65 shock}}_{\text{common to all}} + \underbrace{\text{MA-specific time-varying effect}}_{\text{treatment effect}} + \underbrace{\text{Time-invariant selection}}_{\text{fixed traits}}\end{aligned}$$

$$\begin{aligned}\Delta^{\text{non-MA}} &= \big(Workout^{\text{non-MA}}_{65,\text{post}} - Workout^{\text{non-MA}}_{65,\text{pre}}\big) \\ &= \underbrace{\text{Universal 65 shock}}_{\text{common to all}} + \underbrace{\text{Non-MA time-varying effect}}_{\text{counterfactual path}} + \underbrace{\text{Time-invariant selection}}_{\text{fixed traits}}\end{aligned}$$

Taking the difference between these two jumps eliminates the components common to both groups:

$$\text{RDDD} = \Delta^{MA} - \Delta^{\textit{non-MA}} = (\text{MA-specific time-varying effect}) - (\text{Non-MA time-varying effect})\,.$$

Hence, the RDDD estimand removes the universal 65 shock such as retirement or social security and time invariant selections into Medicare Advantage such as fixed individual differences.

3.1 RDDD Specification

We estimate the following equation for our main specification.

$$
\begin{aligned}
Y_{it} = {} & \alpha + \beta\,(\text{Post}_{it} \times MA_i) + \gamma_1\,\text{Post}_{it} + \gamma_2\,MA_i \\
& + f(Age_{it}) + \text{Post}_{it}\,f(Age_{it}) + MA_i\,f(Age_{it}) \\
& + (\text{Post}_{it} \times MA_i)\,f(Age_{it}) + \boldsymbol{\delta}^{\top} X_{it} + \mu_i + \tau_t + \varepsilon_{it}.
\end{aligned} \tag{2}
$$

where Y_{it} denotes vigorous workout days per week for individual i at time t. Post_{it} equals 1 if $Age_{it} \geq 65$. MA_i equals 1 for individuals ever observed in Medicare Advantage. $f(Age_{it})$ is a smooth local-linear function of age X_{it} includes demographic controls such as gender, race , education level. μ_i and τ_t denote individual and year fixed effects. Standard errors are clustered at the individual level.

In addition, to examine the evolution of the treatment effect and test for pre-trends as well as possible selections, we estimate a dynamic RDDD model where b_{it} indexes one-year age bins relative to age 65 ($b_{it} = 0$ for age 65; $b_{it} = -1$ for 64):

$$
\begin{aligned}
Y_{it} = {} & \alpha + \sum_{k \neq -1} \beta_k \mathbb{1}\{b_{it} = k\}\,MA_i + \sum_{k \neq -1} \phi_k \mathbb{1}\{b_{it} = k\} \\
& + g(Age_{it}) + \text{Post}_{it}\,g(Age_{it}) + MA_i\,g(Age_{it}) + (\text{Post}_{it} \times MA_i)\,g(Age_{it}) \\
& + \boldsymbol{\delta}' X_{it} + \mu_i + \tau_t + \varepsilon_{it}.
\end{aligned} \tag{3}
$$

The coefficients β_k measure the age-specific difference in outcomes between MA and non-MA individuals relative to $k = -1$ (age 64). Pre-trend validation requires $\beta_k \approx 0$ for $k < 0$. Post-65 β_k trace the timing and persistence of behavioral responses.

4 Results

4.1 Discontinuities in Workout Behavior

We begin by presenting nonparametric evidence on workout behavior around the Medicare eligibility threshold. Figure 1 plots monthly LOWESS-smoothed probability of daily exercise, separately for MA and Non-MA enrollees. LOWESS fit has an advantage over polynomial fit as it does not assume any functional forms. Two patterns emerge clearly in the plot. Prior to age 65, MA and non-MA beneficiaries display nearly parallel trends in daily workout likelihood. In addition, exactly at the eligibility threshold, MA enrollees exhibit a discrete increase in daily workout probability, whereas Non-MA enrollees do not. This visual jump anticipates the parametric RDDD estimates and suggests that MA-linked fitness benefits trigger behavioral responses.

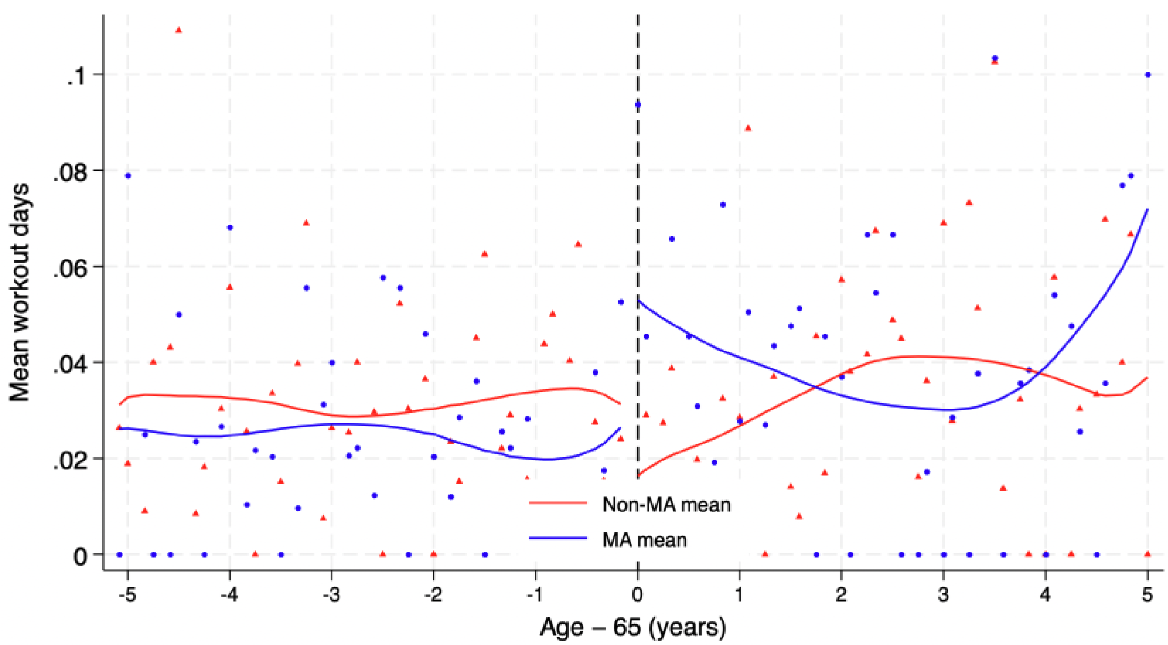


Figure 1
Notes: Monthly LOWESS-smoothed probability of exercising every day (binary outcome = 1 if daily workout) around age 65 for Medicare Advantage (MA) and non-MA groups. Circles represent MA group means and triangles represent non-MA group means.

Importantly, the figure also demonstrates that while MA enrollees increase their workout levels at age 65, Non-MA drop theirs. This divergent pattern is consistent with a wide range of age-related health, and lifestyle transitions such as retirement, increased caregiving responsibilities, and broader aging related declines in physical activity. The presence of these countervailing forces at age 65 emphasize why neither a simple RD nor a standard DiD design can isolate the causal effect of MA on physical activity.

A standard RD at age 65 would conflate MA-specific behavioral responses with universal age-65 shocks while a traditional DiD would not effectively control non-linear age profiles or discontinuities common to both groups. The RDDD framework addresses both limitations by explicitly differencing out the age-65 discontinuity experience by both groups, allowing us to attribute the residual discontinuity among MA enrollees specifically to MA fitness incentives rather than to broader aging effect.

4.2 Static RDDD results

Figure 2 presents the first stage discontinuity in Medicare Advantange enrollment at the Medicare eligibility cutoff. Consistent with the institutional rule, we observe a sharp and visually clear jump in MA enrollment at the threshold. This confirms the strong first stage relevance for the RDDD design and validate age 65 as an effective running variable for identifying the variation in MA enrollment.

Table 2 reports reduced-form RDDD estimates of the differential age-65 discontinuity in the probability of daily exercise for MA groups relative to non-MA group across different bandwidth choices. Using Calonico et al. (2014) bias-corrected , data-driven optimal bandwidth of 2.5 years, we find that MA enrollment leads to a statistically significant increase in vigorous exercise about 4.7 percentage points. Although binary exercise measure does not capture minutes of activity directly, the magnitude of this effect is substantial given that only 14% of older adults meet the federal physical activity guidelines of at least 75 minutes of vigorous exercise per weekCDC (2022). Our estimates suggest that MA fitness benefits meaningfully shift individuals toward meeting this guideline, underscoring a significant improvement in health behavior among Medicare beneficiaries.

To complement main specification, we also estimate the RDDD model using alternative bandwidths in Table 2 Panel B. In particular, as Health and Retirement Study is conducted biennially, bandwidths between two and four years align with our study design so that we can at least include one or two waves pre- and post- 65. Across these bandwidths windows, the estimated MA effect remain positive, stable in magnitude and statistically significant. This validates that the discontinuity is not an artifact of bandwidth choice, but reflects consistent and robust increase in physical activity linked with MA's fitness benefits.

Figure 3 presents the event study of the RDDD design, which we use primarily for assessing the parallel pre-65 trend which is the critical assumption of our identification strategy. The difference in discontinuity between MA and non-MA beneficiaries are flat and statistically insignificant which supports the key assumption that, in the absence of MA-specific fitness benefits, both groups would have shown similar discontinuities in the likelihood of daily exercise. At the Medicare eligibility threshold, the event study plot shows a sharp jump in physical activity among MA enrollees relative to non-MA enrollees. The magnitude is considerable and immediate precisely at age 65 which aligns with the activation of MA-linked fitness benefit. However, this effect attenuates and becomes insignificant overtime. This highlights a short-run behavioral boost as individuals gain access to free fitness benefits, consistent with the idea that new financial incentives initially increase the workout frequency.

This attenuation in later years aligns with existing evidence in the physical activity literature among younger population Pojskic et al. (2019), which has shown that financial incentives, fitness subsidies generate short-run and immediate response but it is hard to sustain this positive impact in the long-run. Commitment, habit formation and motivation, rather than financial incentives alone, are the key barriers to long-term adherence in physical activity.

To further address the concern that MA and Non-MA enrollees may already differ in workout level prior to Medicare eligibility, we complement our main RDDD specification with standard event study analysis. Figure 4 presents regular event study comparing raw workout levels (not discontinuity) between MA and non-MA groups. This plot reveals that both groups show similar workout levels and parallel trends prior to Medicare eligibility, with no evidence of systematic divergence in pre-treatment periods. Further, at age 65, we observe a considerable gap with MA beneficiaries increasing their workout frequency while non-MA individuals show no comparable change. However, we do not interpret these post-65 coefficients as causal estimates since enrollment in Medicare Advantage versus enrollment in Traditional Medicare are both endogenous choices.

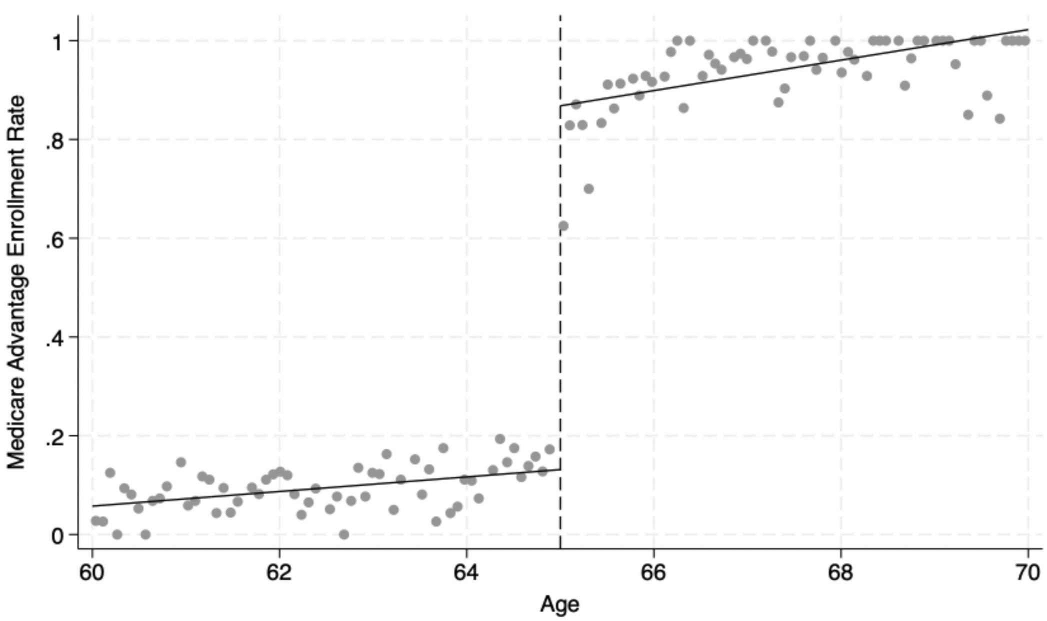


Figure 2
First stage Discontinuity in Medicare Advantage Enrollment at Age 65

Table 2: RDDD Estimates of the differential jump in workout at age 65

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.539$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.047**	0.411*	0.057***	0.039***	0.024*
	(0.022)	(0.236)	(0.017)	(0.015)	(0.013)
Pre-65 mean, MA group[b]	0.027	0.016	0.027	0.025	0.024
Post-65 mean, MA group[b]	0.044	0.031	0.041	0.038	0.039
Pre-65 mean, Non-MA group[b]	0.030	0.044	0.030	0.031	0.030
Post-65 mean, Non-MA group[b]	0.029	0.026	0.031	0.033	0.033
Observations	5,142	356	6,724	9,295	11,079
R^2	0.547	0.503	0.539	0.476	0.433
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD estimates of the differential discontinuity at age 65 in a binary indicator for daily exercise, using different bandwidth choices h (in years). The dependent variable equals 1 if the respondent reports exercising "every day", and 0 otherwise. The coefficient $\Delta^{MA} - \Delta^{\text{Non-MA}}$ captures the difference between the jump at age 65 for individuals in the MA group and the corresponding jump for the non-MA comparison group.[a] Coefficients are reported in percentage points.[b] Means are computed within the estimation sample for each bandwidth, separately by MA status and by whether age is below (Pre-65) or above (Post-65) the cutoff; Standard errors clustered at the individual level are reported in parentheses. All specifications include individual and year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

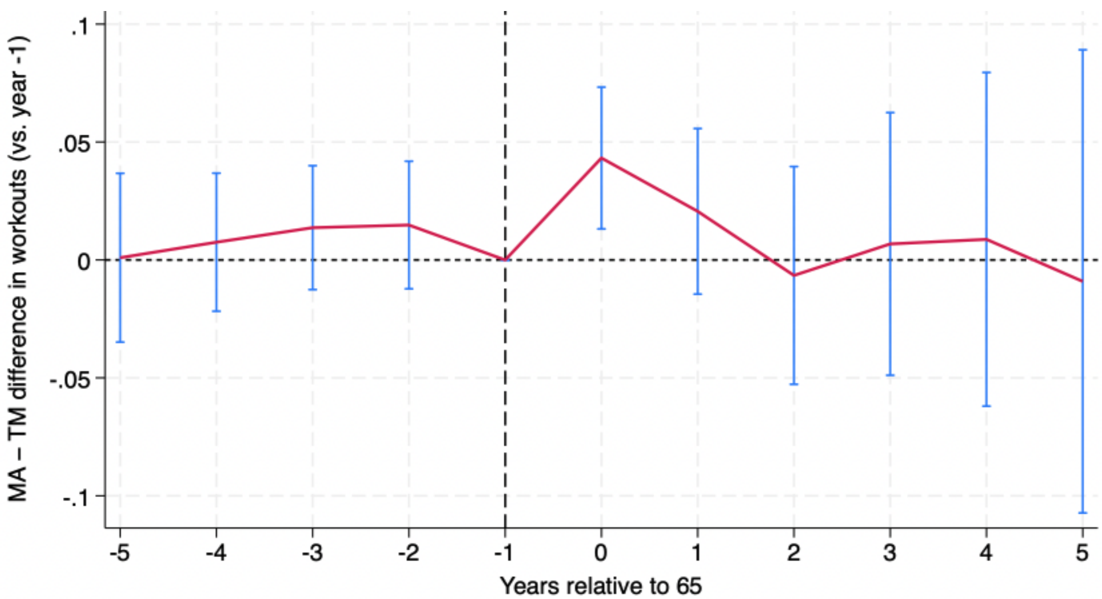


Figure 3
Notes: Event-study estimates of yearly daily exercise probability between Medicare Advantage (MA) and Non-MA beneficiaries in workout days, relative to age 65. The dotted horizontal line indicates zero difference and the dashed vertical line marks a reference year which is a year before Medicare eligibility. Points represent bin means and bars show 95% confidence intervals.

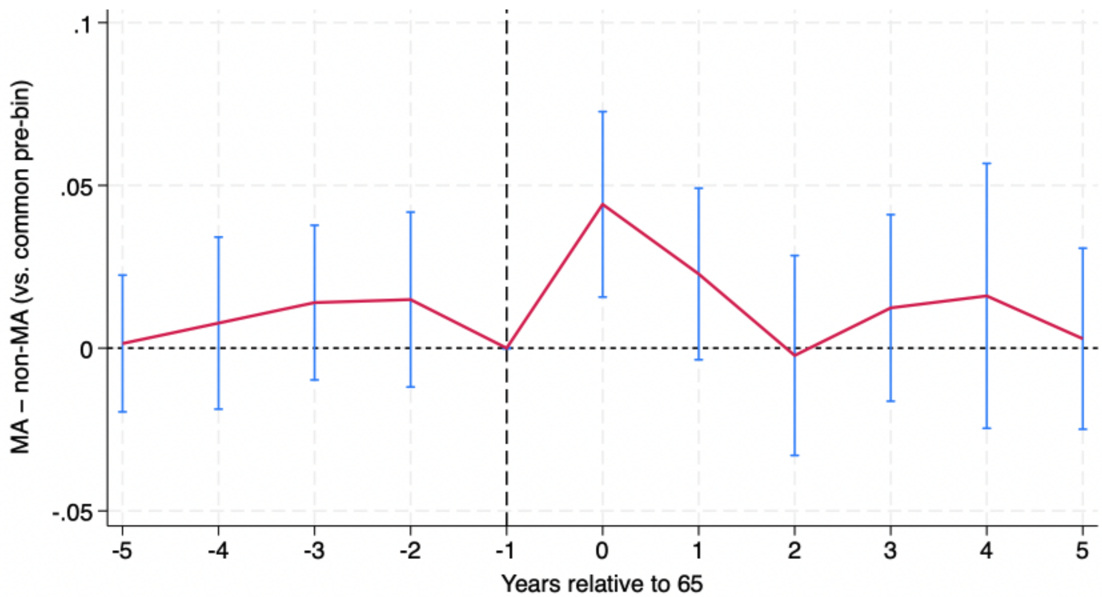


Figure 4
Notes: Event-study estimates of yearly differences in workout level between Medicare Advantage (MA) and Non-MA beneficiaries, relative to a reference year. The dotted horizontal line indicates zero difference and the dashed vertical line marks a reference year which is a year before Medicare eligibility. Points represent bin means and bars show 95% confidence intervals.

5 Heterogeneous Analysis

We investigate whether the RDDD differential effect of medicare eligibility on daily exercise differs across subgroups. Heterogeneity analysis is crucial for our understanding of how behavioral response to Medicare Advantage's fitness benefits. We examine heterogeneity along three dimensions : Gender, Race/Ethnicity (White vs all other groups) , Educational attainment (College degree vs No College degree). For each subgroup analysis, we estimate the same reduced-form RDDD specification used in the main analysis and report static RDDD estimate using data-driven optimal bandwidths and alternative bandwidths as well as dynamic event study.

5.1 Static RDDD results

Gender Differences

The static RDDD estiamtes in Tables 3 and 4 show that female beneficiaries exhibit larger increase in the probability of exercising daily at age 65. For female, the differential in discontinuity is around 5-6 percentage points at optimal bandwidths and remains positive across a range of alternative bandwidths. On the other hand, point estimates for male are smaller (around 2-4 percentage point) but statistically insignificant. This heterogeneity in gender is consistent with prior evidence showing that women are more responsive to health promoting incentives and more women participate in MA fitness programs then men.

Race/Ethnicity Differences

Racial heterogeneity is prominent in Table 5 and Table 6. White respondents show small and statistically insignificant RDDD estimates across all bandwidths. in contrast, Non-White seniors respond strongly to MA fitness benefits with 14 percentage points at the optimal bandwidth. These effect sizes are among the largest among different subgroups. This pattern highlights that MA's supplement fitness offerings may benefit minority populations who face greater barriers to physical activity, including unequal access to community recreational facilities and higher financial constraints which all significantly limit the gym or fitness program participations.

Educational Differences Differential impact depending on educational attainment is also substantial in Table 7 and Table 8. Among college-educated respondents, we find no statistically significant results while non-college educated seniors show modest but significant responses. This finding implies that the MA fitness benefit reduces meaningful barriers for lower-education groups, potentially related to baseline knowledge about the benefits of exercise , affordability, access, and motivation.

Table 3: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, Male

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.606$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.043	0.047	0.052*	0.021	0.015
	(0.031)	(0.360)	(0.028)	(0.025)	(0.021)
Pre-66 mean, MA group[b]	0.038	0.031	0.036	0.032	0.032
Post-66 mean, MA group[b]	0.039	0.000	0.043	0.045	0.048
Pre-66 mean, Non-MA group[b]	0.047	0.095	0.043	0.043	0.043
Post-66 mean, Non-MA group[b]	0.042	0.000	0.044	0.044	0.045
Observations	2,274	148	2,789	3,897	4,677
R^2	0.571	0.549	0.553	0.499	0.465
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD estimates of the differential discontinuity at age 65 in a binary indicator for daily exercise, restricting the sample to male. The dependent variable equals 1 if the respondent reports exercising "every day", and 0 otherwise. The coefficient $\Delta^{MA} - \Delta^{\text{Non-MA}}$ captures the difference between the jump at age 65 for individuals in the MA group and the corresponding jump for the non-MA comparison group.[a] Coefficients are reported in percentage points.[b] Means are computed within the estimation sample for each bandwidth, separately by MA status; Standard errors clustered at the individual level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, Female

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.913$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.055**	0.583	0.059***	0.050***	0.028*
	(0.023)	(0.371)	(0.021)	(0.018)	(0.015)
Pre-66 mean, MA group[b]	0.020	0.000	0.021	0.021	0.020
Post-66 mean, MA group[b]	0.040	0.063	0.040	0.033	0.032
Pre-66 mean, Non-MA group[b]	0.021	0.014	0.021	0.021	0.021
Post-66 mean, Non-MA group[b]	0.022	0.042	0.021	0.024	0.024
Observations	3,651	208	3,935	5,398	6,402
R^2	0.520	0.554	0.522	0.447	0.389
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Estimates are obtained from the same reduced-form RDDD specification described in the male subgroup table in Table3. The only difference is that the sample is restricted to the subgroup indicated in each panel. All variable definitions, interpretation of coefficients, and model components (i.e. fixed effects, clustering of standard errors) remain identical.

Table 5: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, White Respondents

	Panel A: Main	Panel B: Alternative Bandwidths			
	(1) $h = 2.556$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	-0.002	0.208	0.023	0.019	0.003
	(0.026)	(0.146)	(0.020)	(0.018)	(0.015)
Pre-65 mean, MA group[b]	0.032	0.000	0.031	0.028	0.027
Post-65 mean, MA group[b]	0.046	0.027	0.043	0.040	0.042
Pre-65 mean, Non-MA group[b]	0.025	0.035	0.028	0.027	0.027
Post-65 mean, Non-MA group[b]	0.024	0.035	0.025	0.028	0.031
Observations	3,394	246	4,432	6,106	7,247
R^2	0.571	0.516	0.558	0.487	0.439
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Estimates are obtained from the same reduced-form RDDD specification described in the male subgroup in Table3. The only difference is that the sample is restricted to the subgroup indicated in each panel. All variable definitions, interpretation of coefficients, and model components (i.e. fixed effects, clustering of standard errors) remain identical.

Table 6: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, Non-White Respondents

	Panel A: Main	Panel B: Alternative Bandwidths			
	(1) $h = 2.915$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.141***	0.429	0.130***	0.080***	0.060**
	(0.037)	(0.440)	(0.034)	(0.028)	(0.023)
Pre-65 mean, MA group[b]	0.019	0.038	0.021	0.021	0.021
Post-65 mean, MA group[b]	0.037	0.038	0.038	0.034	0.032
Pre-65 mean, Non-MA group[b]	0.041	0.071	0.038	0.040	0.038
Post-65 mean, Non-MA group[b]	0.047	0.000	0.045	0.045	0.041
Observations	2,084	108	2,267	3,150	3,784
R^2	0.499	0.558	0.510	0.461	0.425
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Estimates are obtained from the same reduced-form RDDD specification described in the male subgroup in Table3. The only difference is that the sample is restricted to the subgroup indicated in each panel. All variable definitions, interpretation of coefficients, and model components (i.e. fixed effects, clustering of standard errors) remain identical.

Table 7: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, College-Educated

	Panel A: Main	Panel B: Alternative Bandwidths			
	(1) $h = 2.726$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.037	0.163	0.038	0.016	0.031
	(0.039)	(0.198)	(0.033)	(0.029)	(0.023)
Pre-65 mean, MA group[b]	0.031	0.000	0.032	0.026	0.028
Post-65 mean, MA group[b]	0.055	0.000	0.060	0.061	0.059
Pre-65 mean, Non-MA group[b]	0.039	0.045	0.039	0.041	0.038
Post-65 mean, Non-MA group[b]	0.043	0.045	0.046	0.047	0.047
Observations	1,906	120	2,207	2,988	3,576
R^2	0.576	0.520	0.558	0.487	0.458
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Estimates are obtained from the same reduced-form RDDD specification described in the male subgroup in Table3. The only difference is that the sample is restricted to the subgroup indicated in each panel. All variable definitions, interpretation of coefficients, and model components (i.e. fixed effects, clustering of standard errors) remain identical.

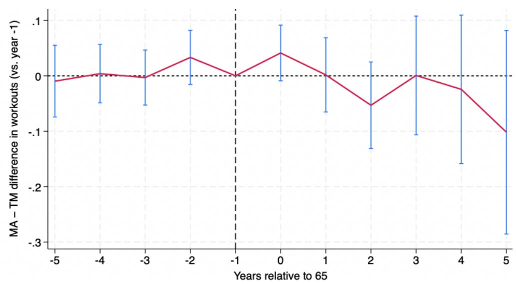
Table 8: RDDD Estimates of the Differential Jump in Daily Exercise at Age 65, Non-College Educated

	Panel A: Main	Panel B: Alternative Bandwidths			
	(1) $h = 2.726$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.053**	0.496	0.063***	0.049***	0.021
	(0.023)	(0.302)	(0.020)	(0.017)	(0.015)
Pre-65 mean, MA group[b]	0.024	0.021	0.024	0.024	0.023
Post-65 mean, MA group[b]	0.036	0.043	0.034	0.030	0.031
Pre-65 mean, Non-MA group[b]	0.027	0.043	0.024	0.024	0.025
Post-65 mean, Non-MA group[b]	0.023	0.014	0.023	0.025	0.026
Observations	3,762	234	4,465	6,230	7,415
R^2	0.534	0.514	0.524	0.470	0.417
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

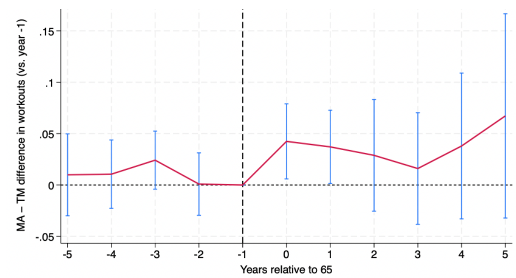
Notes: Estimates are obtained from the same reduced-form RDDD specification described in the male subgroup in Table3. The only difference is that the sample is restricted to the subgroup indicated in each panel. All variable definitions, interpretation of coefficients, and model components (i.e. fixed effects, clustering of standard errors) remain identical.

5.2 Dynamic RDDD event study results

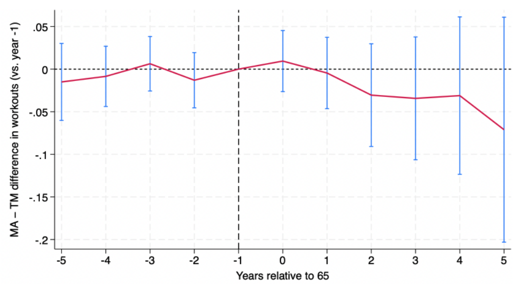
Figure5 presents event study plots for heterogeneity analysis, illustrating how daily exercise probability evolves relative to the reference year (a year before Medicare eligibility). Three consistent patterns emerge : (1) Within each subgroup, we do not find any pre-trend in difference in discontinuity in daily workout probability, (2) Non-white and female seniors show the largest and most immediate response at age 65 , (3) The effect does not persist in the longer term which is consistent with our main pooled RDDD specification results.



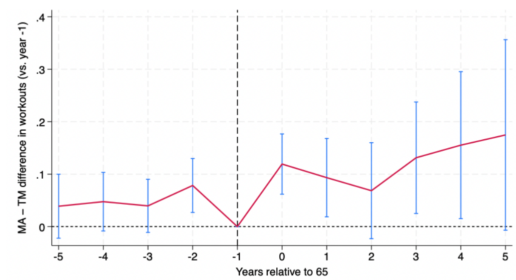
(a) Male



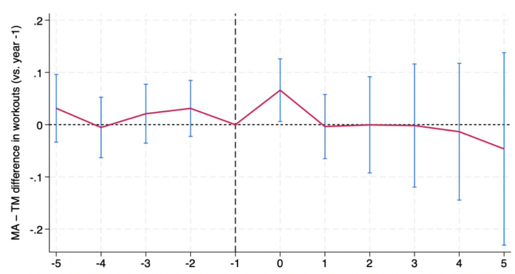
(b) Female



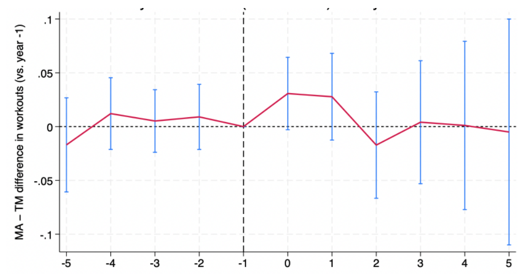
(c) White



(d) Non-White



(e) College degree



(f) No college degree

Figure 5
Reduced-form RDDD estimates of discontinuities in daily exercise between MA and non-MA respondents by subgroup. The dependent variable is a binary indicator equal to 1 for exercising every day. Coefficients represent subgroup-specific estimates of $\Delta^{MA} - \Delta^{\text{Non-MA}}$, the difference in discontinuities in daily exercise at the Medicare eligibility threshold. Pre- and post-65 means are calculated within each subgroup and bandwidth-specific estimation sample. Standard errors are clustered at the individual level. All models include individual and year fixed effects.

6 Robustness Check

To assess the validity of our results, we perform a comprehensive set of robustness checks that address potential concerns about our findings. These series of robustness checks support the estimated differential discontinuity at age 65 represents a genuine behavioral response associated with the enrollment in Medicare Advantage with fitness benefits, rather than the artifacts of model specification, age related dynamics,and local irregularities in the running variables, or spurious discontinuities.

6.1 Alternative Workout Frequency Measure

To assess whether our main findings are sensitive to the strict binary threshold defining daily vigorous physical activity, we complement the primary specification with a quasi-continuous recoding of the workout frequency measure. While the binary indicator isolates respondents who consistently engage in vigorous exercise at the highest observable frequency, providing a conservative and policy-relevant measure, it may mask meaningful variation in lower but still behaviorally significant activity levels. To address this, we construct a parsimonious 0–1–7 scale in which "hardly ever or never" is coded as 0, intermediate low-frequency responses ("once a week" and "one to three times a month") as 1, higher but non-daily frequency ("more than once a week") also as 1, and "every day" as 7. The persistence of the effect under this alternative outcome specification in Table 9strengthens our conclusion that Medicare Advantage enrollment meaningfully increases physical activity among MA groups compared to Non-MA groups. Figure6 represents the event study plot tracing the dynamic evolve of the difference in discontinuities compared to a reference year. It underscores the immediate positive impact and parallel trends as we find in our main RDDD specification.

Table 9: RDDD Estimates of the differential jump in workout at age 65

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.853$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$[a]	0.059***	0.411*	0.057***	0.039***	0.024*
	(0.018)	(0.236)	(0.017)	(0.015)	(0.013)
Pre-65 mean, MA group[b]	0.670	0.578	0.677	0.667	0.660
Post-65 mean, MA group[b]	0.731	0.672	0.737	0.722	0.729
Pre-65 mean, Non-MA group[b]	0.715	0.684	0.713	0.718	0.726
Post-65 mean, Non-MA group[b]	0.707	0.711	0.701	0.700	0.705
Observations	6,226	356	6,724	9,295	11,079
R^2	0.542	0.503	0.539	0.476	0.433
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD estimates of the differential discontinuity at age 65 in a discrete measure of vigorous exercise, using different bandwidth choices h (in years). The dependent variable takes values 0, 1, or 7, corresponding respectively to "hardly ever or never", "more than once a week, one to three times a month , once a week", and "every day".[a] The coefficient $\Delta^{MA} - \Delta^{\text{Non-MA}}$ captures the difference between the jump at age 65 for individuals in the MA group and the corresponding jump for the non-MA comparison group; coefficients are reported in units of the 0–1–7 exercise index.[b] Means are computed within the estimation sample for each bandwidth, separately by MA status and pre-, post- age 65; values report the average of the 0–1–7 index. Standard errors clustered at the individual level are reported in parentheses. All specifications include individual and year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

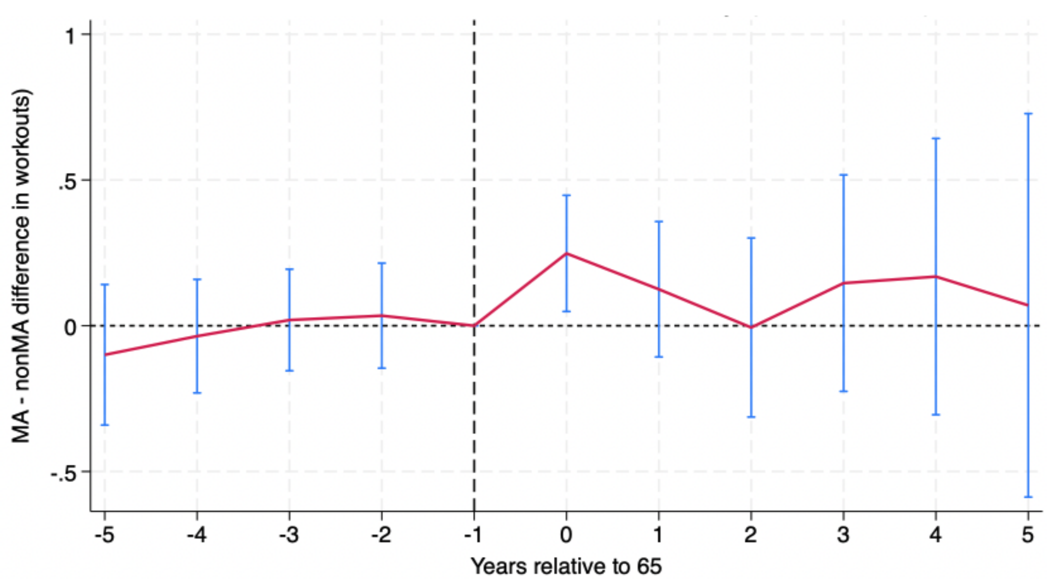


Figure 6
Notes: Event-study estimates of yearly differences in workout level (0,1,7) between Medicare Advantage (MA) and Non-MA beneficiaries, relative to age 65. The dotted horizontal line indicates zero difference and the dashed vertical line marks the reference year. Points represent bin means and bars show 95% confidence intervals.

6.2 Alternative outcomes: Retirement and Private Insurance Enrollment Status

We estimate the same RDDD specification using two alternative outcomes that possibly change around Medicare eligibility that may affect workout frequencies : retirement and the number of private insurance coverage status such as employer-sponsored supplemental plans. The purpose of these tests is to rule out the possibility that the seemingly physical activity jump reflects broader life-cycle transitions around age 65. Consistent with expectations, retirement does not show a meaningful differential discontinuity at age 65 represented in Table10. In addition, we find statistically significant decline in the number of private insurance plans at age 65 for the MA group relative to non-MA group shown in Table11. This sharp reduction indicates that seniors are not simultaneously holding private coverage that could independently encourage exercise. The only insurance margin that changes discontinuously at age 65 for MA group is the shift into MA plans which uniquely offer structured free fitness benefits.

Table 10: RDDD Estimates of the differential jump in retirement at age 65

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.853$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.047	0.095	0.039	0.048	0.033
	(0.039)	(0.426)	(0.037)	(0.032)	(0.027)
Pre-65 mean, MA group	0.338	0.391	0.333	0.290	0.262
Post-65 mean, MA group	0.563	0.438	0.565	0.585	0.599
Pre-65 mean, Non-MA group	0.306	0.339	0.299	0.259	0.235
Post-65 mean, Non-MA group	0.476	0.452	0.477	0.487	0.496
Observations	6,265	358	6,764	9,336	11,122
R^2	0.748	0.804	0.739	0.693	0.665
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD estimates of the differential discontinuity in retirement status. The dependent variable equals 1 if the respondent reports being retired. [a] Coefficients are in percentage points. Standard errors clustered at the individual level in parentheses. All specifications include individual and year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: RDDD Estimates of the differential jump in private coverage at age 65

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.14$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ [a]	-0.345^{***}	0.050	-0.350^{***}	-0.399^{***}	-0.418^{***}
	(0.080)	(0.673)	(0.047)	(0.040)	(0.036)
Pre-65 mean, MA group[b]	0.714	0.656	0.710	0.708	0.712
Post-65 mean, MA group[b]	0.217	0.266	0.178	0.166	0.163
Pre-65 mean, Non-MA group[b]	0.776	0.757	0.780	0.781	0.784
Post-65 mean, Non-MA group[b]	0.717	0.722	0.703	0.712	0.712
Observations	3,837	358	6,730	9,294	11,079
R^2	0.751	0.748	0.722	0.677	0.656
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD estimates of the differential discontinuity at age 65 in the number of for private health insurance enrollment, using different bandwidth choices h (in years). The coefficient $\Delta^{MA} - \Delta^{\text{Non-MA}}$ captures the difference between the jump at age 65 for individuals in the MA group and the corresponding jump for the non-MA comparison group.[a] Coefficients are reported in the number of private insurance plans.[b] Means are computed within the estimation sample for each bandwidth, separately by MA status and by whether age is below (Pre-65) or above (Post-65) the cutoff; values are the number of private insurance plans. Standard errors clustered at the individual level are reported in parentheses. All specifications include individual and year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.3 Donut hole analysis

Next, we address concerns about the possible manipulation or administrative errors that can happen within a very narrow window around the Medicare eligibility cutoff. To check this local irregularities, we re-estimate the model excluding the window of 3 months pre- and post-65. This "donut hole" deliberately removes the data most sensitive to local misreporting or potential manipulation and tests the stability of our main RDDD specification. As shown in Table12,the RDDD results stay robust and it suggests that our main results are not driven by peculiarities among small group of individuals within the narrow window around the Medicare eligibility cutoff.

Table 12: RDDD Donut-Hole Estimates of the differential jump in workout at age 65

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 2.853$	(2) $h = 1$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	0.052***	0.411*	0.050***	0.034**	0.022*
	(0.019)	(0.236)	(0.017)	(0.015)	(0.013)
Pre-65 mean, MA group[b]	0.027	0.016	0.027	0.025	0.024
Post-65 mean, MA group[b]	0.037	0.031	0.039	0.037	0.038
Pre-65 mean, Non-MA group[b]	0.031	0.044	0.031	0.031	0.031
Post-65 mean, Non-MA group[b]	0.033	0.026	0.032	0.033	0.034
Observations	6,126	356	6,625	9,187	10,968
R^2	0.195	-0.038	0.206	0.185	0.176
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports reduced-form RDDD "donut-hole" estimates of the differential discontinuity at age 65 in a binary indicator for daily exercise, using different bandwidth choices h (in years). The donut-hole specification excludes individuals within 3 months on either side of age 65. Means correspond to probabilities of exercise everyday. Standard errors clustered at the individual level are reported in parentheses. All specifications include individual and year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.4 Placebo tests at false cutoffs

Lastly, we further validate our empirical design by performing placebo tests at a false cutoff of age 66, which serves as a critical falsification check. Unlike age 65, turning 66 does not correspond to any institutional or policy change in Medicare but possibly correspond to more retirement. Thus, a correctly specified RDDD model should produce no meaningful differential discontinuity at this artificial cutoff. Table13 shows these results and reports the placebo discontinuities statistically insignificant and negative direction. The absence of a spurious jump validates that our main RDDD specification is unique to the true eligibility threshold at age 65.

Table 13: Placebo RDDD Estimates of the differential jump in workout at age 66

	Panel A: Main	Panel B: Alternative bandwidths			
	(1) $h = 3.282$	(2) $h = 1$	(3) $h = 2$	(4) $h = 4$	(5) $h = 5$
$\Delta^{MA} - \Delta^{\text{Non-MA}}$ (pp)[a]	-0.019	-0.157	0.008	-0.013	-0.021
	(0.020)	(0.185)	(0.036)	(0.017)	(0.014)
Pre-66 mean, MA group[b]	0.028	0.000	0.028	0.030	0.029
Post-66 mean, MA group[b]	0.036	0.048	0.033	0.038	0.035
Pre-66 mean, Non-MA group[b]	0.028	0.000	0.026	0.028	0.029
Post-66 mean, Non-MA group[b]	0.036	0.000	0.036	0.038	0.038
Observations	6,369	114	2,746	8,104	10,237
R^2	0.508	0.548	0.568	0.485	0.443
Individual fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Table reports placebo reduced-form RDDD estimates of the differential discontinuity at age 66 (instead of the true age-65 eligibility cutoff) in a binary indicator for regular exercise, using different bandwidth choices h (in years). The dependent variable equals 1 if the respondent reports exercising "every day", and 0 otherwise. The coefficient $\Delta^{MA} - \Delta^{\text{Non-MA}}$ captures the difference between the jump at age 66 for individuals in the MA group and the corresponding jump for the non-MA comparison group.[a] Coefficients are reported in percentage points.[b] Means are computed within the estimation sample for each bandwidth, separately by MA status and by whether age is below (Pre-66) or above (Post-66) the cutoff; values are probabilities of daily exercise. Standard errors clustered at the individual level are reported in parentheses. All specifications include individual and year fixed effects.

7 Conclusion

We provide the first quasi-experimental evidence on how Medicare Advantage (MA) enrollment shapes seniors' vigorous exercise with the binary indicator for exercising daily. Exercising daily gets higher chance for seniors to meet the federal physical activity guideline which is more than 150 minutes of moderate-intensity , or 75 minutes vigorous-intensity exercise per week. Exploiting the Regression Discontinuity in Difference in Difference (RDDD), we estimate a reduced-form of differential discontinuity in the probability of exercising everyday at age 65 for MA enrollees compared to Non-MA enrollees. This approach addresses selection concerns by differencing out both observable and unobservable characteristics within and across groups. Using nationally representative panel data from Health and Retirement Study, we find a meaningful and sizable increase in the probability of daily exercise at age 65 for the MA group compared to Non-MA group. These results emphasize the behavioral impact of supplemental fitness benefit which is uniquely provided by MA plans.

Our findings have several implications and contributions. First, they demonstrate health insurance benefit structure trigger behavioral response, preventive health behavior in particular. By reducing financial and logistical barriers to structured exercise programs, MA plans effectively lead to more active lifestyles when the free fitness benefits activate at the Medicare eligibility. Even modest improvements in vigorous physical activity at older ages may generate substantial effect considering the fact that the baseline physical activity is significantly low among older populations.

In addition, the heterogeneity results underscore who benefits the most from these incentives. The largest increase in daily exercise occur among Non-White senior groups that historically face structural barriers to physical activity and gym access. Our finding signals that fitness benefits embedded in MA plans may be particularly effective in narrowing socioeconomic and racial disparities in healthy aging especially through improving the access to better physical activity.

Lastly, the attenuation of effects after age 65 demonstrates the need for sustained engagement. While MA eligibility induces an immediate behavioral response, maintaining improvements in physical activity requires recurring incentives, targeted outreach, government support, or even more personalized wellness program. Our results call attention to the potential value of continued reinforcement rather than one-time eligibility shock.

As MA penetration continues to grow exponentially, the scope and the structure of supplemental fitness benefit will play an increasingly crucial role in shaping health trajectory of the aging population. Our findings emphasize the well-designed, structured insurance programs can function as a policy lever that actively promote healthy aging and provide actionable guidance for policymakers and insurers seeking to design programs that foster healthy life-style.

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