Racial and Ethnic Disparities in SSDI Entry and Health*

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Abstract

There has long been concern about racial disparities in Social Security Disability Insurance (DI), but little is known about how the health and entry patterns of DI recipients vary by race and ethnicity. In this paper, we describe trends in the racial/ethnic composition of DI recipients and show how the health of DI entrants and the responsiveness of DI entry to economic conditions and program rules varies with race and ethnicity. Our analysis relies on the racial/ethnic categorization in Medicare administrative data, so we begin by validating this variable against Census self-reports. We proceed to document the race and ethnicity of all DI recipients since 1992. Turning to entry patterns, we find that per-capita DI entry is highest among Blacks and lowest among Asians, while illness burden as measured by medical expenditure and mortality is lowest among Asians and Hispanics and highest among Blacks and Natives. Third, we analyze how poor economic conditions affect DI entry for different racial and ethnic subgroups. Finally, we show racial/ethnic variation in the effect of an age-based change in the program rules for eligibility. We find that the impact of relaxing the eligibility rules at ages 50 and 55 is largest among Natives and smallest among Asians.

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1 Introduction

There has long been concern about racial disparities in the DI program (GAO 1992). However, little is known about how the health and entry patterns of DI recipients vary by race and ethnicity. In a recent paper (**?**, henceforth CMM), we made use of the fact that DI recipients become eligible for Medicare two years after they begin to receive DI cash benefits to document the relationship between the health of DI entrants and economic conditions, shedding new light on the importance of age-based changes in DI eligibility that occur at ages 50 and 55 in driving cyclicality. This paper expands on our previous work by exploring trends in the racial/ethnic composition of DI recipients and how the health of DI entrants and the responsiveness of DI entry to economic conditions and age differs by race and ethnicity.

One of the main barriers to understanding racial differences in the DI program has been a lack of data on the race and health of DI recipients. Data on race and ethnicity is not available in SSA's public use data, and such information in its restricted use files is limited (Martin, 2016). We fill in this gap in three main ways. First, since DI recipients gain Medicare coverage after a 24-month qualifying period, we can use information contained in recipients' Medicare records to assign race/ethnicity to DI beneficiaries. Although these data have known limitations(Martin (2016), discussed below), they provide a unique window into the relationship between race/ethnicity, DI entry, and health and mortality among DI recipients. Thus our analysis provides insight into the equity implications of programmatic features of DI, such as the role of the grid rules in qualifying for DI. Second, DI entry increases in recessions, suggesting that other safety net programs like Unemployment Insurance (UI) fail to adequately support individuals with functional limitations during economic downturns. In particular, Black workers receive UI benefits at lower rates (Kuka and Stuart, 2021). Consequently our exploration of the sensitivity of DI entry to unemployment at application by race/ethnicity illuminates a key dimension of heterogeneity omitted from analyses of DI cyclicality (e.g., Autor and Duggan (2003); Maestas, Mullen and Strand (2021)). Third, CMM documented the importance of the age discontinuities in DI entry patterns, both overall and in response to unemployment. In this paper we examine these patterns by race/ethnicity. If sensitivity to the grid rule discontinuities differs by race/ethnicity, structural barriers like access to qualified legal assistance in applying for DI or reluctance to engage with the health care system may play a role in perpetuating these differences.

The rest of the paper proceeds as follows. In Section 2 we provide background information about the DI program and its relationship to Medicare. Section 3 describes the data, and Section 4 compares the racial patterns found in the Medicare data to those of the U.S. Census. Section 5 presents the main results, and Section 6 concludes.

2 Background

2.1 Disability Determination Process

The Social Security Disability Insurance program provides benefits to individuals with work-limiting disabilities that include cash benefits and health insurance through the Medicare program beginning 24 months later. For individuals with a qualifying work history, whether they are granted DI benefits is determined through a five-step process that assesses the individual's impairments and the types of work they are capable of doing on a sustained basis. The first step involves establishing that the applicant is not currently working. Applicants will be denied benefits if their average monthly earnings exceed a certain amount, which is known as the Substantial Gainful Activity threshold. Individuals who are not currently working continue on to step 2, where it must be established that the applicant's condition is sufficiently severe as to significantly limit their ability to work and is expected to last longer than a year.

For applicants who pass the first two steps, the third step assesses whether the individual's condition is among a number of "listed impairments." Listed impairments include things like cardiovascular diseases or musculoskeletal conditions that prevent independent movement. Often whether one has one of these conditions can be established through medical test results or other well-defined criteria. Individuals with listed impairments are granted DI benefits.

For those whose conditions are severe but do not meet the criteria of a listed impairment, the next step in the process involves determining whether the applicant is capable of sustained work. In step 4, SSA considers whether the person is capable of doing their former job, and for people who are determined not to be able to do their former jobs, step 5 asks whether there is any other type of work the person can do on a sustained basis. As part of the evaluation in step 5, recommendations are generated as to whether the person should be found disabled that take into account the person's maximum sustained work capacity, education, whether

their work history suggests they have skills that can be transferred to a new industry, and their age. These recommendations are codified in the so-called medical-vocational grid, or "grid rules."

At ages 50 and 55 the grid rule criteria relax discontinuously, so that a person with a particular work capacity, education, and level of transferable job skills is recommended to be found not disabled if their age is below the threshold but disabled if their age is above the threshold. For example, as can be seen in Table 1, an individual who is capable of sedentary work but does not have a high school degree or any transferable skills would be found not disabled prior to age 50 but disabled after age 50. As we documented in CMM, the change in the grid rules causes a jump in enrollment at the threshold ages of 50 and 55 as a group only admissible under the relaxed criteria joins DI; later, we will characterize the health status of this group by race/ethnicity.

2.2 Medicare Eligibility for DI Recipients

Medicare is the primary provider of medical insurance for disabled DI recipients.[1] Medicare Part A hospital coverage is provided to all disabled DI recipients, while Part B (physician services) coverage is available at an additional premium. DI recipients with low incomes may be entitled for secondary insurance through Medicaid, which will pay Medicare's premiums and cost-sharing and may also supply certain other services. DI recipients on Medicare have the option of choosing a Medicare Advantage (managed care) plan, and may choose to purchase a Medigap supplementary insurance policy if such policies are available in their area.

Medicare eligibility for DI recipients begins 24 months after DI entry (e.g., 24 months after cash benefits begin). In our analysis of DI entry and economic conditions, we aim to characterize economic conditions at the time of application rather than DI entry. DI application can actually occur before or after DI entry; this is because retroactive DI benefits are awarded when an applicant's disability began before their application. Below, we describe how we leverage publicly-available data on application timing for those entering Medicare in a particular month to characterize economic conditions at application for DI recipients in Medicare.

[1] Although DI may provide cash benefits to nondisabled dependents of disabled individuals, Medicare coverage is limited to the disabled.

3 Data and Measures

3.1 Medicare Data

Our primary analysis sample is derived from administrative Medicare data covering all beneficiaries in 1992–2017. We first develop a "universe" sample of all DI recipients in Medicare over this time period.[2] This sample is limited to Medicare beneficiaries under age 65, and additionally excludes individuals who gained Medicare coverage due to end-stage renal disease and are unlikely to be eligible for DI. There are 44,968,618 individuals represented in this sample, observed over an average of 4.6 years each.

Secondly, we develop an "entrant" sample, which captures previously-working individuals entering DI between the ages 20 to 60 over the years 1991 to 2015. To ensure a focus on previously-working individuals, we exclude those with childhood disabilities (who enter DI after a redetermination at age 18) and those who enter DI close to the early retirement age of 62. To measure age at DI entry, we use each individual's date of birth and Medicare coverage start date and take an individual's DI entry date to be 24 months (the duration of the Medicare qualifying period) before their Medicare coverage start date. Our final Medicare sample includes 15,790,262 beneficiaries gaining Medicare eligibility at ages 22–62 in 1993–2017, corresponding to DI entry at ages 20–60 in 1991–2015.

Most DI recipients who exit the program actually remain in Medicare.[3] Since we are interested in characterizing the health of DI recipients, we retain all observations of these individuals, even if they are no longer DI recipients.

Our primary measure of health status is medical spending, observed for fee-for-service Medicare (FFS) beneficiaries in 1999–2017. Our measure of spending is the total allowed amount—the Medicare portion plus beneficiary cost-sharing—for all covered services.[4] For each beneficiary, we measure annual medical spending in each year they are enrolled only in

[2]Our "universe" sample of DI recipients in Medicare is close to the universe of DI recipients with disabilities over this time period; analysis reported in **?** suggests that about 5% of DI recipients die during the 24 month waiting period for Medicare eligibility.

[3]DI exits occur predominantly for four reasons: conversion to Old Age and Survivors Insurance retirement benefits, return to work, medical improvement, and death. Retirement conversions occur at age 65 and Medicare eligibility continues without interruption. Beneficiaries younger than age 65 who return to work above the SGA level retain Medicare eligibility for at least 8.5 years (Social Security Administration, n.d.). For those who experience a medical improvement, which may be established at a routine audit, Medicare eligibility ends the month after notification of the terminating event.

[4]Covered services include physician visits, inpatient hospitalizations, outpatient services such as imaging or outpatient surgeries, stays in skilled nursing or hospice facilities, and durable medical equipment. We exclude spending on outpatient prescription drugs, which were not covered by Medicare until 2006.

FFS, beginning with the first calendar year after their Medicare coverage starts. We convert all spending values to 2017 dollars using the CPI-U for medical care.

Our secondary measure of health status is mortality, which we observe for all Medicare beneficiaries and in all years of the sample. For each beneficiary, we measure mortality as an indicator for death in each year they are enrolled in Medicare, beginning with the first calendar year after their Medicare coverage starts. To adjust for secular mortality trends, we deflate the death indicators by annual mortality among all US residents aged 20–84 relative to year 2017, analogous to the CPI adjustment for medical spending.

Finally, we measure DI entry rates for each racial/ethnic group, county, and month. The numerator for this rate is a count from the primary Medicare sample of DI recipients aged 22-62 entering Medicare. The denominator is the population for that race/ethnicity, county, month, and age range, obtained from CDC Wonder (Census Bureau Population Estimates Program, n.d.).

3.2 Race Data

The race and ethnicity information in Medicare's enrollment data come from information voluntarily provided to SSA when the individual was issued a Social Security card (Office of the Inspector General, 2022). There are a number of reasons why this data collection falls short of current best practices. First, prior to 1980, individuals were constrained to choose one of only three categories when applying for a Social Security card: White, Black, or Other. Even after 1980, SSA collected race/ethnicity via a single question and required individuals to select a single category. Second, beginning in 1989 SSA discontinued collecting this information because Social Security numbers were assigned along with birth certificates rather than through filling out a separate form. Thus, the SSA-collected variable fails to capture all racial categories, conflates race and ethnicity, most reflects a parent's report at birth (rather than self-report), and is missing for younger beneficiaries or immigrants.

Medicare records report two variables capturing race. One, the beneficiary race code (BRC) is derived from SSA data. The other, the Research Triangle institute (RTI) Race Code, modifies the BRC using an algorithm that takes into account the applicant's first and last name, geography, and the language used for agency communications (Zuckerman et al., 2022). These variables take on one of seven values: Unknown, non-Hispanic White, Black (or African-American), Other, Asian/Pacific Islander, Hispanic, American Indian /

Alaska Native.[5] Relative to the BRC data, the RTI race code corrects for well-established undercounting of Hispanics, Asian American/Pacific Islanders, and American Indians/Alaska Natives. When compared to self-reported data for Medicare beneficiaries who receive home health services, the RTI race code continues to somewhat undercount Asians and Natives (Jarrín et al., 2020). However, the RTI race code is the primary variable that CMS uses in reporting on disparities since self-report is not available for most beneficiaries (Office of the Inspector General, 2022).

In our "universe" sample, the RTI race code is available for 55% of beneficiaries. For our "entrant" sample, the subset of the DI recipient universe entering in 1993 or later, we observe the RTI race code for 97% of beneficiaries.

4 Validation of Medicare's Racial/Ethnic Categories

To evaluate the validity of the race/ethnicity information we use for our analysis, we compare the prevalence of various categories in our Medicare analysis sample to that which is found in the U.S. Census. To make the comparison as close as possible, we focus on individuals who were 66 years old in 2017. There are several potential sources of differences between the Medicare sample and the Census. First, the Census contains all U.S. residents, while the Medicare data contain only Medicare beneficiaries. In particular, due to work-history requirements we expect there to be individuals in the Census who are not found in Medicare. Second, the Census collects race and ethnicity information through separate questions, while Medicare uses only a single question. This could lead to issues in, for example, the case of the roughly one third of individuals who identify as American Indian/Alaska Native who also identify as Hispanic. It is not clear which one of the Medicare categories such people would choose. Third, the Census categorizes all individuals, while Medicare admits the category "Other/unknown". Finally, the Census race information was self-reported in 2017, while the Medicare data was collected at the time of Social Security application, commonly by the applicants' parent, and norms on how to answer these questions may have changed in the interim.

Sources of Difference

[5] see https://resdac.org/cms-data/variables/research-triangle-institute-rti-race-code. Throughout the paper we use NH to indicate non-Hispanic.

Census	Medicare
US residents	Beneficiaries
Race AND ethnicity	Single variable
Everyone categorized	"Other/Unknown"
Self-reported in 2017	Reported at SS card application

Before beginning our analysis, we need to align the categories in Medicare with those of the Census. We crosswalk the White, Black, Asian/Pacific Islander and American Indian/Alaska Native categories in Medicare to the corresponding answers to the Census race question provided the respondent also anwers that they are not Hispanic or Latino. Conversely, we equate the Medicare category "Hispanic" with the group of individuals who declare in the Census data that they are of Hispanic or Latino origin.

Using this crosswalk, Figure 1 provides counts of individuals who are 66 years old in 2017 by Medicare race category. Figure 2 presents the same information expressed as a ratio of the number of people in Medicare relative to the number in the Census. Overall, the Medicare data captures the population quite well, with the total number of Medicare beneficiaries coming to 97.4% of the Census population. This slight undercount is to be expected due to the fact that some U.S. residents will be ineligible for Medicare. The Medicare data represents the vast majority of White non-Hispanics (94.7%) and Black non-Hispanics (95.8%), with slightly lower representation of Hispanics (90.6%). However, despite efforts to correct for undercounting in the Medicare data using the RTI algorithm, Asians and American Indians/Alaska Natives are still significantly undercounted, with the total number of Medicare beneficiaries categorized as Asian equaling only 75.9% of the total U.S. residents reporting Asian race and non-Hispanic ethnicity in 2017; the corresponding figure for Natives is only 61.9%.

While these figures indicate undercounting of race/ethnicity categories on average, due to the coarse nature of the raw data and imperfections in the RTI algorithm, we cannot rule out offsetting errors (e.g., there may be individuals categorized as Hispanic who are actually Asian while others are categorized as Asian while actually being Hispanic). To address potential undercounting, in some of our results we will reweight the size of the groups by the ratios in Figure 2.

Alignment of Race/Ethnicity Categories in Medicare and the Census

Medicare	Census Race	Census Ethnicity
White Non-Hispanic (NH)	White	Not Hispanic or Latino
Black	Black or African American	Not Hispanic or Latino
Asian/Pacific Islander	Asian/Pacific Islander	Not Hispanic or Latino
Hispanic	Any Race	Hispanic or Latino
American Indian/Alaska Native	American Indian/Alaska Native	Not Hispanic or Latino

5 Results

In this section, we will present several sets of results that characterize the racial/ethnicity makeup of DI recipients in the Medicare population and possible heterogeneity in their propensity to enter the program or their health once on the program.

5.1 Racial/Ethnic Composition of DI Over Time

Figure 3 characterizes the racial/ethnic composition of all DI recipients in Medicare over time. Over the period of our analysis, the fraction of White NH has declined somewhat, offset by an increase in Black NH, Hispanic, and Asian NH. Over time the Unknown category has also decreased.

While Figure 3 characterizes the levels of the different racial/ethnic groups in our study population, Figure 4 characterizes new entrants into the program. The curves depict the number of monthly entrants into DI in each racial/ethnic group per million such residents in the population. Thus the height of the curve characterizes the risk of a member of each group entering into DI. Here we see that, as a fraction of their respective populations, Black NH enter DI most frequently, followed by White NH and Native NH. Hispanics have somewhat lower risk of entering, and Asian NH have the lowest overall rate of entry.

The curves in Figure 4 are roughly parallel, showing similar patterns over time. As we show in CMM, CI entry tends to rise in recessions and fall in expansions, and we see that this pattern holds true within each of the racial/ethnic groups. [6]

As discussed above, one potential issue in comparing entry rates across different racial/ethnic groups in DI is that different groups are undercounted at different rates relative to the Census

[6] Although this cylical pattern appears less pronounced among Asians, this is to some extent an artifact of their lower overall entry rate.

population. To address this issue, Figure 5 adjusts the level of the curves by the undercounting ratios reported in Figure 2. After adjusting for undercounting, Black NH and Native NH have the highest entry rate consistently over the period of our study, followed by White NH, Hispanic NH, and Asian NH. Thus the primary change between the unadjusted and adjusted entry rates is on the Native NH group.

Summarizing, we find that the entry rate is always highest for the Black NH group. The entry rate for the Native NH group may be similarly high, or somewhat lower (closer to White NH) depending on the extent of undercounting of this group. The White NH group, consistently the largest in our data, falls in the middle, with the Hispanic and Asian NH groups having lower entry rates. These differences among groups can be significant. Throughout our data, NH Asians are about one third as likely to enter DI as Whites. On the other hand, NH Blacks are 1.5 to 2 times as likely to enter as NH Whites, and 4 to 5 times as likely to enter as NH Asians.

5.2 Health of DI Recipients by Race/Ethnicity

We now turn to examining heterogeneity in the health of DI recipients across the Medicare racial/ethnic categories. We first consider total medical spending by Medicare as a summary measure of recipients' health. For each beneficiary in our "entrant" sample, we measure total medical spending (measured in 2017 dollars) for the calendar years 1999-2017. Our analysis sample consists of 125 million beneficiary-years, with the average beneficiary observed for an average of 8 years. Importantly, we only observe medical spending for beneficiaries enrolled in traditional, fee-for-service Medicare. Thus our analysis does not capture the 22% of beneficiaries in Medicare Advantage. [7]

Figure 7 shows average total annual Medicare spending for each of the Medicare race/ethnicity categories. The blue columns are raw averages, while the orange columns include age and year fixed effects to control for differences in the composition of the groups and annual patterns in Medicare spending. Individuals in the Whites NH and Asian NH groups have the lowest spending. Relative to these groups, Black NH individuals spend 36-40% more, while

[7]Figure 6 reports enrollment in Medicare Advantage among DI recipients by race/ethnicity over time. In the early part of the sample period, most racial/ethnic groups experienced parallel trends in Medicare Advantage enrollment, but in recent years Hispanics and Blacks have increased enrollment most quickly. The faster growth for Blacks and Hispanics confirms the pattern reported in Meyers et al. (2021) for all Medicare beneficiaries.

people in the Native NH group spend roughly 21% more. These differences are robust to inclusion of age and year fixed effects, suggesting the differences are not due to differences in the age composition within groups (e.g., if Black NH DI recipients are older than their White NH counterparts) or differential patterns over time.

While spending averages are a good proxy measure for overall health, they could be influences by differential patterns to access the healthcare system across the groups. For example, if Asian NH are less likely to go to the doctor than members of other groups, this could account for their lower spending without capturing a true difference in health. To address this issue, we also consider mortality rates across the different groups. These findings are presented in Figure 8. In contrast to the spending results, here we find similar mortality rates across the White NH, Black NH, and Native NH groups, with somewhat (30%) lower mortality for Asian NH and Hispanics.

Across both measures, Black NH and Native NH DI recipients appear to be in worse health, while Asian NH and Hispanic individuals are in better health. For the White NH group, the results are somewhat more nuanced, with lower spending but higher mortality.

5.3 Heterogeneity in the Response of DI Entry to Economic Conditions

To characterize how DI entry rates relate to local economic conditions at the time of application, we follow methods from CMM to estimate the local unemployment rate at the time of application.

A challenge with assigning conditions at application to DI beneficiaries in our primary sample is that Medicare data do not report DI application dates. Instead, we use SSA's Disability Analysis File Public Use File (PUF) (2018 vintage), which contains individual-level data on DI program participation and benefits for a random 10% sample of individuals who have received disability benefits in any month in 1996–2018. The PUF reports the start date of DI benefit entitlement ("entry date"), the date the DI application was filed ("application date"), the start date of Medicare coverage, and date of birth.

We use the PUF to calculate the fraction $p_{m\tau}$ of DI beneficiaries who gained Medicare coverage in month m (in 1993–2017) and applied for DI in month τ (in 1990–2017). We obtain monthly unemployment for county c and month τ from the Bureau of Labor Statistics from

1990 to 2017. We then calculate the average county unemployment rate at application for DI beneficiaries who gain Medicare coverage in month m and county c as the average county unemployment rate $u_{c\tau}$ in all months τ, weighted by $p_{m\tau}$; that is,

$$[\textit{unemployment rate}]_{cm} = \sum_{\tau} p_{m\tau} u_{c\tau}.$$

We now turn to considering whether and how racial/ethnic groups differ in their response to changes in economic conditions. We use the county unemployment rate as our proxy for overall economic conditions, because the Bureau of Labor Statistics does not report the unemployment rate for racial/ethnic groups except for the nation as a whole; note the relevance of the county unemployment rate for a particular racial/ethnic group depends on the racial/ethnic homogeneity of the county. We examine the impact of changes in county unemployment on race-specific DI entry rates.

Our analysis follows the method employed in CMM and is based on the regression model of Liebman (2015). Specifically, we estimate the following regression, which essentially amounts to estimating the primary regression equation from CMM separately by race.

$$\textit{Entry}_{rcm} = \alpha_r [\textit{unemployment at application}]_{cm} + \delta_{cr} + \varepsilon_{rcm}$$

In equation 5.3, the dependent variable, $\textit{Entry}_{rcm}$, is the number of DI entrants of race r in county c and month m per million residents. The primary independent variable is $[\textit{unemployment at application}]_{cm}$, the unemployment rate in county c in month m. We include county-by-race fixed effects to control for time invariant differences in entry across racial/ethnic groups and geography; these fixed effects isolate the portion of entry that varies over time and potentially covaries with economic fluctuations.

Figure 9 presents estimates of the primary coefficient of interest, α_r, scaled by the average entry rate for each racial/ethnic group. The White NH, Black NH, and Asian NH groups exhibit a similar sensitivity to unemployment, with a one percentage point increase in local unemployment leading to around a 4.5 percent increase in their DI entry rate. The Native NH and Hispanic groups have significantly lower responsiveness rates, about half the size of the rate for the other groups. Note that the proportional response reported in Figure 9 should not be affected by undercounting, since undercounting should affect both its denominator (the average DI entry rate for the racial/ethnic group) and numerator (the increase in the DI entry rate for each percentage point of unemployment) similarly.

5.4 Heterogeneity in the Effect of a Change in DI Eligibility Rules

We now turn to characterizing heterogeneity in the response to a age-related change in the rules that govern entry in to the DI program.[8] As described in Section 2, the recommendations for DI eligibility are codified in the program's "medical-vocational grid rules," which, while not binding, strongly influence whether or not a person is judged to be disabled and admitted to the program. For our purposes, a key feature of the rules is the criteria relax as individuals reach ages 50 and 55, making it more likely that an applicant will be admitted to DI.

One potential criticism of the analysis of the impact of economic conditions on entry is that economic conditions, themselves, may change health and consequently the likelihood of qualifying for DI. If these impacts differ by race/ethnicity, then these health changes could be driving the differential entry patterns we found in the previous section. The grid rule discontinuities provide another insight into this point by acting as an exogenous factor that increases the likelihood of entering into DI but do not directly affect health.

Before turning to heterogeneity by race, the aggregate impact of the grid rule relaxations at ages 50 and 55 is depicted in Figure 10 (reproduced from CMM), which depicts entry into DI as a function of age. As is apparent, the entry rate increases smoothly with age up to age 50, where there is a spike. Between ages 50 and 55, the slope of the curve returns to what it was at younger ages, but there is an apparent level shift at age 50, capturing the fact that the rules not only relax at age 50, but they remain relaxed as applicants continue to age. Another spike in entry occurs when the rules relax even further at age 55, and there is another apparent level shift at higher ages.[9]

Figure 11 decomposes the trend in Figure 10 by race/ethnic group, where we see that the basic features of the aggregate curve are reproduced for each race/ethnic category. At all ages, the Black NH group has the highest entry rate into DI, followed by White NH, Native NH, and Hispanics, all of which are roughly equal. The Asian NH group has the lowest entry rate, which is about half as large as the White NH entry rate and less than one third as large as the Black NH entry rate at higher ages.

All groups exhibit spikes in their entry rate at ages 50 and 55. Although the spikes are

[8] See CMM for a fuller discussion of the age-related discontinuity in program rules at ages 50 and 55 and how the rules affect entry patterns and the health of DI recipients.

[9] The spike at the youngest ages arises from children who were disabled at lower ages who qualify for DI at age 18 as they reach adulthood.

smaller in absolute terms for the Asian NH group, this is partially a reflection of the group's lower overall entry rate. The following table characterizes the percentage increase in entry at ages 50 and 55, which are all quite similar. While the Asian NH group entry spikes are slightly smaller than those of the other groups the difference is less pronounced when viewed in percentage terms.

Race/Ethnicity	% Increase at 50	% Increase at 55
White NH	64%	50%
Black NH	73%	51%
Asian NH	51%	39%
Native NH	79%	50%
Hispanic	78%	45%

Figure 12 depicts average annual medical spending by age and race. The Black NH group is once again the highest, followed by the Native NH group. The Hispanic group has next highest spending, followed by White NH and Asian NH, although in the case of these last three groups the ranking is not as clear and changes somewhat at different ages. For each of the groups, there are downward deviations at ages 50 and 55, indicating that those who are admitted at these ages are somewhat healthier (i.e., less costly) than the age trend would predict, which is consistent with the fact that the eligibility requirements loosen at these ages.

Mortality by age and race is depicted in Figure 13. As one expects, mortality increases with age for all groups. Consistent with the relaxation of eligibility requirements at ages 50 and 55 we see downward deviations in mortality for all races, although they are somewhat smaller and not as clearly defined as in the case of spending. As in the case of spending, Black NH and Native NH have the highest age-mortality profiles. Unlike the case for spending where they were relatively low, the White NH group is similar to Black NH and Native NH. The Asian NH and Hispanic groups exhibit somewhat lower mortality, with around 30 deaths per thousand group members at age 60, relative to 45-50 deaths per thousand group members for the other groups.

The comparisons we have made so far look at average characteristics by age. However, focusing in on entrants at age 50 and 55, some of these entrants would have been admitted to DI even if the eligibility requirements had not changed, while others, whom we call the

discontinuity marginals, are admitted only under the less stringent criteria. As a final exercise we focus in on the discontinuity marginals in order to see whether their characteristics differ by race/ethnicity.

The changes in the grid rules at ages 50 and 55 are not directly related to health. Rather they tend to focus on the extent to which the applicant's skills are transferable to other jobs or industries; younger applicants are assumed to be able to transfer to a different industry even if they cannot work in their current job. Those admitted to DI because of the age discontinuity have limited work capacity ("sedentary" for 50 year olds and "light" for 55 year olds), a high school education or less, and a history of unskilled labor or labor without transferable skills, and we expect inframarginal entrants (i.e., those that would be admitted to DI even under the more strict criteria applied to younger applicants) to look similar below and above the discontinuity at ages 49 and 50, respectively. On the other hand, the relaxed criteria will also admit a group of healthier 50 year old marginals. Thus, if we assume that inframarginal 49 year olds and 50 year olds are the same, we can then back out the implied characteristics of the inframarginal 50 year olds.

Specifically, we back out the health of discontinuity marginals by assuming that the average health of those entering at an age threshold is a weighted average of the health of inframarginals and discontinuity marginals. Further, we assume that the number of 49 year olds is a good approximation of the number of inframarginals who enter at 50 years old, and that those inframarginals would be of similar health as 49 year old entrants. , and that, further, the inframarginals can be approximated by the size and health of 49 year old entrants. Letting N^{49} and N^{50} denote the number of 49- and 50-year-old entrants, and $\overline{health}^{49}$ and $\overline{health}^{50}$ their average health, we write the weighted average below.

$$\overline{health}^{50} = \frac{N^{49}}{N^{50}}\overline{health}^{49} + \frac{N^{50} - N^{49}}{N^{50}}\overline{health}^{m} \tag{1}$$

We observe N^{49}, N^{50}, $\overline{health}^{49}$ and $\overline{health}^{50}$ in the data and calculate $\overline{health}^{m}$, the implied average health of the marginals induced to join DI by the discontinuity.

The results of this exercise for overall spending and mortality at the first discontinuity (age 50) are presented in Figure 14. The blue columns represent overall spending for marginals from each race/ethnicity category relative to 49 year old entrants from that category, while the orange columns do the same for mortality. For the White NH group, the

age discontinuity marginals are very similar to the inframarginals, with only slightly lower spending and mortality. For Black NH and Hispanic, the marginal entrants have around 15% lower spending and mortality, consistent with the idea that the marginals are more distinct – substantially healthier – for those groups. The marginal Asian NH entrants are almost 40% cheaper than the inframarginals, but experience only around 10% lower mortality. Somewhat paradoxically, marginal Native NH entrants exhibit 20% lower spending but around 5% *higher* mortality than the inframarginal entrants from this group.

6 Conclusion

In this paper we developed a number of novel descriptive facts about racial and ethnic patterns in the DI program. Exploiting the fact that DI recipients receive health insurance through the Medicare system, we are able to document heterogeneous patterns not only in enrollment and entry into the program but also in health. After assessing the validity of Medicare's race/ethnicity variables using the United States Census, we showed that the highest rate of DI entry is found among non-Hispanic Blacks, while non-Hispanic Asians have the lowest rate, with non-Hispanic Whites and Hispanics falling in the middle. Depending on whether one adjusts for potential undercounting of Natives in the Medicare data, non-Hispanic Natives could have an entry rate as high as non-Hispanic Blacks, or it could be somewhat more moderate. In terms of our health measures, non-Hispanic Blacks have the highest spending and among the highest mortality rates, while non-Hispanic Asians do well in terms of both of these measures. For the other groups the two measures are not as consistent, with, for example, non-Hispanic Whites having low spending but high mortality, and Hispanics exhibiting the opposite pattern.

We document heterogeneity in the response of racial/ethnic groups to high unemployment. We find that non-Hispanic Whites, Blacks, and Asians respond to a one percent increase in the local unemployment rate by increasing DI enrollment by around 4 percent, with lower responsiveness in Hispanics and non-Hispanic Natives. When looking at entry into DI by age, we find that non-Hispanic Blacks have the highest entry rate into DI at all ages. Further, this group exhibits the highest medical spending and has among the highest mortality rate at all ages.

To the extent that a consistent pattern emerges it is that non-Hispanic Blacks enter DI

more often and have worse health (as measured by aggregate spending and mortality) than the other groups. However, it is not clear how this should be interpreted. If the Black NH group has a greater propensity to medical disability, then the higher entry rates and medical spending indicate that the DI program is working as intended, admitting people in need and providing those in worse health with more care. However, it is also possible that the Black non-Hispanic group does not gain access to DI until their conditions have progressed further than the other groups, which is why they need additional care.

While the Medicare data allows us to observe health outcomes for DI recipients, an important limitation of our analysis is that we observe only those who are admitted to the program and remain in it for two years until their Medicare coverage begins. Consequently, we are unable to consider questions such as whether some groups, conditional on their medical conditions, are more or less likely to be admitted to DI. We are also unable to investigate the causal impact of DI on health (and potential differences across races) due to the fact that we do not observe DI recipients before joining the program nor do we observe people who are never admitted to the program.

Nevertheless, the racial and ethnic patterns in DI entry and health that are documented for the first time in this paper should provide important guidance to policymakers considering the design and implementation of DI or planning for the program's future needs in light of the country's changing demographics.

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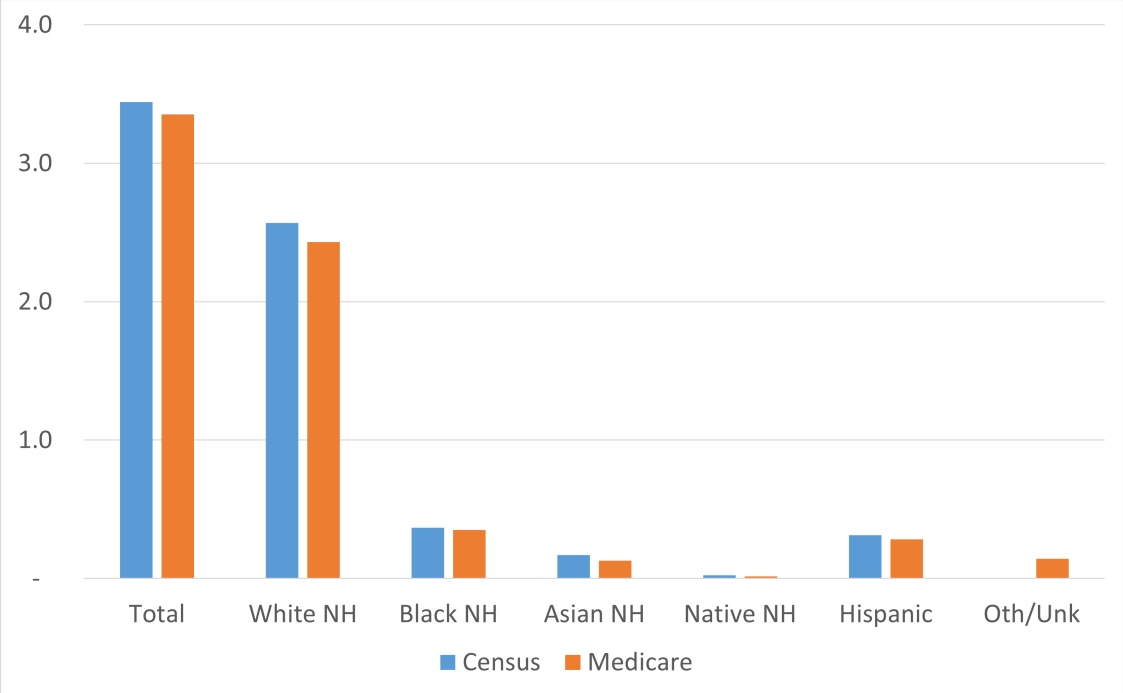
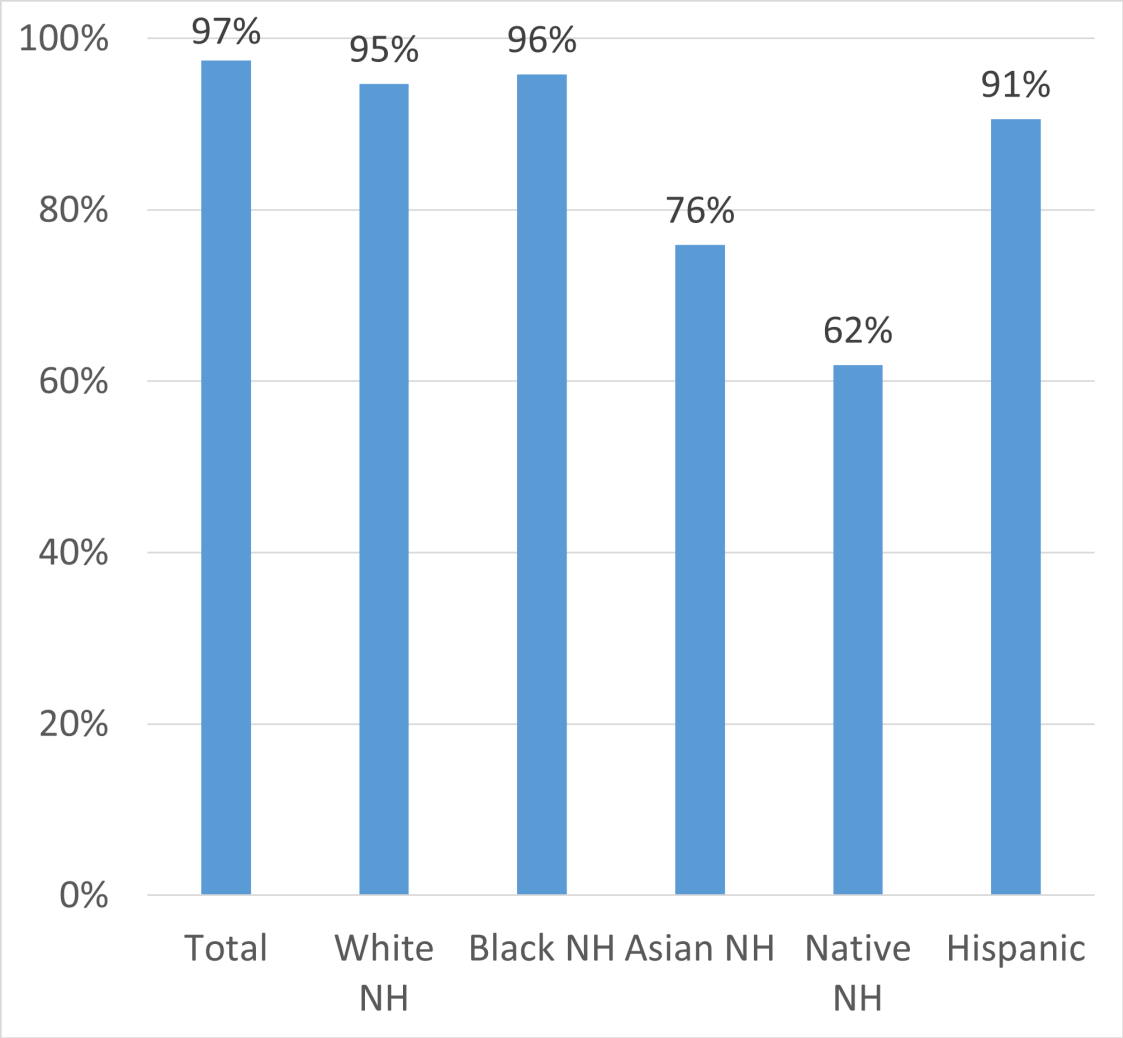
Figures and Tables

Figure 1: Medicare and Census Counts of 66 year olds in 2017 (in millions), by Race/Ethnicity



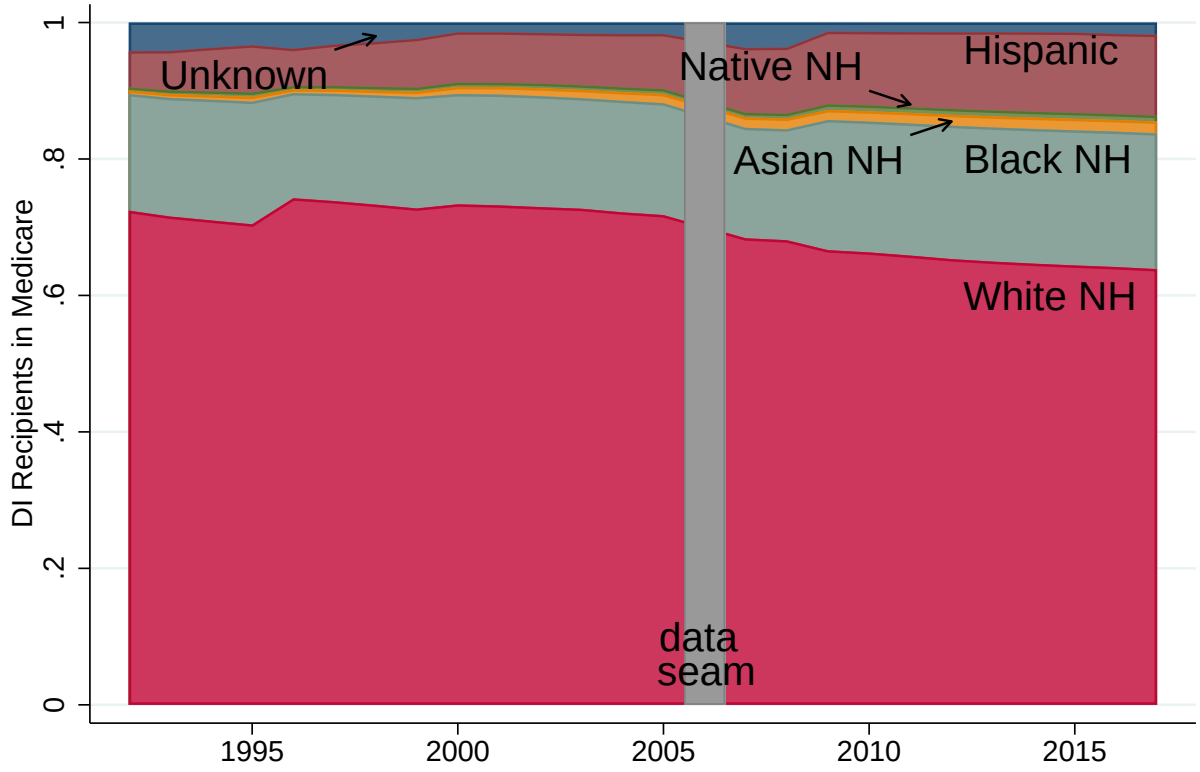
Notes: This figure reports the number (in millions) of 66-year-old individuals in 2017 in each racial/ethnic category according to Medicare (left, blue bar) and the U.S. Census (right, orange bar). See text for correspondence of racial/ethnic categories between the two datasets.

Figure 2: Ratio of Medicare Count to Census Count by Race/Ethnicity



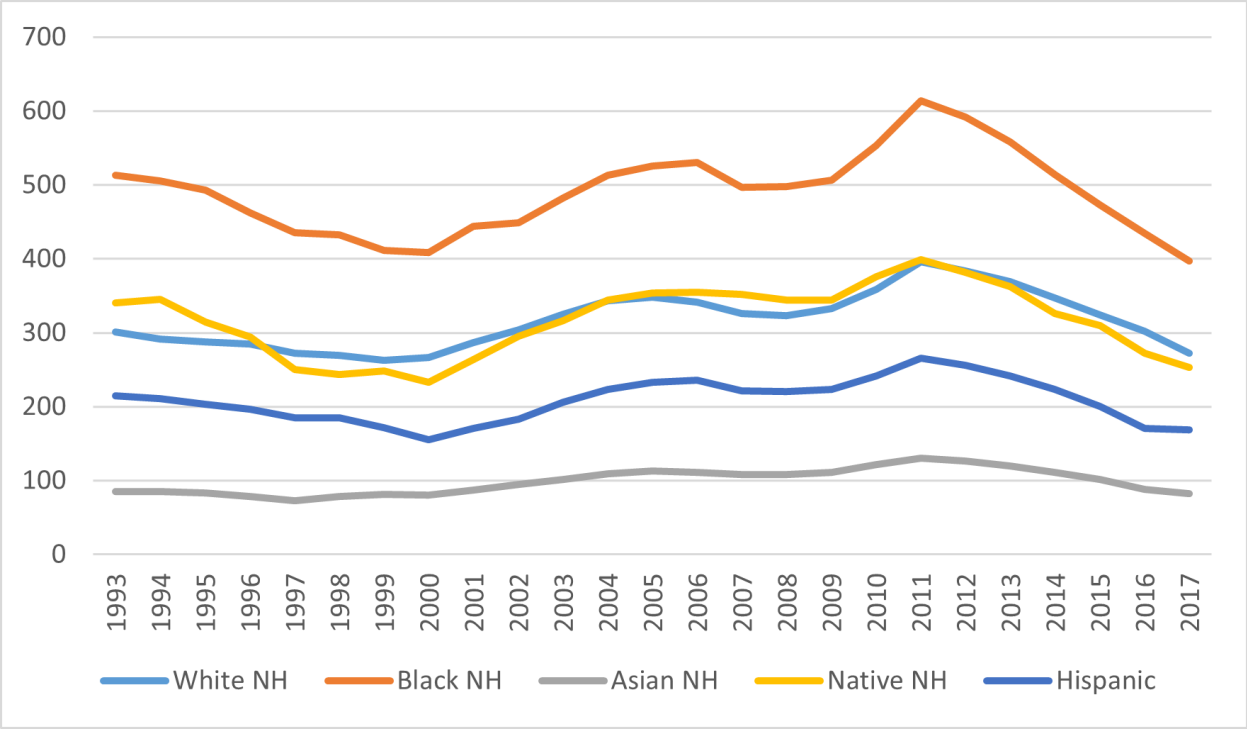
Notes: This figure reports the ratio of the number of 66 year olds in Medicare in 2017 in each racial/ethnic category to the number of 66 year olds in 2017 according to the U.S. Census.

Figure 3: Composition of All DI Recipients in Medicare, 1992–2017



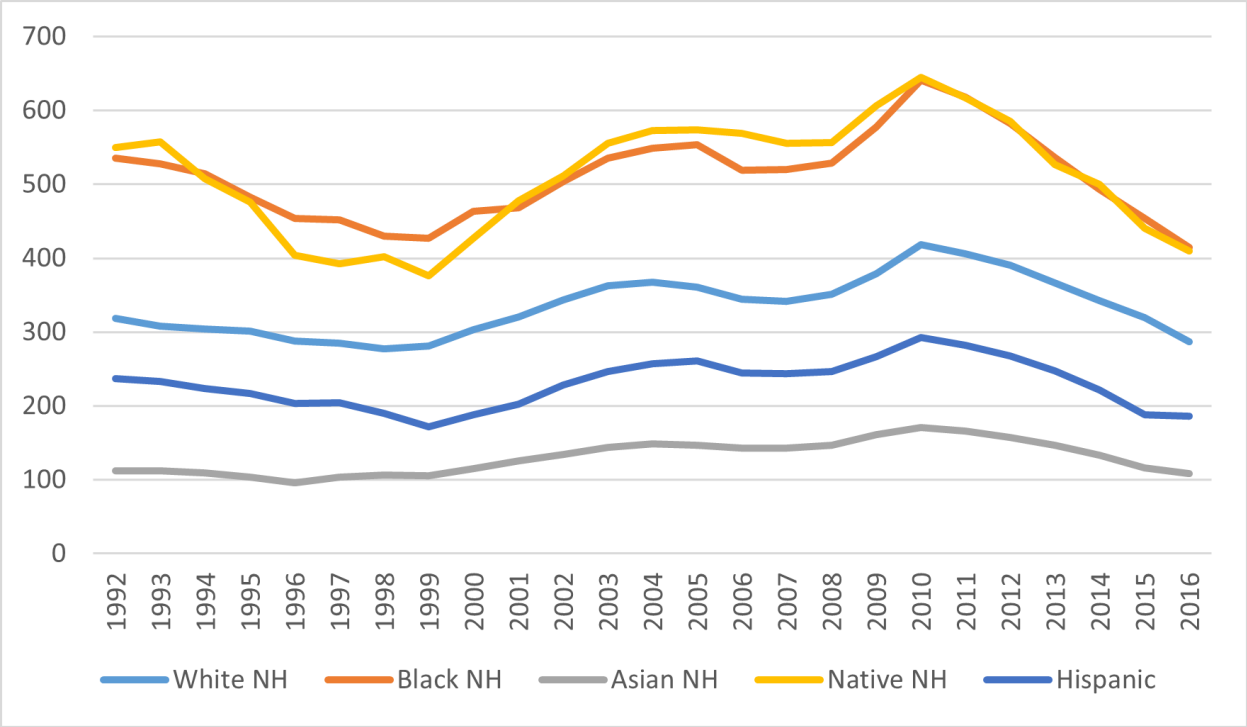
Notes: This figure reports the racial/ethnic categorization of the universe of DI recipients in Medicare between 1992 and 2017. The gray area labeled "data seam" denotes a transition between Medicare data formats.

Figure 4: DI Entry Rate by Race/Ethnicity, 1993–2017



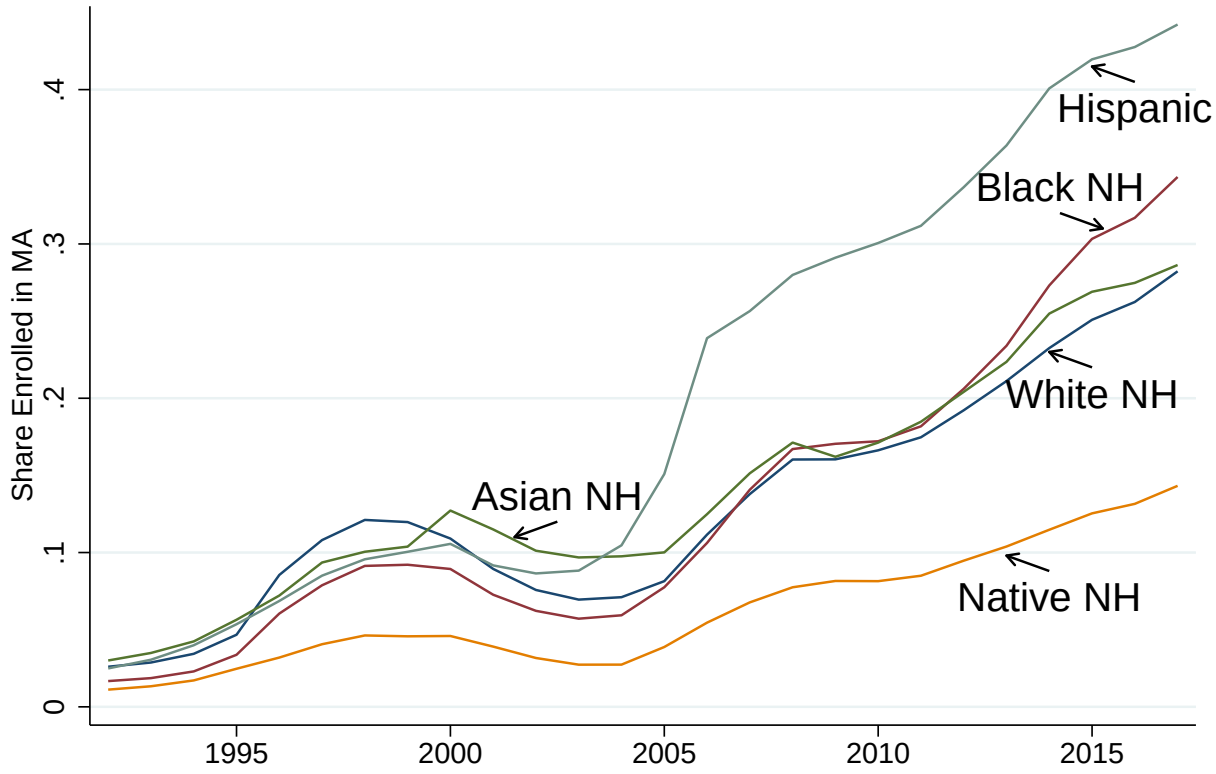
Notes: This figure reports the DI entry rate, meaning the number of DI entrants to Medicare aged 22-62 in a particular racial/ethnic category per month divided by the number of individuals aged 22-62 in that racial/ethnic category. The rate is reported using Medicare entrants 1993–2017, corresponding to DI entrants 1991–2015.

Figure 5: DI Entry Rate by Race/Ethnicity, 1993–2017, Adjusted for Undercounting



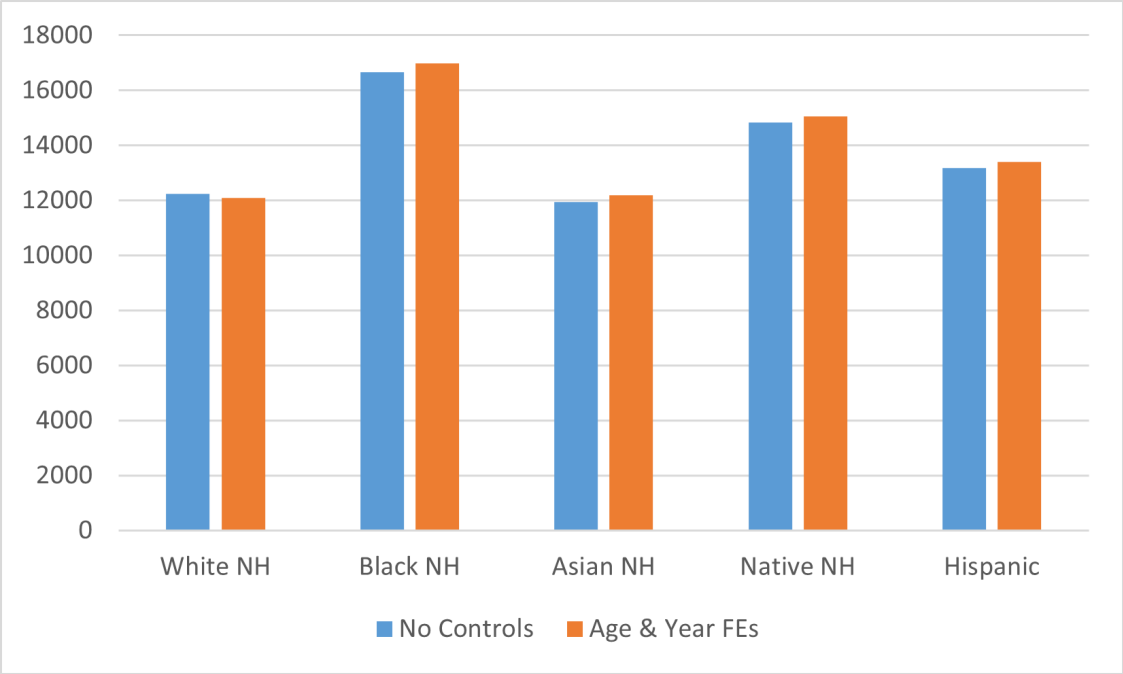
Notes: This figure repeats Figure 4 but divides each data series by its corresponding undercounting ratio as reported in Figure 2.

Figure 6: Share of DI Recipients Enrolled in Medicare Advantage, 1992–2017



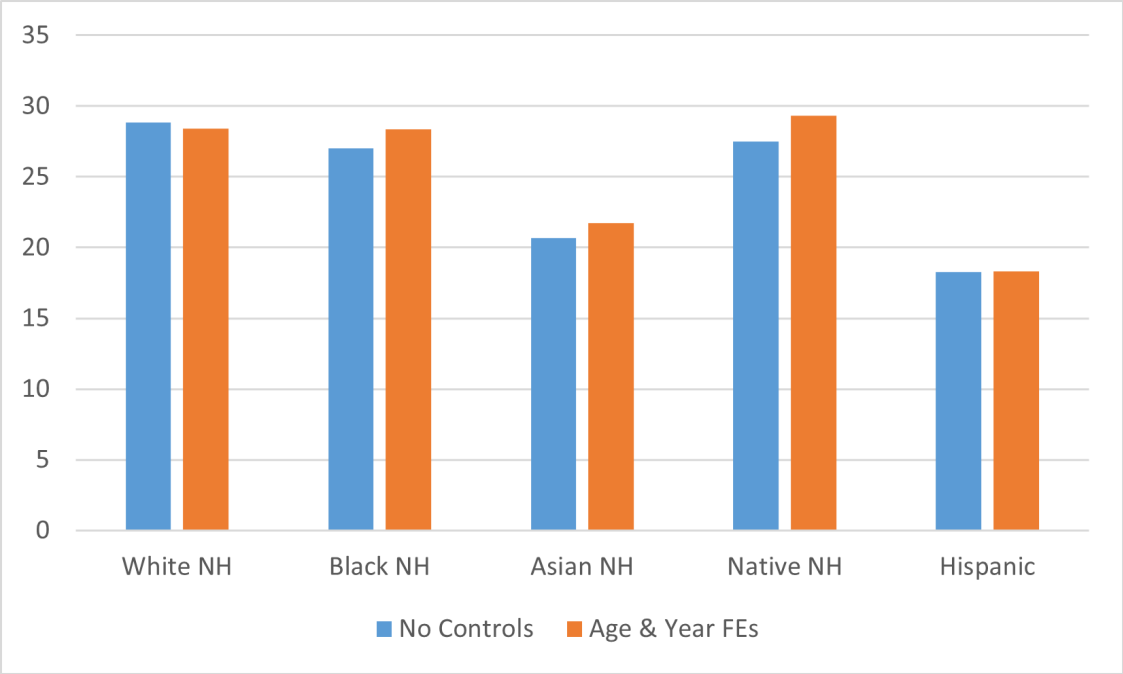
Notes: This figure reports the share of the universe of DI recipients in Medicare reporting any month of enrollment in Medicare Advantage in each year.

Figure 7: Average Medical Spending ($) for DI Recipients in Medicare by Race/Ethnicity



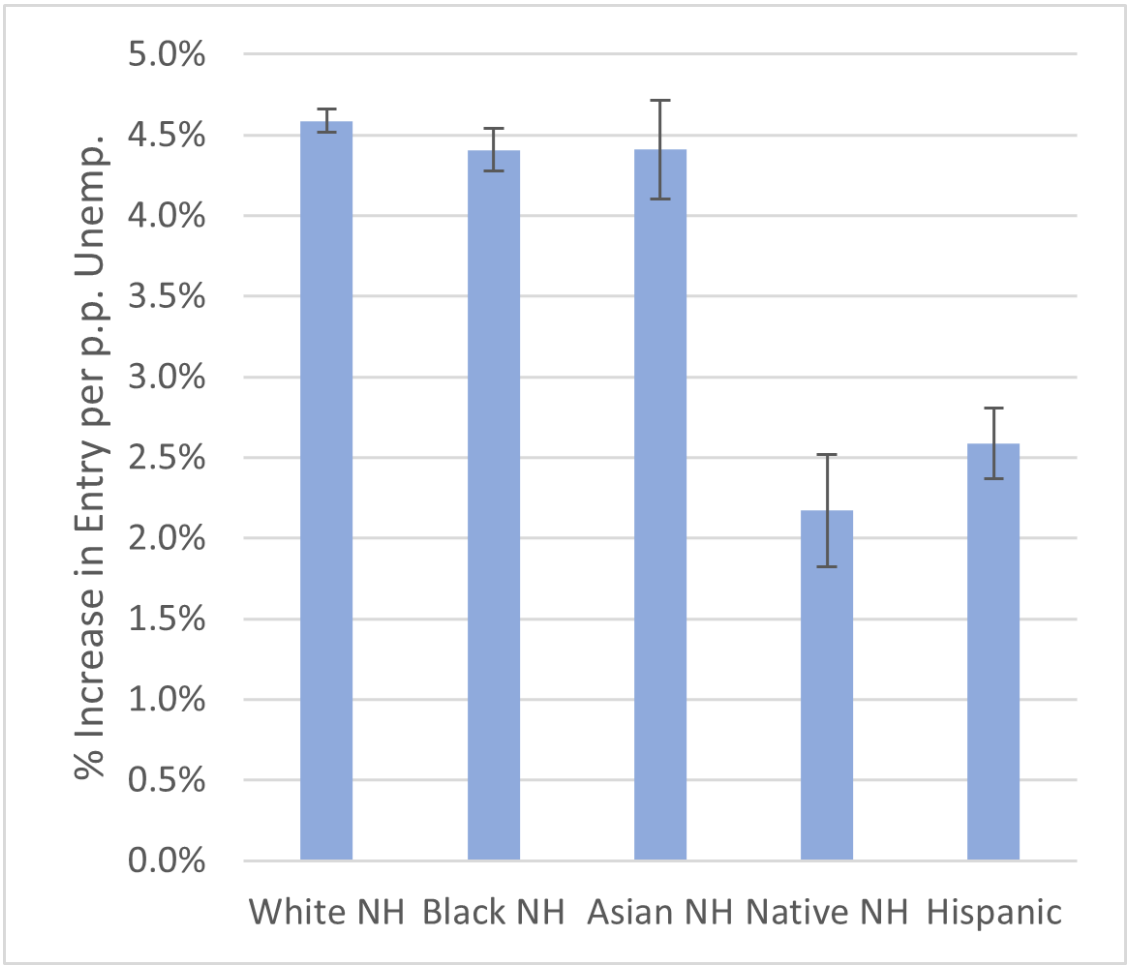
Notes: This figure reports the average annual medical spending in dollars, without (blue, left) or with (orange, right) fixed effects for year of age and calendar year. The average reflects DI recipients who entered Medicare 1993–2017. Medical spending is reported for these individuals when enrolled in FFS in the years 1999 to 2017.

Figure 8: Average Mortality Rate for DI Recipients in Medicare by Race/Ethnicity



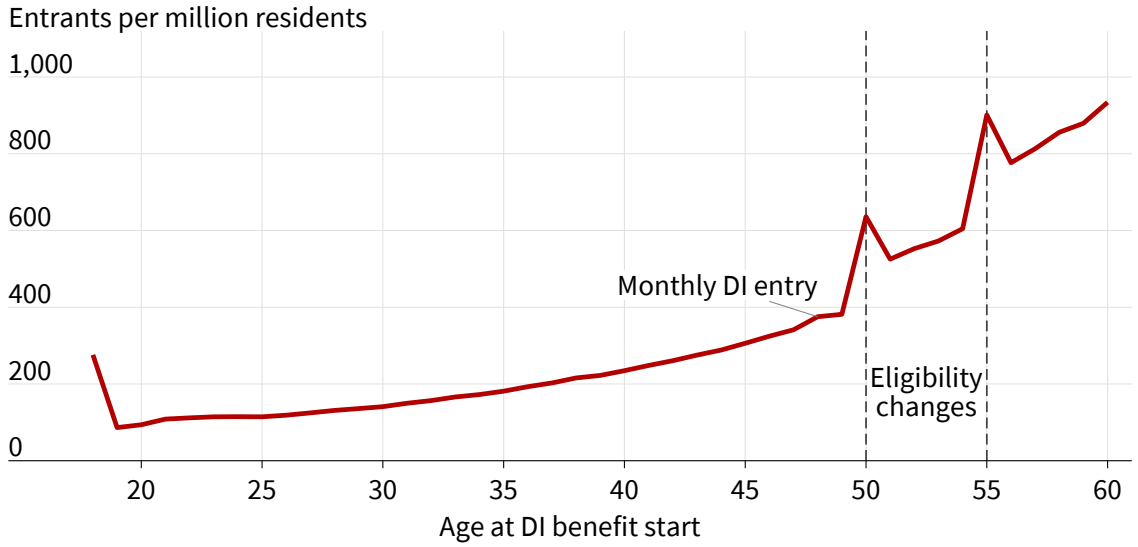
Notes: This figure reports the average mortality (annual deaths per 1000), without (blue, left) or with (orange, right) fixed effects for year of age and calendar year. The average reflects DI recipients who entered Medicare 1993–2017. Mortality is reported for these individuals for the years 1993–2017.

Figure 9: Percentage Impact of Unemployment on DI Entry, by Race



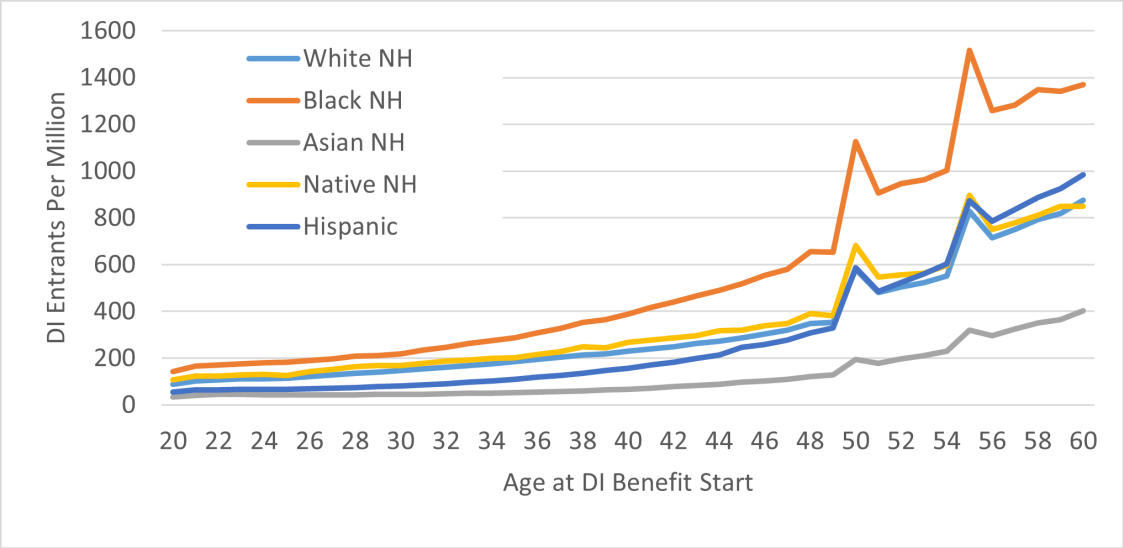
Notes: The figure presents estimates of the α_r coefficients from equation 5.3, reflecting the percentage influence of a one percentage point increase in unemployment on DI entry for each of the Medicare race/ethnicity categories.

Figure 10: Cyclicality of DI entry, by age at entry



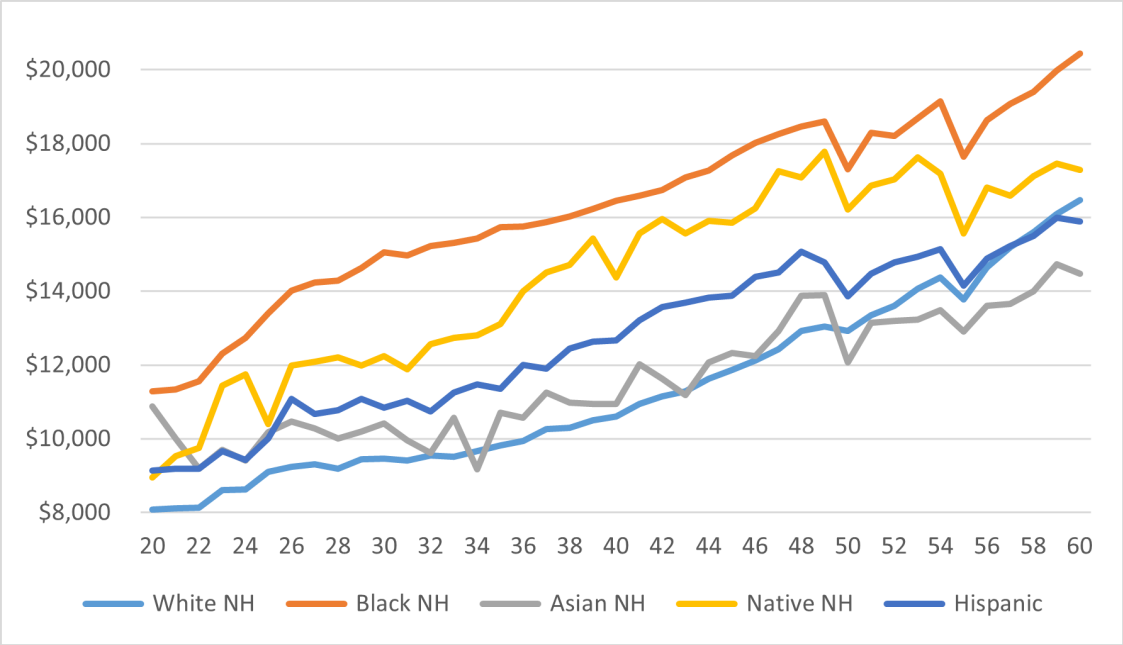
Notes: The figure shows the cyclicality of DI entry in our primary sample by age at entry. Entry is measured for each county, month, and age as the number of entrants per million same-aged residents. The curve's height reflects the change in monthly DI entry at a given age associated with a 1 percentage point increase in the county unemployment rate at the time of DI application.

Figure 11: Cyclicality of DI entry, by age at entry and race/ethnicity



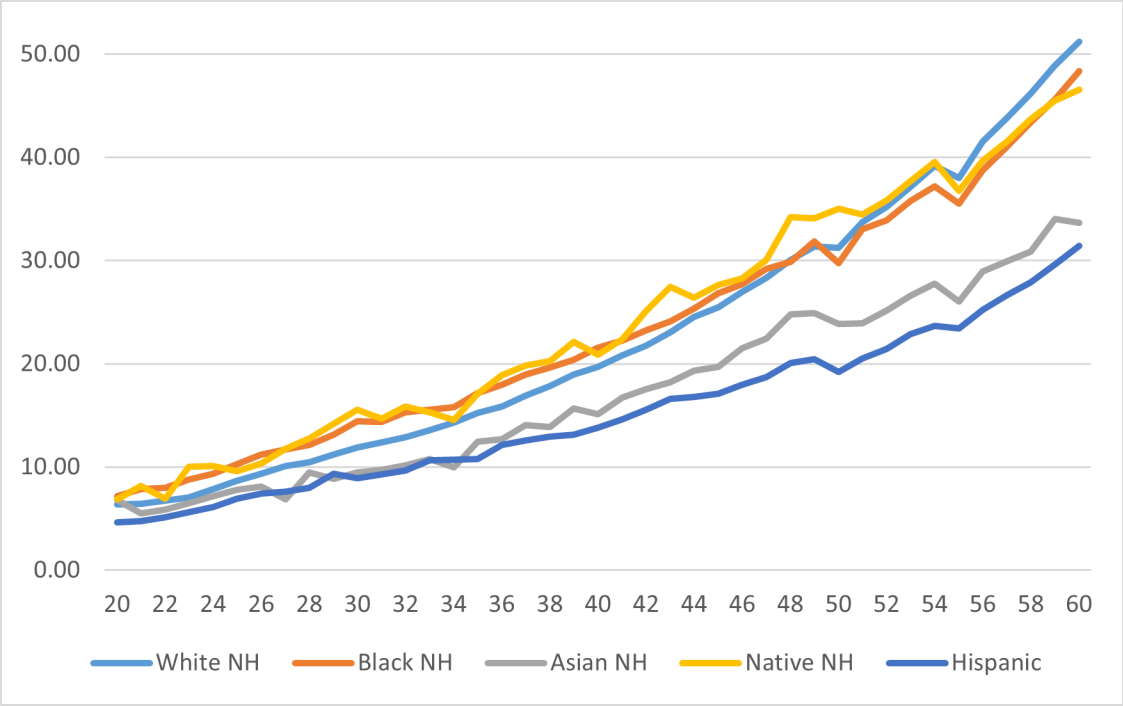
Notes: The figure repeats the analysis of Figure 10 separately for each Medicare race/ethnicity group. The height of each curve represents, for one of the race/ethnicity categories, the change in monthly DI entry at a given age associated with a 1 percentage point increase in the county unemployment rate at the time of DI application.

Figure 12: Medical Spending by Age and Race



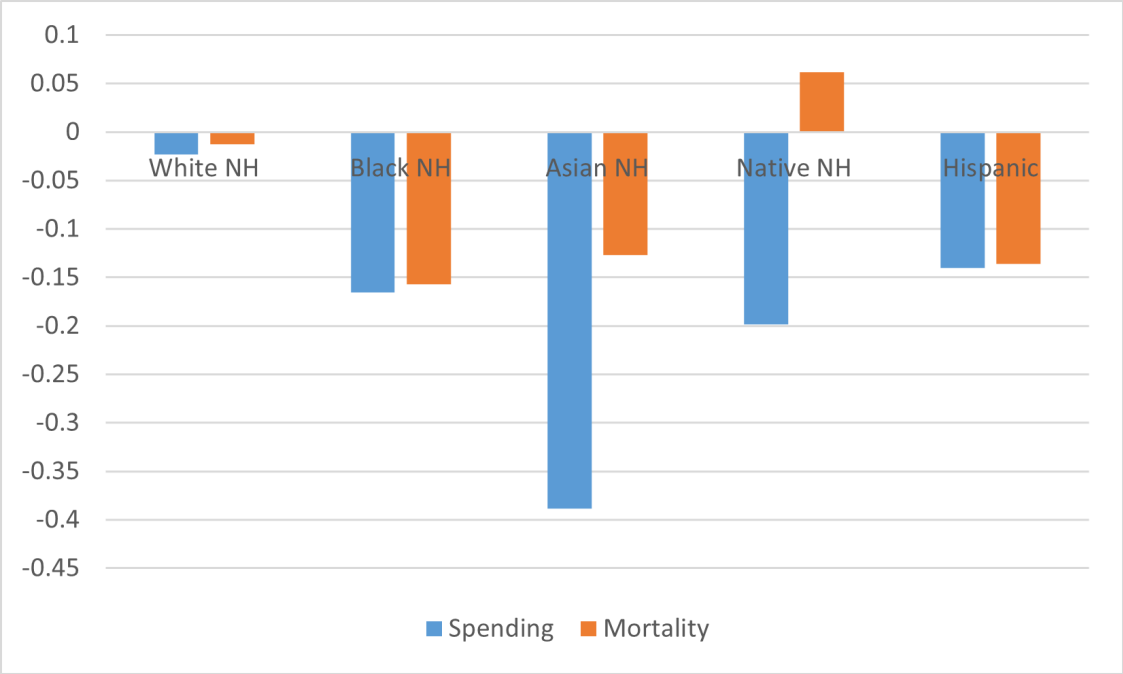
Notes: The height of each curve represents, for one of the race/ethnicity categories, the average annual Medicare spending for members of that category as a function of their age at DI application.

Figure 13: Mortality by Age and Race



Notes: The height of each curve represents, for one of the race/ethnicity categories, the average annual mortality for members of that category as a function of their age at DI application.

Figure 14: Health of Age Discontinuity Marginals by Race



Notes: This figure reports the difference in health status for discontinuity marginals of each race/ethnicity compared to 49-year-old entrants of the same race/ethnicity. See equation 1 for calculation of the health of age discontinuity marginals. Health status is measured by medical spending (left, blue) or mortality (right, orange).

Table 1: Age discontinuities in the SSA Vocational Grids

MSWC	Education	Previous Work Experience	Outcome
Sedentary	Illiterate	Unskilled or none	Not disabled at 44, disabled at 45
Sedentary	Less than HS grad	Unskilled or none	Not disabled at 49, disabled at 50
Sedentary	Less than HS grad	Nontransferable skills	Not disabled at 49, disabled at 50
Sedentary	Less than HS grad	Transferable skills	Not disabled
Sedentary	HS grad – no direct entry into skilled work	Unskilled or none	Not disabled at 49, disabled at 50
Sedentary	HS grad – no direct entry into skilled work	Nontransferable skills	Not disabled at 49, disabled at 50
Sedentary	HS grad – no direct entry into skilled work	Transferable skills	Not disabled
Sedentary	HS grad – provides for direct entry into skilled work	Unskilled or none, nontransferable skills, or transferable skills	Not disabled
Light	Illiterate	Unskilled or none	Not disabled at 49, disabled at 50
Light	Less than HS grad	Unskilled or none	Not disabled at 54, disabled at 55
Light	Less than HS grad	Nontransferable skills	Not disabled at 54, disabled at 55
Light	Less than HS grad	Transferable skills	Not disabled
Light	HS grad – no direct entry into skilled work	Unskilled or none	Not disabled at 54, disabled at 55
Light	HS grad – no direct entry into skilled work	Nontransferable skills	Not disabled at 54, disabled at 55
Light	HS grad – no direct entry into skilled work	Transferable skills	Not disabled
Light	HS grad – provides for direct entry into skilled work	Unskilled or none, nontransferable skills, or transferable skills	Not disabled

Notes: "MSWC" signifies Maximum Sustained Work Capacity. "HS grad" signifies high school graduate. Individuals with MSWC medium or above are excluded; there are few to no age discontinuities for these groups.