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Racial Disparities in the Quality of Nursing Home Care*

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Abstract

We document significant disparities in the quality of publicly-financed nursing home care provided to Black patients and White patients in the United States. To do so, we use detailed data on the physical and mental health of about 0.5 million Black and 4 million White nursing home patients covered by Medicare between 2011 and 2016 to estimate race-specific quality measures for almost 10,000 nursing homes. We estimate that, on average, Black patients in our sample receive a quality of nursing home care that is only about one-third of that received by White patients. About two-thirds of this disparity reflect differences in the quality of care received by observably similar Black and White patients in the *same* nursing home, rather than differences in which nursing homes different patients go to. Within-nursing home disparities are smaller in nursing homes that treat a larger share of Black patients and in for-profit nursing homes, and larger in nursing homes with higher staffing ratios.

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1 Introduction

The nursing home sector in the United States is critical for the health and well-being of the elderly. In 2016, it provided care to over 1.3 million patients at an annual cost of $160 billion, or roughly 5% of national health expenditures (Harrington et al. 2018; CMS 2019). But for decades, there have been widespread concerns both about the overall quality of nursing home care in the US, as well as disparities in the quality of care received across different demographic groups (Rau 2018; Rau and Lucas 2018; Goldstein and Gebeloff 2019; Jacobs and Richtel 2019; Wunderlich, Sloan, and Davis 1996; GAO 2016, 2019; Estrada, Agarwal, and Stone 2021; Konetzka and Werner 2009; Travers et al. 2018).

In this paper, we estimate the extent of racial disparities in the quality of Medicare-covered nursing home care received by Black non-Hispanic patients and White non-Hispanic patients. We then decompose these disparities into differences in the quality of care received by patients of different race at the *same* nursing home, and differences in the nursing homes attended. To do so, we draw on rich data on the physical and mental health of all nursing home patients in Medicare and Medicaid certified nursing homes ("SNFs"). We focus on Medicare patients, for whom nursing homes are intended to provide short-term care that is designed to aid in the recovery from a hospitalization or medical care.[1] In 2016, about one fifth of hospitalized Medicare patients were discharged to nursing homes, at an annual cost to Medicare of nearly $30 billion, or about 8% of overall Medicare spending (MedPAC 2018). We combine the consistently and comprehensively measured health assessment data into a one-dimensional "health index" that measures how fit the patient is to return to the community; specifically, it measures the probability that the individual will be discharged to the community within a week of the assessment.

We extend the framework for estimating the average value-added of each nursing home that we developed in Einav, Finkelstein, and Mahoney (2022) (hereafter, EFM) to allow for nursing-home-specific value-added to vary across Black patients and White patients. A nursing home's value added reflects the average improvement in a patient's health index between her assessment at admission and the one taken 30 days later. Following EFM, we develop a model of the patient's health production function that depends on both her health at admission and the nursing home she attends. We use the distance between a patient's residence and the nursing homes in her market to account for potential non-random sorting of patients into nursing homes, even conditional on the rich set of patient health measures and demographic characteristics at admission. We account for selection out of the nursing

[1] Specifically, we focus on the approximately 70% of Medicare patients with coverage from Traditional Medicare (henceforth "Medicare"), as opposed to coverage from a private Medicare Advantage plan.

home prior to the patient's 30-day assessment with an explicit model of the nursing home's discharge decision that is similar in spirit to Heckman (1979). In contrast to EFM, we allow the health production function, the model of nursing home selection, and the model of nursing home discharge to all be race-specific. We estimate the model by maximum likelihood using data from 2011 to 2016 on health assessments of about 4 million White Medicare patients and 0.5 million Black Medicare patients at about 10,000 different nursing homes.

We find large disparities in the nursing home value added received for Black patients and White patients. The average White patient attends a nursing home that increases her average health index – i.e. the weekly probability of being discharged home – by 4.2 percentage points between admission and 30 days. By contrast, the average Black patient attends a nursing home that increases her average health index by only 1.4 percentage points, or only about one-third of the improvement experienced by White patients. To put that in perspective, consider that in the cross-section of admitted patients, a 1 percentage point improvement in the health index is associated with approximately 1 fewer day in the nursing home. This means that the 2.8 percentage point difference in average value added for Black patients compared to White patients is roughly equivalent to a White patient with the same initial health as a Black patient being discharged at a given health level 3 days sooner, or over 10 percent of the median length of stay of patients in our sample, than the Black patient.

Broadly, there are two potential sources of the disparities we document: differential treatment of Black and White patients within the *same* nursing home and differential allocation of Black and White patients across nursing homes of different quality. Understanding the relative role of these two forces is an important first step for considering potentially effective policy responses. Our framework allows us to decompose the disparities we document in the value-added experienced by Black and White patients along these two margins. In particular, since we have estimated race-specific value added at each nursing home, we can estimate counterfactual health improvements if Black patients experienced the value-added provided to White patients at their nursing home, or if Black patients were differently allocated across nursing homes within their market.

These counterfactuals provide several intriguing findings. First, we document that most – about 90% – of the disparities reflect within-market differences in the nursing home quality received by Black patients compared to White patients, rather than the differential distribution of Black and White patients across markets with different average nursing home quality. Specifically, we estimate an average within-market difference in experienced value added of 2.5 percentage points, which is quite close to the nationwide average of 2.8 percentage points. This is encouraging since there are likely more policy levers for achieving reallocation of patients within markets than across them. However, we also find that most of

the within-market disparities reflect differences in the quality of care received by Black and White patients in the same nursing home, rather than differences in the nursing homes they attend. Specifically, we find that if, counterfactually, Black patients received the average value-added of White patients in their nursing home, this would eliminate about two-thirds of the within-market White-Black disparity in experienced value added, with the within-market gap in value added declining from 2.5 percentage points to 0.9 percentage points. By contrast, if Black patients were allocated across nursing homes within their markets in the same proportions as White patients, the within-market gap would shrink by only about 20%, to 2.1 percentage points.

Given the large role played by differences in the quality of care received within the same nursing home, in the last part of the paper we briefly explore what nursing home characteristics correlate with larger racial gaps in value added within a given nursing home. We document substantial variation in the within-nursing home gap in value added. The (patient-weighted) average nursing home provides a 4.1 percentage point value added for White patients and a 2.2 percentage point value added for Black patients, producing an average within-nursing home gap in value added of 0.019. Yet the standard deviation of this gap is 0.05. Strikingly, we find that the within-nursing home gap in value-added is *higher* for nursing homes given higher overall quality ratings by the widely-used Nursing Home Compare "star ratings" (CMS 2008; GAO 2016) constructed by the Centers for Medicare and Medicaid Services (CMS). This in turn primarily reflects the staffing component of these ratings; nursing homes with higher staff to patient ratios also have higher racial gaps in value added.

Our paper contributes to an existing literature that has documented considerable disparities in the quality of nursing home care received by patients of different race e.g., (Estrada, Agarwal, and Stone 2021; Konetzka and Werner 2009; Smith et al. 2007; Grabowski and McGuire 2009; Mack et al. 2018; Travers et al. 2018; Fennell et al. 2010; Mor et al. 2004). Many papers in this literature have used nursing-home wide measures, such as staffing ratios, deficiency rates from state inspections, or the Nursing Home Compare star ratings to measure nursing home quality. Relative to this, our approach offers two key innovations. First, we complement these input-based disparity measures with an outcomes-based approach which measures disparities in the health improvements experienced by Black nursing home patients relative to White nursing home patients. Second, and relatedly, the prior, input-based measures apply to the nursing home as a whole; as a result, the literature has used them to describe differences in the average quality of nursing homes that different patients go to, but cannot speak to potential differences in the quality of care received by different patients

within a nursing home (Konetzka and Werner 2009).[2] By contrast, our outcome-based approach reveals substantial disparities in the quality of care received within the same nursing home, in addition to differences in the quality of nursing homes that different patients go to.

Our paper relates more broadly to an enormous literature – which we cannot attempt to summarize here – that has documented striking racial disparities in age-adjusted death rates and explored potential causes. The causes are multifaceted and inter-related, and are affected by structural racism in multiple domains over the life-cycle (Williams and Jackson 2005; Hardeman, Medina, and Kozhimannil 2016; Lavizzo-Mourey, Besser, and Williams 2021; Estrada, Agarwal, and Stone 2021; Konetzka and Werner 2009; Travers et al. 2018). They include both social determinants (such as differences in income and education), medical determinants (such as differences in underlying comorbidities, differences in the quality of care received from a given health-care provider due to communication and biases, differences in insurance, and differences in the health care providers patients use), and institutional features that give rise to historical and current inequities, including neighborhood segregation and prior de jure hospital segregation (Cutler, Deaton, and Lleras-Muney 2006; Braveman, Egerter, and Williams 2011; Chandra and Skinner 2003; Chandra, Kakani, and Sacarny 2022; Institute of Medicine 2003; Chandra and Staiger 2010; Alsan, Garrick, and Graziani 2019; Bach et al. 2004; Barnato et al. 2005; Skinner et al. 2005; Jha et al. 2007; Asch et al. 2021; Hasnain-Wynia et al. 2007; Joynt et al. 2013; Greenwood et al. 2020; Obermeyer et al. 2019; Chetty et al. 2016; Case and Deaton 2015, 2017). Our findings of substantial disparities in the quality of care received by Black and White patients within the same nursing home suggest the importance of further work on factors that could affect the quality of care received by the same health-care provider, such as communication frictions, issues of trust, or biases.

The rest of the paper proceeds as follows. Section 2 describes the institutional setting and the data we use. Section 3 proposes an econometric model of race-specific nursing home value-added. Section 4 provides details on how we implement the model and how we combine over 100 health measures in the data into a single measure of patient health. Section 5 presents our results. Finally, Section 6 concludes.

[2]Other papers have used more specific measures such as patient pain and pain management or vaccination rates, which can be measured at the level of the individual patient. Here, however, there are challenges distinguishing differences in the quality of care patients receive from differences in the underlying health of the patient at admission (which can contribute for example to differences in pain and pain management), as well as differences in when patients are discharged (which can contribute for example to differences in within-facility vaccination rates). Differences in patient health within a nursing home by race seem likely, given the evidence that these factors affect the probability of nursing home access and admission (Akamigbo and Wolinsky 2007; Feng et al. 2011; Thomeer, Mudrazija, and Angel 2015).

2 Setting and Data

2.1 Institutional Setting

Nursing homes provide both short-term care to patients recovering from a hospitalization or illness, and long-term care to patients in need of ongoing assistance with their daily living. Most short-term patients are covered by Medicare, which pays for short-term nursing and rehabilitation services for patients recovering from a surgical procedure (e.g., hip replacement) or a health event (e.g., stroke). Medicare coverage is predicated on the expectation that the patient is on a path to recovery and return to the community. By contrast, most long-term patients are covered by Medicaid. Many of these patients start on Medicare at admission due to dual-eligibility.[3]

During our study period, Medicare reimbursed SNFs at a prospective daily rate that varied by geography and the health of the patient at admission (MedPAC 2020). Beginning on the 21st day of the stay the patient has some cost-sharing with Medicare and after 100 days in the SNF Medicare no longer covers the stay.

SNFs that are certified by Medicare and Medicaid must follow federal regulations that assert SNFs respect the civil right's of the patients they care for and ethically treat all patients (*42 C.F.R. §483* 2016). SNFs are re-certified annually and during this process inspectors visit the SNFs. During these inspections, SNFs provide data on staffing and other characteristics of the nursing home and the inspectors also record any quality deficiencies that may affect resident health (CMS 2018; Harrington et al. 2018; LTCFocus, n.d.). To be certified by Medicare, SNFs must also regularly assess the health of Medicare patients (CMS 2017). These assessments record over 100 different health measures of the patients over time and make up the data we use in this paper.

The data collected during re-certification also constitute the inputs to CMS' "five-star" rating system. These ratings are both used by consumers in choosing SNFs as well as insurers and regulators (CMS 2008; GAO 2016; *12 U.S.C. §1715w* 2014; CMS, n.d.).

2.2 Data Sources

Our primary data source is the Centers for Medicare and Medicaid Services' (CMS') Long-Term Care "Minimum Data Set" for Resident Assessment and Care Screening (hereafter, MDS). These data contain a series of federally mandated, standardized patient assessments

[3]As a result, in our data seventy percent of patients are on Medicare at admission, but only 14% have Medicare as their primary payer at a random point in time during their stay. Sixty percent of patients have Medicaid as their primary payer at a random point in time. These statistics are consistent with the aforementioned details of coverage by public payers.

that track the health status of all patients in Medicare and Medicaid certified nursing homes. Such nursing homes are known as Skilled Nursing Facilities (SNFs). These data have been widely used by researchers studying the economics of nursing homes (e.g., Grabowski, Gruber, and Angelelli 2008; Cornell et al. 2019; Hackmann 2019; Gandhi 2020; Gupta et al. 2021; Hackmann, Pohl, and Ziebarth 2021; Einav, Finkelstein, and Mahoney 2022). The MDS — together with additional Medicare data — provides basic demographics (age, race, gender, zip code of residence, whether the patient is dually eligible for Medicaid and marital status). Facility-level data on SNFs — such as number of beds, occupancy rate, and whether it is for-profit — is available from the OSCAR/CASPER system.

The rich, longitudinal information that the required assessments at admission and at 30 days provide on patient health are the backbone of our measurement of value added. Specifically, we draw on approximately 100 health measures that were consistently captured over our study period. Many are physical health measures, such as vomiting, falls, or shortness of breath; or physical limitations to activities of daily living – such as walking, dressing, or toileting – that are measured on a 5-point scale ranging from fully independent (requiring no help or staff oversight at any time) to total dependence (requiring full staff help every time during a 7-day period). Other categories of health measures include those that deal with mental health, use of restraints, pain, use of treatment and equipment, cognition (e.g. delirium), and interactions with others (e.g. ability to understand others and speech clarity).

Naturally, these measures speak to different dimensions of health. Likewise, SNF ability to improve a given measure may vary across measures. Our baseline approach — which follows the spirit of Morris et al. (2018) — is to construct a univariate health index that combines the health assessment data in a way that is guided by SNFs' purpose with regard to Medicare patients: shepherding them to the point where they can safely be discharged back to the community. Specifically, we construct the heath index with a regression tree that uses the 30-day health assessment data to predict whether the patient is discharged to the community within 7 days of their 30-day assessment. From this perspective, a higher quality SNF is one that can nurture a patient more quickly to the level of health that is conducive to community discharge.

2.3 Sample Construction and Summary Statistics

We start with the sample used in EFM. This covers 6.8 million patient-stays for Medicare patients 65 and over at more than 13,000 SNFs between October 2011 and September 2016; for computational feasibility, it was also limited to SNFs that have at least 50 stays that

meet our sample requirements.[4] We make two additional restrictions here. First, we restrict to White Non-Hispanic and Black non-Hispanic patients.

Second, we restrict to patient-stays in markets that account for at least 0.1% of Black admissions nationwide. Due to geographic concentration of Black patients in certain regions of the United States, it would be impossible to estimate value added for all markets. To define the market or "choice set" of SNFs for each patient, we use the standard market definition for hospital choice, namely the 306 Hospital Referral Regions (HRRs). Appendix Figure A1 shows a map of HRRs and their share of Black admissions to illustrate which markets are excluded by the restriction that each HRR accounts for at least 0.1% of Black admissions. This leaves us with our final sample of 4.5 million patient-stays at 9,970 SNFs, consisting of 474,775 Black patients and 4,043,489 White patients.

Table 1 shows summary statistics of our sample, separately by race. The average White patient is 81 years old; 64% are female, 37% are married at admission and 14% are dually eligible for Medicaid at admission. Black patients are slightly younger than Whites, slightly more likely to be male, much less likely to be married, and much more likely to be dual (39% of Black patients compared to only 14% of White patients). Black patients also have a longer average length of stay - 51 days compared to 42 days for White patients. Fifty seven percent of White patients are discharged before 30 days compared to 53 percent of Black patients; but Black patients are much less likely to be discharged to the community (35 percent compared to 45 percent) and slightly more likely to be discharged to an acute care hospital or hospice or die in the SNF.

3 An Econometric Model of Race-Specific Nursing Home Value Added

3.1 Defining Race-Specific Value Added

Consider a population of patients, each denoted by i, who are randomly allocated to SNFs, denoted by j. Each patient has a race $r(i) \in \{b, w\}$ where b corresponds to Black and w corresponds to White. We observe the health of patients in period 1 and period 2, denoted by $h_{i,1}$ and $h_{i,2}$, respectively. The health of a patient in period 1 corresponds to the initial assessment and the health of a patient in period 2 corresponds to the 30-day assessment. Race-specific value added for SNF j is defined as $\alpha_{j,r(i)}$ in the equation

[4]For more details on how this sample is constructed, see Section 2.3 of EFM.

$$h_{i,2} = \alpha_{j,r(i)} + \theta h_{i,1} + \varepsilon_{i,r(i)} \tag{1}$$

where $\varepsilon_{i,r(i)}$ is a mean-zero iid race specific error term and θ is the serial correlation in health. Therefore, race-specific value added can be thought of as the average improvement in health at SNF j for race $r(i)$ conditional on health at admission $h_{i,1}$. This assumes that $\alpha_{j,r(i)}$ is homogeneous across patients of the same race within a SNF and that the serial correlation in health is homogeneous across all patients and SNFs. The serial correlation must be common for us to interpret both differences in value added across patients of different races within SNFs and differences in value added across SNFs.

There are two key challenges to estimating Equation (1) which EFM discuss. First, patients are not randomly assigned to SNFs. If patients choose nursing homes in such a way that health improvements are correlated with value added, estimates of $\alpha_{j,r(i)}$ will be biased. To overcome this, EFM follow the econometric methodology introduced in Dubin and McFadden (1984) and use distance as an instrument for SNF choice to construct a control function that accounts for any selection into the SNF that may bias the estimates of $\alpha_{j,r(i)}$. In this paper, we innovate on the framework in EFM by allowing SNF choice to vary by race and we therefore construct race-specific control functions. Second, we do not observe $h_{i,2}$ for all patients because SNFs discharge patients prior to the 30 day health assessment. Sick patients are discharged to a hopsital or hospice or die in the SNF ("upstream"), while healthy patients are discharged to the community ("downstream"). If changes in patient health are correlated with discharge the estimates of $\alpha_{j,r(i)}$ will be biased. To overcome this, EFM model discharge upstream and downstream in the spirit of Heckman (1979). In this paper, we allow for race-specific downstream discharge decisions.

3.2 Race-Specific Value Added Controlling for Selection In and Selection Out

Following EFM, SNFs first make a downstream discharge decision for each patient $d_i^D \in \{0, 1\}$. Then, SNFs make an upstream discharge decision, $d_i^U \in \{0, 1\}$, for the set of patients for which $d_i^D = 0$.

We assume a stylized probit discharge rule for downstream discharge as in EFM. Specifically SNFs discharge patients downstream according to the following rule:

$$d_i^D = 1 \iff h_{i,2} \geq \lambda_{j,r(i)} + v_{i,r(i)} \tag{2}$$

where $\lambda_{j,r(i)}$ is SNF j's downstream discharge threshold for a patient of race $r(i)$ and $\nu_{i,r(i)}$ is an iid race-specific error term, drawn from $N(0, \sigma_{\nu,r(i)})$.

We model upstream discharge as a function of $h_{i,2}$ as

$$\Pr(d_i^U = 1 | d_i^D = 0) = \Phi(\gamma_0 + \gamma_1 h_{i,2}) \tag{3}$$

where $\Phi(\cdot)$ is the standard normal cumulative density function. To control for selection into the SNF we model race-specific SNF choice. Let the utility of patient i from SNF j be given by

$$u_{i,j} = \delta_{j,r(i)}(x_i) - \tau_{r(i)} m_{i,j} + \eta_{i,j} \tag{4}$$

where $\delta_{j,r(i)}$ is the average utility from SNF j for patients of race $r(i)$ with characteristics x_i, $m_{i,j}$ is the log distance between patient i's residence and SNF j, and $\eta_{i,j}$ is a iid error term drawn from a Type 1 Extreme Value distribution. Conditional on the patient's choice of SNF, $c_{i,j}$, $h_{i,1}$, and the demand shocks, $\eta_{i,j}$, expected health in period 2 is given by

$$\mathbb{E}[h_{i,2} | c_{i,j}, h_{i,1}, \eta_{i,1}, ..., \eta_{i|J_i|}] = \alpha_{j,r(i)} + \theta h_{i,1} + \sum_{k \in J_i} \phi_{k,r(i)}(\eta_{i,k} - \mu_\eta) + \varphi_{r(i)}(\eta_{i,j} - \mu_\eta) \tag{5}$$

where J_i is patient i's choice set and μ_η is the mean of the error terms. Integrating over the η's yields

$$\mathbb{E}[h_{i,2} | c_{i,j}, h_{i,1}, m_{i,1}, ..., m_{i|J_i|}] = \alpha_{j,r(i)} + \theta h_{i,1} + \sum_{k \in J_i} \phi_{k,r(i)} \beta_{i,k} + \varphi_{r(i)} \beta_{i,j} \tag{6}$$

where

$$\beta_{i,k}(j) = \begin{cases} -\log \hat{p}_{i,k} & k = j \\ \frac{\hat{p}_{i,k}}{1 - \hat{p}_{i,k}} \log(\hat{p}_{i,k}) & \text{otherwise} \end{cases}, \tag{7}$$

and the logit choice probabilities are the predicted values from the choice model described in equation (4):

$$\hat{p}_{i,j} = \frac{\exp\left(\delta_{j,r(i)}(x_i) - \tau_{r(i)} m_{i,j}\right)}{\sum_{k \in J_i} \exp\left(\delta_{k,r(i)}(x_i) - \tau_{r(i)} m_{i,k}\right)}. \tag{8}$$

4 Implementation

4.1 Health Index

To create a univariate representation of health, we follow EFM in creating a health index that describes a patient's probability of discharge to the community within 7 days of their 30-day assessment given the health assessment data from the MDS. To do this we use a regression tree that predicts the probability of discharge to the community within 7 days of the 30-day assessment given the health measures at the 30-day assessment. Hence, the health index can be thought of as a weighted average of health measures where the weights are in proportion to how the health measure affects the chance the patient is discharged to the community. Some of the most important health measures include mood, needing help with toileting, and needing help with locomotion (i.e., moving between locations).

Figure 1 shows the distribution of the health index at admission by race. Black patients have an average health index at admission of 0.11 while White patients have an average health index at admission of 0.14. Therefore, Black patients have a four percentage point lower probability of being discharged to the community within 7 days of the 30 day assessment given their health at admission. Visually, we can see that there is much more mass near zero in the Black distribution relative to the White distribution.

4.2 Estimation

First, we estimate SNF demand by race according to the specification in Equation (4) market-by-market to construct the control functions, $\beta_{i,k}$, which are used in Equation (6). Given the control functions, we estimate the model by maximum likelihood. A computational challenge is that seven parameters (the "national" parameters) enter the likelihood for all SNFs $(\theta, \sigma_{\epsilon,b}, \sigma_{\epsilon,w}, \sigma_{\nu,b}, \sigma_{\nu,w}, \varphi_b, \varphi_w)$. To address this, we perform a grid search over these national parameters and for a given grid we can estimate the model market-by-market. Then, given the likelihood across all the grid points we find the set of seven national parameters that maximize the likelihood and use the corresponding market-level estimates for the other parameters.

Another challenge is that there are some SNFs with very few patients of a given race,

meaning we cannot easily estimate race-specific value added for these SNFs. However, it is problematic to simply omit these SNFs from our sample since they may be relevant for counterfactual exercises that reallocate patients to SNFs. Therefore, we pool small SNFs together within markets and estimate a common White-Black gap in value added for these SNFs. Specifically, SNFs with fewer than 25 Black patients are pooled together and so are SNFs with fewer than 25 White patients. This allows us to estimate White value added for 9,940 SNFs and Black value added for 9,926 SNFs. Without pooling SNFs we would only be able to estimate Black value added for about 6,000 SNFs.

5 Results

5.1 Race-Specific Estimates of Nursing Home Value Added

Table 2 reports summary statistics of the estimated parameters. On average, White value added is larger than Black value added with an average White-Black gap of 0.019, more than 40% of average White value added of 0.041 and 80% of average Black value added of 0.022. Together with the estimate that $\theta = 0.99$, this indicates that an average SNF improves a White patient's probability of discharge to the community by about 4.1 percentage points from admission to 30 days and improves a Black patient's probability of discharge to the community by about 2.2 percentage points from admission to 30 days.

There is also substantial dispersion in race-specific value added across SNFs, the difference between a 90th percentile and 10th percentile SNF in terms of Black and White value added is 0.098 and 0.063, respectively.[5] Given the relationship between our health index and length of stay shown in Appendix Figure A2 this corresponds to about 10 and 6 days respectively, meaning that reallocating a Black (White) patient from the 10th to 90th percentile SNF saves Medicare about $4,700 ($2,800).

Figure 2 shows that there is substantial heterogeneity in the White-Black gap both across and within markets. The average difference between the 90th and 10th percentile SNF in terms of the White-Black gap within markets is about 0.08 or about 1.6 standard deviations of the White-Black gap.

To better understand the relationship between Black value added and White value added at the SNF level, Figure 3 shows the distribution of Black value added at each decile of White value added. The correlation between the Black and White value added is about 0.5, but there is substantial dispersion in Black value added within any given decile of White value

[5] A standard concern is that dispersion in these estimates reflects estimation error. In Appendix Table A1 we apply Empirical Bayes Shrinkage to the value added estimates and the White-Black gap and it has little to no effect on the estimates so we use the unadjusted estimates throughout the paper.

added. For example, consider a SNF in the fifth decile of White value added: the interquartile range of Black value added is 0.031 which is about half of a standard deviation of Black value added. The other deciles have similar if not more dispersion in Black value added. In the top decile of White value-added, more than 25% of SNFs have below median Black value, highlighting a stark and substantial difference in quality by race within the best nursing homes for White patients.

5.2 Decomposing Disparities in Experienced Value Added

Our focus is on describing and decomposing racial disparities in a patient's *experienced* value added, defined as the patient's own-race value added at the SNF she goes to. Table 3 summarizes our findings. The average Black experienced value added is 0.022, and the average White experienced value added is 0.041 (not shown). Row A shows that the average White-Black gap in experienced value added is about 0.028, or about two thirds of the White experienced value added. Note that the racial disparities in experienced value added are larger than the average (patient-weighted) SNF's White-Black gap of 0.019 (see Table 2). Racial disparities in experienced value added are the result of three forces: differential treatment within SNFs, differential sorting across SNFs, and differential sorting across markets. This highlights the importance of decomposing the White-Black gap in experienced value added since policy interventions to address disparities will depend on which of the three forces are most relevant.

Row B of Table 3 investigates the role of differential sorting of Black patients relative to White patients across markets. To do this, we estimate a patient-level regression of experienced value added on an indicator for being White and on market fixed effects. The coefficient on the White indicator is the White-Black gap in experienced value added purged of the effect of differential sorting across markets. The gap slightly decreases to 0.025 which is about 90% of the gap in row A. The remaining rows focus on decomposing this within-market gap.

Row C investigates the role of differential treatment within SNFs by giving all patients the White value added of their SNF. This substantially shrinks the White-Black gap in experienced value added to 0.009 – a 64% reduction from the within market White-Black gap in experienced value added reported in Row B. It indicates that most of the racial disparity in experienced value added is driven by differential treatment of Black patients and White patients within the *same* SNFs.

Row D investigates the role of differential sorting across SNFs within a market. To accomplish this, we allocate Black patients to SNFs within a market according to each SNF's

market share of White patients, but allocate each patient their race-specific value-added at that SNF. This decreases the White-Black gap in experienced value added to about 0.021 – a 16% reduction from the within market gap in Row B. Although this is small relative to the role of differential treatment within SNFs, the reduction is about 10% of a standard deviation of White value added.

Differential sorting across SNFs within a market may reflect both residential segregation within a market, and differences in which SNFs Black and White patients who live in the same place go to. Rows E and F assess how each contributes to disparities in experienced value added. Panel E re-allocates Blacks to SNFs based on the White choice function. Under these preferences, 83% of Black patients go to a different SNF. But the gap in experienced value added under this new allocation of Black patients to SNFs is still about 0.019. Row F distributes Black patients across zipcodes within markets as Whites are distributed and then re-allocates them to SNFs based on the Black demand function. The gap in experienced value added under this new allocation of Black patients to SNFs is about 0.018.

All together, the results from Table 3 indicate that differential treatment within SNFs within markets is the most relevant force behind the racial disparity in experienced value added. Therefore, for the remainder of the paper we focus on the correlates of the within SNF White-Black gap in value added within markets.

5.3 Correlates of Race-Specific Value Added and the White-Black Gap

Given the results in Table 3, we now seek to characterize the characteristics of SNFs as they relate to value added and the White-Black gap in value added. Table 4 shows partial correlations between value added and SNF characteristics conditional on market fixed effects. SNFs with a higher share Black tend to be worse for both Black and White patients, but they are slightly worse for White patients, meaning the White-Black gap decreases. This is also the case for SNFs with a higher share dual, more beds, and SNFs that are for profit. Table 4 also compares the value added estimates to the CMS star ratings. All of the star ratings are more correlated with White value added than Black value added. For example, the overall rating has a correlation of 0.11 with White value added, but a correlation of 0.05 with Black value added.

Figure 4 shows the SNF-level correlation between the White-Black gap and White value added. The correlation is fairly weak (0.09). The figure also shows that there is substantial dispersion in the White-Black gap for a given value of White value added. Figure 5 shows the distribution of the White-Black gap at the market level. More than 75% of markets have

a positive White-Black gap – the 25th percentile is 0.010, more than 50% of the average gap and about 25% of average White value added (0.041).

6 Conclusion

In this paper, we estimate race-specific value added for almost 10,000 nursing homes. We find substantial racial disparities in experienced value-added, defined as the own-race-specific value added a patient receives at the nursing home she attends. We estimate an average White-Black gap in experienced value added of 0.028, indicating that the average Black patient experiences a value-added that is one-third of that experienced by the average White patient. We find that most of this gap is driven by differential treatment of patients of different race within the same nursing home. We therefore investigate the SNF-level correlates of the White-Black gap in value-added. Somewhat surprisingly, we find that, within a market, the within-nursing home gap in value-added is *higher* for nursing homes that are given higher overall quality ratings by the widely-used Nursing Home Compare "star ratings" constructed by CMS. We also find substantial dispersion within markets in the White-Black gap. The average difference between the 90th and 10th percentile SNF in terms of the White-Black gap within markets is about 0.08 or 1.6 standard deviations of the White-Black gap. Furthermore, the White-Black gap is vritually uncorrelated with White value added. More work is needed to understand what forces contribute to the substsantial gap in White-Black value added within nursing homes, as well as differences in this gap across nursing homes.

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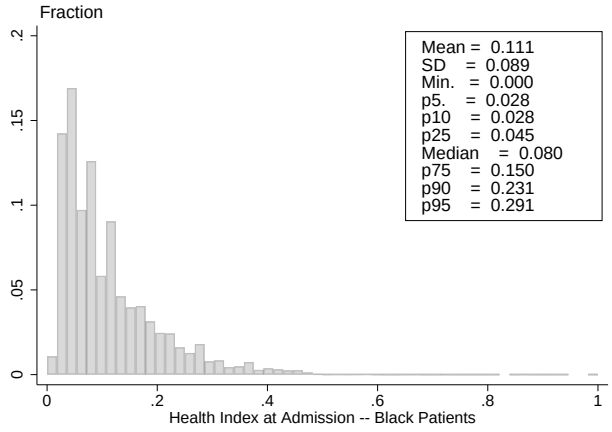
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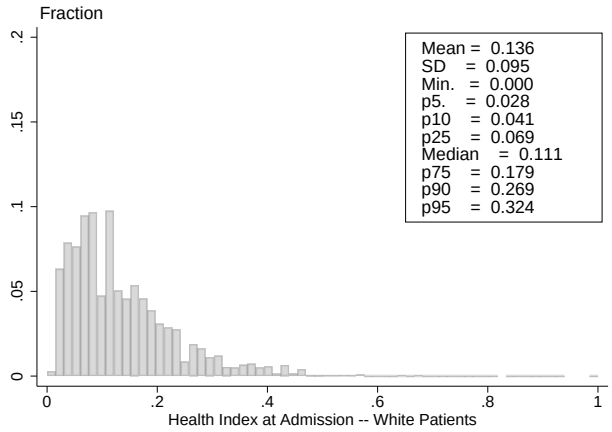
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Figure 1: Distribution of Health Index at Admission

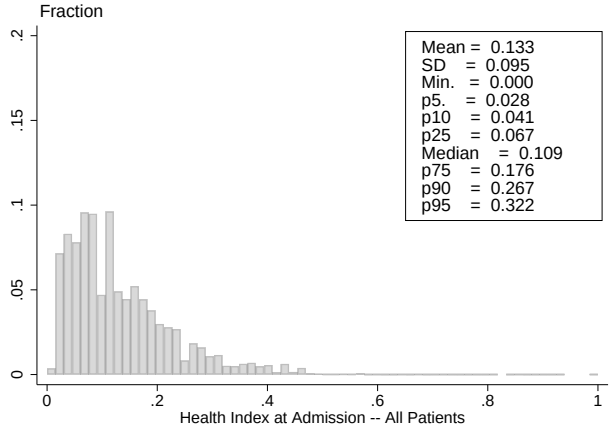
(A) Distribution of Health Index at Admission - Black Patients



(B) Distribution of Health Index at Admission - White Patients



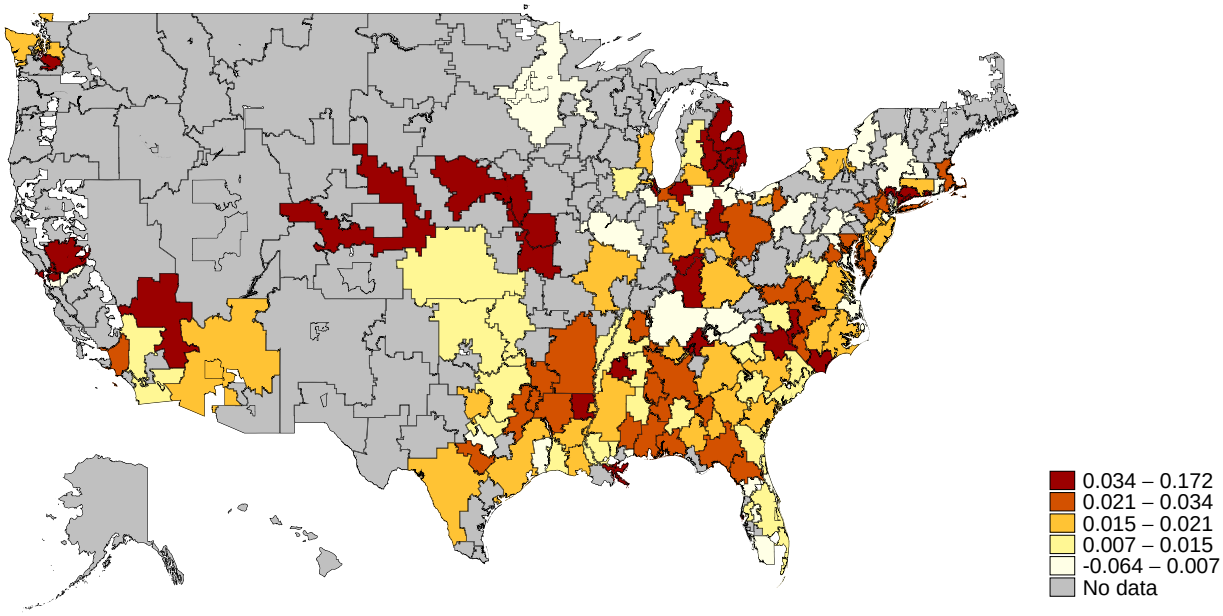
(C) Distribution of Health Index at Admission - All Patients



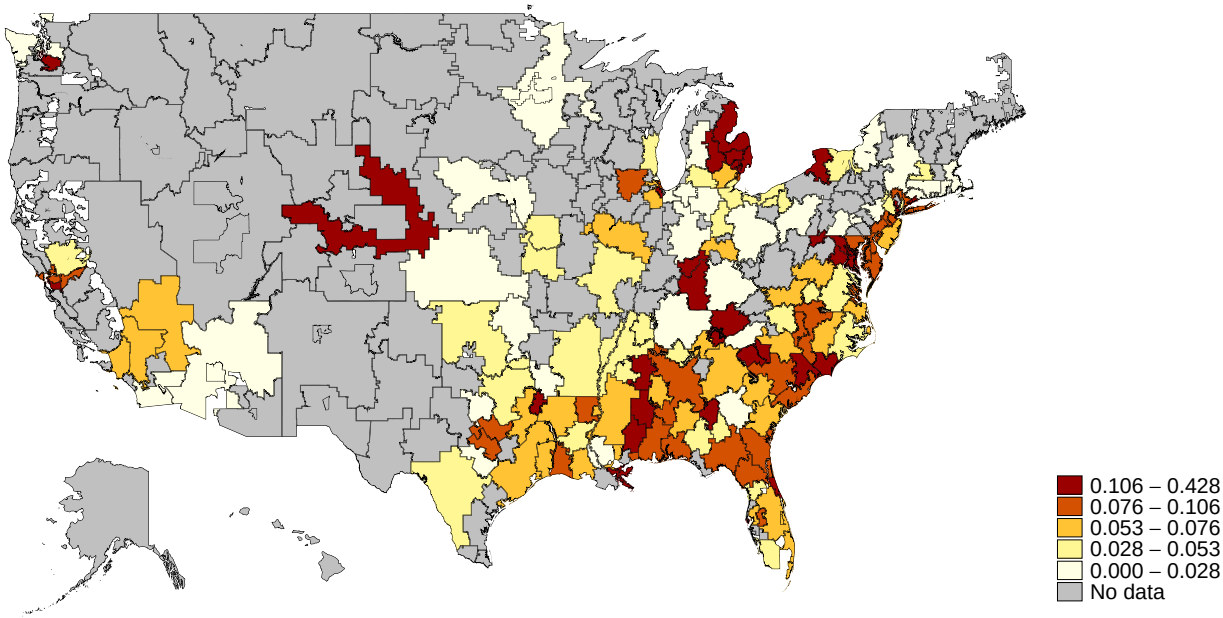
Notes: Panel (A) shows the distribution of the health index at admission $h_{i,1}$ for the 474,775 Black patients in our sample. Panel (B) shows the distribution of the health index at admission $h_{i,1}$ for the 4,043,489 White patients in our sample. Panel (C) shows the distribution of the health index at admission $h_{i,1}$ for all 4,518,264 patients in our sample.

Figure 2: Heterogeneity in the White-Black Across and Within Markets

(A) Average White-Black Gap by Market

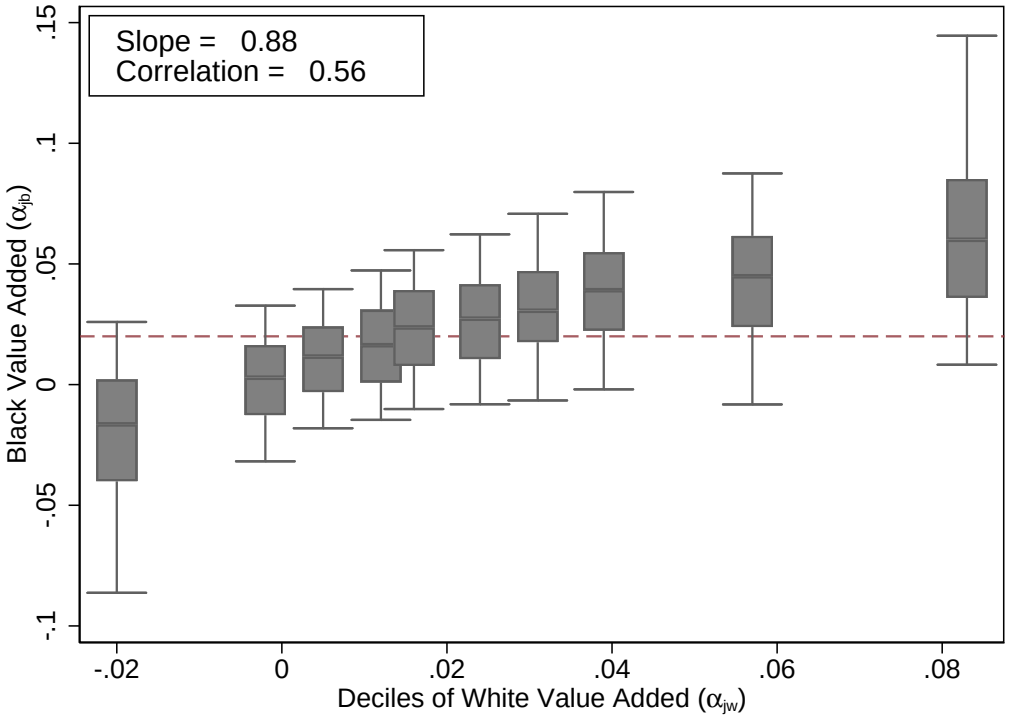


(B) 90-10 Difference in Value Added by Market



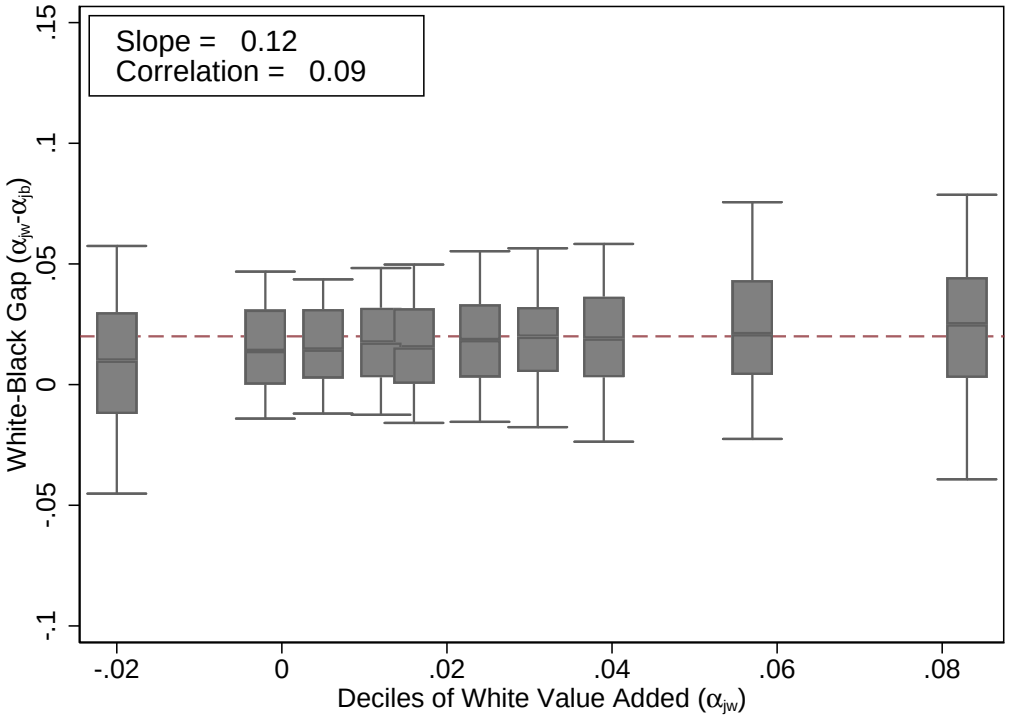
Notes: Panel (A) shows a map of the average White-Black gap by market for the 156 HRRs in our sample. Panel (B) shows a map of the difference between the 90th and 10th percentile SNFs in terms of the White-Black gap across markets for the 156 HRRs in our sample. This map is based on estimates of the White-Black gap for 9,926 SNFs in 156 HRRs.

Figure 3: The Relationship Between Black and White Value Added



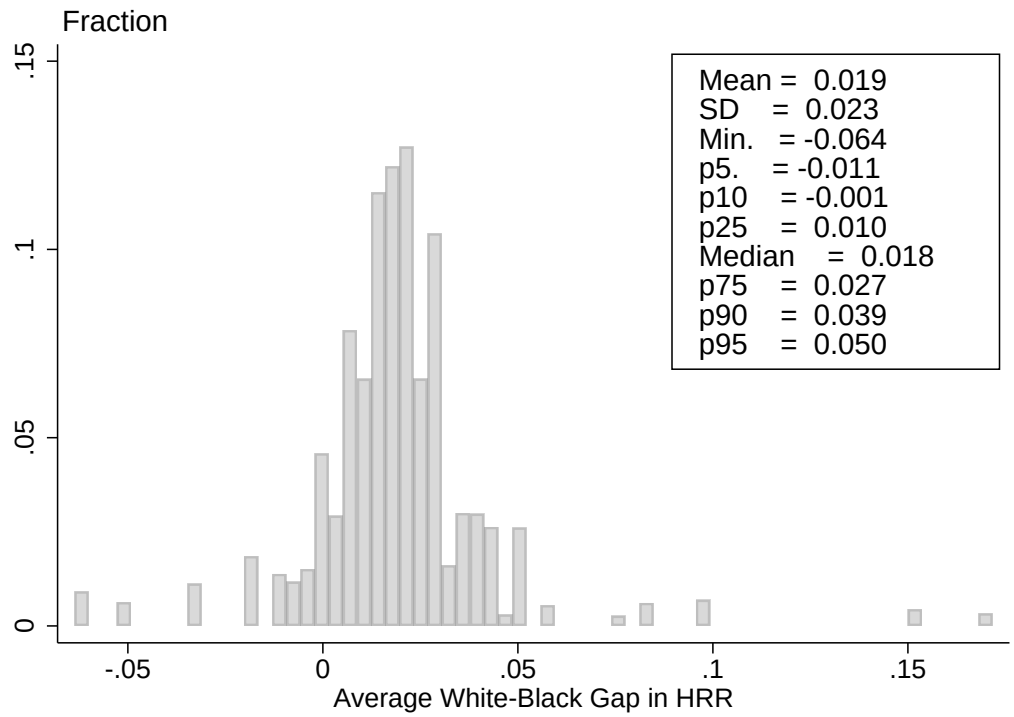
Notes: The figure shows the distribution of Black value added $\alpha_{j,b}$ for each decile of White value added $\alpha_{j,w}$. The box-and-whiskers plot show the median in the middle of the box. The bottoma nd top of each box shows the 25th and 75th percentiles, respectively. The whiskers (or error bars) shows the 10th and 90th percentiles. The dotted red line shows the median Black value added $\alpha_{j,b}$ (0.023). These estimates are for 9,926 SNFs for which we can estimate both Black and White value added.

Figure 4: The Relationship Between the White-Black Gap and White Value Added



Notes: The figure shows the distribution of the White-Black gap in value added $\alpha_{j,w} - \alpha_{j,b}$ for each decile of White value added $\alpha_{j,w}$. The box-and-whiskers plot show the median in the middle of the box. The bottom and top of each box shows the 25th and 75th percentiles, respectively. The whiskers (or error bars) shows the 10th and 90th percentiles. The dotted red line shows the median of the White-Black gap in value added $\alpha_{j,w} - \alpha_{j,b}$ (0.016). These estimates are for 9,926 SNFs for which we can estimate both Black and White value added.

Figure 5: Distribution of the White-Black Gap Across Markets



Notes: The figure shows the distribution of the average White-Black gap in value added across 156 HRRs. Each HRR is weighted by the number of patients in the HRR. The average White-Black gap is based on value added estimates for 9,926 SNFs in 156 HRRs for which we can estimate both Black and White value added.

Table 1: Summary Statistics

	Mean			SD Across SNFs		
	Black	White	All	Black	White	All
	N=474,775	N=4,043,489	N = 4,518,264			
Age	78.39	81.36	81.05	1.88	1.92	2.12
Female	0.62	0.64	0.64	0.10	0.06	0.06
Married	0.26	0.37	0.36	0.09	0.07	0.08
Dual	0.39	0.14	0.16	0.18	0.11	0.14
Length of Stay	51.41	42.37	43.32	28.07	19.06	20.39
Dishcarged before 30 days	0.53	0.57	0.57	0.14	0.12	0.13
In SNF at 30 days	0.47	0.43	0.43	0.14	0.12	0.13
Community at 30 days	0.35	0.45	0.44	0.18	0.15	0.16
ACH at 30 days	0.24	0.19	0.19	0.08	0.05	0.06
Hospice or Dead at 30 days	0.02	0.03	0.03	0.03	0.02	0.02
Other at 30 days	0.03	0.03	0.03	0.03	0.03	0.03

Notes: The table shows summary statistics of our sample. There are 4,518,264 patient-stays in total, 474,755 of which are Black patients and 4,043,489 of which are White patients. These stays occur at 9,970 SNFs in 156 HRRs. Means and standard deviations are shown separately for Black and White Patients. To calculate the standard derivation across SNFs each SNF is weighted by its number of patients.

Table 2: Model Estimates

	Mean	SD	p10	p50	p90
$\alpha_{j,b}$	0.022	0.061	-0.026	0.023	0.072
$\alpha_{j,w}$	0.041	0.038	0.009	0.042	0.072
$\alpha_{j,w} - \alpha_{j,b}$	0.019	0.050	-0.020	0.016	0.057
$\lambda_{j,b}$	0.300	0.257	0.083	0.268	0.567
$\lambda_{j,w}$	0.257	0.124	0.169	0.249	0.322
$\phi_{j,b}$	0.006	0.409	-0.057	-0.009	0.118
$\phi_{j,w}$	-0.005	0.177	-0.012	-0.005	0.002

Notes: The table shows summary statistics of the SNF specific model estimates. Each SNF is weighted by its number of patients. The estimates for White parameters are for 9,940 SNFs and the estimates for Black parameters are for 9,926 SNFs. We estimate the White-Black gap $\alpha_{j,w} - \alpha_{j,b}$ for 9,926 SNFs. The estimated "national" parameters are $\theta = 0.99, \sigma_{\varepsilon,b} = 0.06, \sigma_{\varepsilon,w} = 0.07, \sigma_{\nu,b} = 0.20, \sigma_{\nu,w} = 0.15, \varphi_b = 0.008, \varphi_w = 0.004$.

Table 3: Decomposition of Disparities in Experienced Value Added

	Gap	SE
A. Baseline experienced value added	0.0277	0.0001
B. Within market	0.0246	0.0001
C. Blacks given white value added ($\alpha_{j,w}$) within market	0.0087	0.0001
D. Blacks distributed like whites across SNFs within market	0.0208	0.0001
E. Blacks choose like whites ($\delta_{j,w}$,τ_w) within market (share switch = 0.83)	0.0193	0.0002
F. Blacks distributed like whites across ZIPs & keep ($\delta_{j,b}$,τ_b) within market	0.0183	0.0001

Notes: Panel A shows the average experienced value added. This is calculated by regressing experienced value added (i.e., the value added a patient experiences at the SNF they go to as a function of their race) on an indicator for being White. The gap reported in the table is the coefficient on the White indicator and the standard error (SE) is the associated standard error of that coefficient. Panel B reports the same coefficient and its standard error in a regression that includes market fixed effects. Panel C reports the same coefficient and its standard error as in B, but experienced value added is redefined such that all patients get the White value added of the SNF they go to. Panel D reports the same coefficient and its standard error as in B, but experienced value added is calculated in a counterfactual scenario wherein Blacks are allocated to SNFs within markets according to each SNFs market share of White patients. Panel E reports the same coefficient and its standard error as in B, but experienced value added is calculated in a counterfactual scenario wherein Blacks choose SNFs according to the White demand function. Panel F reports the same coefficient and its standard error as in B, but experienced value added is calculated in a counterfactual scenario wherein Blacks residences are distributed across zipcodes as Whites are and Blacks then choose new SNFs according to the Black demand function. All estimates in this table are based on 4,478,631 patients at 9,926 SNFs for which we can estimate both Black and White value added.

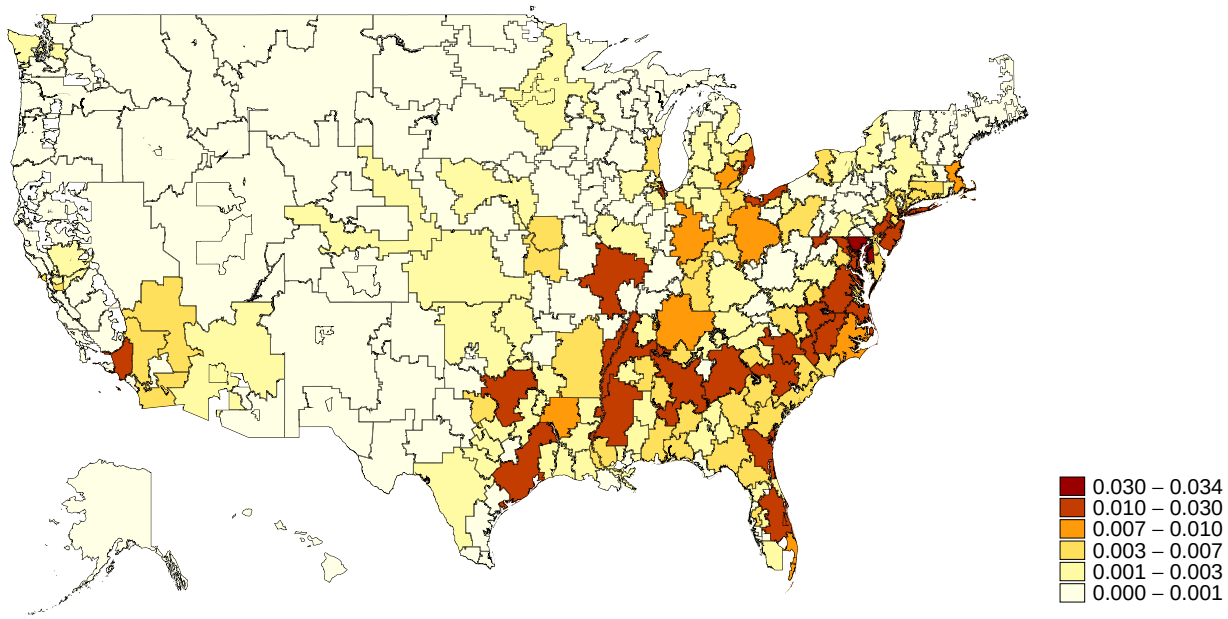
Table 4: Correlates of Value Added and the White-Black Gap

	$\alpha_{j,b}$	$\alpha_{j,w}$	$\alpha_{j,w} - \alpha_{j,b}$
Share Black	-0.043	-0.147	-0.067
Share Dual	-0.106	-0.223	-0.053
Beds	-0.007	-0.024	-0.011
Occupancy	-0.003	-0.003	0.001
For Profit	-0.033	-0.073	-0.017
Overall Rating	0.050	0.108	0.026
Quality Rating	0.028	0.041	-0.001
Inspection Rating	0.045	0.075	0.006
Staffing Rating	0.046	0.120	0.041

Notes: The table shows partial correlations conditional on market fixed fixed effects. These correlations are shown for 4,478,631 patients at 9,929 SNFs for which we can estimate both Black and White value added.

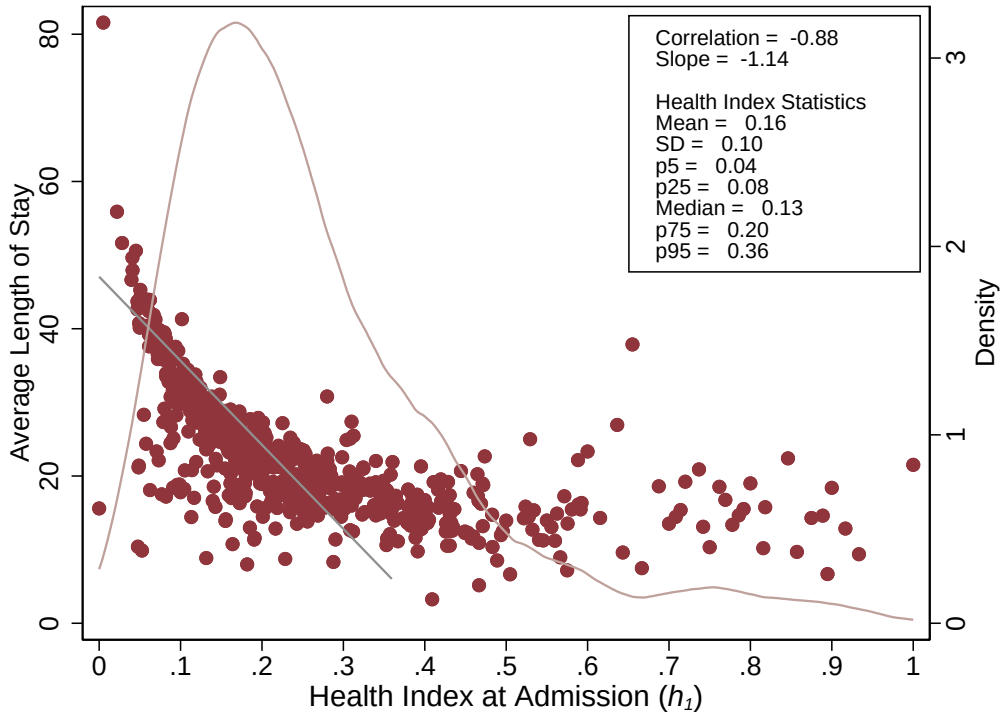
A Appendix Exhibits

Appendix Figure A1: Map of Market Share of Black Admissions



Notes: The figure shows a map of the 306 HRRs in the U.S. The map shows each HRR's share of Black admissions. HRRs in the lightest color have a Black share lower than 0.001, meaning they are excluded from our sample.

Appendix Figure A2: The Relationship Between Length of Stay and the Health Index



Notes: The figure shows the relationship between length of stay in the SNF and the health index at admission $h_{i,1}$ for all 2,782,674 patients discharged to the community in our sample. Each point in the scatter plot represents the average length of stay at one of the 635 unique values of $h_{i,1}$ from the regression tree. The line is the linear fit between average length of stay and and $h_{i,1}$ for patients with $h_{i,1}$ below the 95th percentile. The density is the density of the health index at admission for patients who are discharged to the community.

Appendix Table A1: Summary Statistics of Empirical Bayes Shrunken Estimates

	Mean	SD	p10	p50	p90
$\alpha_{j,b}$	0.020	0.056	-0.024	0.020	0.066
$\alpha_{j,w}$	0.041	0.036	0.010	0.042	0.071
$\alpha_{j,w} - \alpha_{j,b}$	0.019	0.043	-0.016	0.017	0.053

Notes: The table shows summary statistics of race-specifc value-added and the White-Black gap in value-added after we apply empirical Bayes shrinkage. Each SNF is weighted by its number of patients. The estimates for White parameters are for 9,940 SNFs and the estimates for Black parameters are for 9,926 SNFs. We estimate the White-Black gap $\alpha_{j,w} - \alpha_{j,b}$ for 9,926 SNFs. .