Doctors, Patients, and the Racial Mortality Gap: What Are the Causes?

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Abstract

Disparities in health outcomes between white Americans and minorities are well documented. Discrimination and unequal access to care are frequently cited explanations for the racial differences in mortality. It has been alleged that doctors treat minority patients differently or that they are trapped in facilities of inferior quality. I use a new dataset from the Department of Veterans Affairs and employ a novel estimation strategy to investigate the sources of the racial gap in mortality for chronic heart disease, the most expensive chronic condition in the elderly. I show that there are racial differences in mortality even when the quality of clinics and doctors is equalized. It is demonstrated that doctor competence significantly influences patient outcomes; that minorities and whites have access to similar physician quality, and that doctors treat patients similarly regardless of race. Differences in patient self-management trigger a racial mortality gap even when access and treatment are equalized. Considerable reductions in medical costs could be achieved by convincing patients of the importance of strictly following the therapy regimen. A special emphasis on changing the compliance patterns of minorities will have the added benefit of reducing the black-white mortality gap by at least two-thirds.

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Introduction

Research in the last twenty years has shown persistent racial differences in health care access, utilization, and outcomes. Explanations can be broadly grouped into three categories: unequal access, unequal treatment, and unequal quality of care accessible to minorities. Despite a considerable amount of previous work, the question still stands: are there significant and systematic differences between hospitals and doctors in their ability to influence health and do these differences explain the racial gap in mortality? Identifying the correct causes is imperative before we design policies to address them.

A great deal had been done to examine the effect of hospital quality and between-hospital differences in access and quality of treatment on the racial gap in survival. However, no study has investigated the causes and effects of differential treatment of minorities within health care facilities. A more general issue is how important are differences in doctor characteristics in determining outcomes? Are doctors treating black and white patients the same? This is the first paper that differentiates between facility and physician-specific sources of variation and evaluates their contributions to the racial gap. It also offers the first attempt to explain some of the causes of within-facility differences in treatment and outcomes.

This paper examines racial differences in death rates due to Chronic Heart Failure. The sample is limited to patients suffering from Chronic Heart Failure for several reasons. First, heart disease is the leading cause of death in the population over 65 and has become the largest Medicare expense in recent years (33.2 billion in 2007)[2]. In addition, cardiovascular disease is a major contributor to the mortality difference between white Americans and African Americans. It accounts for over 40% of the racial gap. Third, heart disease is a chronic condition and an Ambulatory Case Sensitive Condition, i.e. expensive hospitalizations and rehospitalizations can be avoided with adequate preventive care and disease management. Approximately 10% of all inpatient admissions are for CHF and hospitalizations of black males are almost twice as frequent as of white males[3]. Finally, there are clear guidelines for the pharmacologic management of heart failure which allow me to test the compliance of providers and patients with the optimal therapy.

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[2] According to the AHA statistical abstract, 2007 (http://www.americanheart.org/downloadable/heart/1166711577754HS_StatsInsideText.pdf)

[3] In the population over 65 (Alexander et al, 1999)

There several major advantages of this study. First, I use rich data from the Veterans Affairs Administration. The same cohorts of patients are followed through outpatient, inpatient and pharmacy encounters. These data allow me to contrast measures of on patient compliance with physician recommendations and the quality of clinical care; both factors are shown to significantly influence outcomes.

Second, I examine the effect of observable physician quality indicators on patient survival and argue that within-clinic differences in disease management account for a large share of the observed racial disparities. Common sense dictates that more competent doctors will have positive effects on their patients' health, but no previous study has identified observable characteristics of physicians which contribute to better patient outcomes. Identifying doctor characteristics which influence patient outcomes is crucial in targeting improvement policies and quality initiatives to the correct recipients.

Third, the Veterans Health Administration is frequently commended for equalizing access to health care for minorities and limiting physicians' financial incentives to over or under-provide treatment with a fixed salary scheme. Therefore, I can control for access differences between blacks and whites.

In spite of their efforts to level the playing field for all patients, I document a significant medium-term difference in survival between whites and minorities. This difference cannot be attributed to access to quality care on the part of black patients. It is also shown that there are no observable differences in treatment or quality of care received. Closing the gap in compliance with prescribed therapy between black and white patients would eliminate the difference in medium-term mortality. Increasing minority compliance by 5% could bring a gross societal benefit of at least 0.7 billion a year.

Two directions for policy are suggested. First, significant effort is needed to improve doctors' recognition and application of recommended therapies. This will improve the general medium-term prognosis for all patients. Second, the mortality gap in cardio-vascular diseases and CHF in particular could be significantly reduced by educating patients about self-management. Interventions focused on increasing awareness in minority patients could go a long way towards eliminating disparities. Section 6 discusses other policy implications.

The next section examines previous attempts to explain the black-white differences in mortality and some hypotheses which have been developed. I describe the data and outline the empirical model in sections 3 and 4. Section 5 presents the results. Section 7 concludes.

2. Background

Previous studies have found a consistent negative correlation between black race and patient outcomes (IOM Report, 2000). Several possible reasons have been proposed. First, minority patients are less likely to have insurance, and more likely to be of lower socioeconomic status (SES). In particular, African Americans are more likely to live in poverty, and to have worse health maintenance and preventive care since infancy. As a consequence of lower SES and insurance rates, more complicated and more expensive procedures may be withheld from black patients. Physicians and hospitals may fear that they will not be reimbursed and elect not to recommend the treatment to minority patients. Using data from the Veterans Health Administration gets around many of the differences stemming from unequal access or financial motives for over- or under-providing care to minorities. Institutional barriers to health care provision are minimal and any disparities remaining within the VHA are most likely due to other causes.

Second, many African Americans report not having a regular primary physician, have worse continuity of care and more frequent use of emergency rooms as primary sources of medical attention (Oster and Bindman, 2003). Studies have shown that irregularity and fragmentation of medical care lead to less efficient health management and hence worse outcomes. Poverty, insufficient health education and awareness of one's health needs, distrust in the health system, and institutional hurdles to obtaining regular care are some of the underlying reasons discussed in the literature. Again, using VA data overcomes this problem.

A third explanation is that the quality of health care received by black patients, whenever they are able to access it, is worse than health care available to whites. Studies have found that doctors who treat primarily black patients are less likely to be board certified, more likely to report not being able to provide high quality care to their patients, and that black patients have less access to high-quality specialists and non-emergency hospitalizations. In particular, lower income African Americans have access to lower-quality cardiac surgeons and are treated by lower-volume surgeons (Bach et al, 2004; Mukamel et al, 2000; Rothenberg et al, 2004). This amounts to institutionally ingrained discrimination affecting the entire society.

The persistence of these trends after adjusting for SES and regional differences has been explained by statistical discrimination, clinical uncertainty or stereotyping (Balsa and McGuire, 2002). Clinical uncertainty might contribute to over- or under-prescription of therapies to black patients because of uncertainty about the severity or appropriate treatment in the minority group. Stereotyping refers to attributing certain qualities to patients belonging to a minority group based on expectations about the average behavior of members of the group. For example, Bogart et al. (2001) demonstrate that doctors are less likely to prescribe certain medications to minority patients because they expect lower patient compliance. Using data from doctor-patient encounters I show that there is no evidence of such statistical discrimination in the VA health care system.

Previous research shows that minorities differ in their attitudes towards health and the health care system. Goldman and Smith (2002) show that patients' adherence to prescribed therapy and the ability to perform self-maintenance vary significantly with race and education. Blacks and less educated individuals are more likely to experience lapses in treatment caused by their own non-compliance with physician recommendations. These lapses are especially important for chronic conditions, requiring strict adherence to prescribed therapy and life-style changes that can significantly prolong life. Mistrust in the health care system is a potential cause of these effects. Black patients with cardiac conditions are less satisfied with the health care they receive and more likely to mistrust the system as a whole (LaVeist et al, 2000).

Finally, because of geographic residential segregation and the lower socioeconomic status of minority populations, the quality of the hospitals, hospital equipment and personnel may be worse in areas populated by minorities. Even if patients are fully insured and maintain a regular schedule of check-ups and preventive care, they would have worse treatment and subsequent mortality outcomes because of the quality of the clinic or hospital in which they are treated. I show that differences in death rates within the VA equal-access system are not due to lower quality of the facilities they use.

Here studies diverge in assessing the relative contributions of within- and between hospital racial differences in care. A major problem is that data are rarely recorded for the physician-patient pairs which form during an encounter. This is impossible in a hospital setting, where the patient is attended to by a number of staff. Empirical work assigns the remaining gap after controlling for hospital quality to within-hospital differences. Clearly, this is insufficient if the goal is to pinpoint the major source of disparities.

Empirical research on racial disparities in cardiac care has concentrated on patients who suffer heart attacks (acute myocardial infarctions, or AMI). Recent studies have found that a substantial part of the racial disparity in treatments is accounted for by the specific hospital to which patients are admitted (Bradley et al 2004; Barnato et al. 2005; Skinner et al, 2005). Skinner et al (2005) find large between-hospital differences in the treatment of AMIs and yet a substantial fraction of the aggregate differences is unexplained. They suggest that factors such as the quality of physicians may explain the remaining difference within hospitals. For example, if white physicians communicate more effectively with white patients, this would translate into more adequate treatment for white patients at all hospitals (Balsa and McGuire (2003)).

The trouble with using (30-, 180, or 1 year) mortality rates from AMI to estimate within vs between hospital sources of disparities is that patients being treated in emergency conditions are assigned doctors randomly at least in the first (and crucial) hours after the AMI. Hence the differences in mortality rates are largely driven by the average doctor quality between hospitals. It is harder to pick up the effects of subsequent, post acute-stage patient sorting into different providers.

Substandard care leads to more frequent hospitalizations, lower quality of life, and ultimately larger costs of care for minority patients. Efforts to address the mounting health care costs for the elderly must start with identifying the causes for worsening chronic conditions, especially in the economically disadvantaged populations who may wait to address their health needs until covered by Medicare. The VHA is frequently cited as a potential model for a future unified, universal access medical system. The remaining disparities in patients' outcomes within the VA exist in addition to differences due to unequal access to private care. They are likely to persist even in the presence of equalized access. Understanding the causes of these disparities is crucial for designing a better system of health care provision.

A substantial advantage of this paper is that I can track the sequence of doctors that patients encounter over time. I use a sample of patients with Chronic Heart Failure (CHF, or Congestive Heart Failure, or Heart Failure) - a chronic and eventually fatal condition. I concentrate on the effects of outpatient care because this illness is managed on an outpatient (ambulatory) basis. These patients are treated in an equal-access integrated health care system, where financial incentives for patients and doctors and greatly reduced. The veterans' health administration (VHA) provides free health care for all eligible veterans. The VA's physicians are salaried and hospitals and outpatient centers receive funding depending on the number of patients treated. Using the population of patients with Chronic (Congestive) Heart Failure (CHF) treated in the VHA, I avoid many of the complications arising from differences in socioeconomic status between races. Even studies using Medicare data could produce biased results because minority patients may have accumulated worse health over their lifespan before they turned 65 and became eligible for free medical care. In my sample patients have either been eligible for medical care through the Department of Defense (when on active duty) or through the VA. Any remaining differences by race are more easily attributable to unequal treatment by physicians or differences in patients' attitudes to health.

3. Data

The data in this study were drawn from the VA Medical SAS inpatient and outpatient datasets, the Beneficiary Identification Records Locator Subsystem (BIRLS) death files, the VA Enrollment files, and the Veterans Service Support Administration (VSSA) clinic performance measures database. Data on zip codes were extracted from the Census. The data cover all outpatients who were diagnosed with CHF between October 1998 and October 2004[4].

Currently, the majority of veterans belong to the age cohorts who served in WWII, the Korean War, and the Vietnam War. The median age of all veterans is 55, with veterans comprising the majority of all civilian males older than 65. The proportion varies by race. Veterans account for over 60% of white males older than 65, but only 37% of black males aged 65-75 and 51% of black males aged over 75 (Bureau of the Census 2001).

I restrict the sample to patients who utilized community based outpatient clinics at least twice in the first year after CHF diagnosis. These people could be credibly identified as served by the Veterans Health Administration. Of those patients I exclude the individuals who did not have complete information on their race which could be verified either across visits and/or by using the inpatient datasets and the Medicare data. There were 2487 patients whose race could not be determined because the different datasets reported it differently. Finally, I restrict the sample to male veterans only. Female veterans comprise less than 2% of the veteran population in this age group and are arguably different from the average female in that age group. The final sample consists of 48972 VHA patients. CHF disproportionately affects elderly people and the military had restrictions on enrolling African Americans until the Korean War. This means that blacks are underrepresented in this sample compared

[4] All outpatient visits are recorded in the outpatient files. Hospitalizations in a VA or related hospital are recorded in the inpatient files. The Enrollment files use Social Security administration data, as well as the VA's internal accounts to record death. The BIRLS files pool data from the veterans benefits administration (including death/burial benefits) as well as notifications from hospitals (through the inpatient files), relatives/acquaintances, cemeteries or any other branch of the veterans system. Death data were initially extracted from the VA BIRLS files, double checked against the VA enrollment files, and then checked again against data from Medicare. The triple-checking of the death data ensures that I use accurate vital status records.

to the overall veteran population and to the US population in general. Black patients comprise about 7.6% of the sample[5].

A substantial advantage over previous research is that VA data allow me to control for income. Because blacks on average have lower socioeconomic status (SES) and tend to delay seeking health care, it is likely that "blacker" hospitals are also "sicker" or poorer hospitals. The advantage of VA data is that the centralized budgeting system of the VA is government-sponsored, hence the SES of the patients does not influence the resources of the clinic. In the VA physician visits, procedures and hospitalizations are virtually free, and prescription drugs heavily subsidized at prices lower than Medicare prices. Co-payments are still in the process of being introduced and are required only from enrollees with the highest SES and no service-related conditions. Patients could only obtain prescription medications at subsidized prices if those medications are prescribed by a VA physician. Patients must maintain a primary care physician in the VA. Studies which use data from Medicare claims suffer from the fact that provider quality is influenced by the financial status of all patients, not only those covered by Medicare. In addition, Medicare claims data do not include HMO patients, which may introduce selection bias. Financial and other resources are distributed on the basis of the patient load - clinics serve a larger proportion of patients get more funding.

Income is reported on the enrollment forms each year and is used to determine the patients' priority group and their benefits. Previous studies control for income using mean or median zip-code income data from the Census bureau. However this measure can be misleading especially when the emphasis is on the effect of minority status or SES on health. Segregated neighborhoods have wide variations in income. Median income would over-estimate the financial means of the minority population and at best provide a crude measure of the SES of the zip-code as a whole.

Congestive heart failure is a progressive disorder with fatal outcomes. Mortality rates in the first year after diagnosis are about 10%. However, if care is managed well, patients' chances of living longer and their quality of life can be improved significantly. The recommended medical therapy is

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5 LaVeist (1994) among others points out that race is a poorly measured variable whose designation varies depending on the reporting body. I use race data from Medicare and the VA. Nearly 90% of the patients have a record in Medicare. For the remaining 10% I use the data from the Veterans Affairs administration, where I cross-check race with data from different encounters. S. Arday et al (2000) show that the Medicare race variable corresponds very closely to self-reported race. For the part of the sample which has a record both in Medicare and in the VA, I find that 3% of the patients had a difference in the coding of race between Medicare and VA. This discrepancy can be attributed to coding errors on both sides and is unavoidable in administrative data. Overall I believe the race designation which I use in the analysis is very close to self-reported race.

well publicized. Once the first year of treatment has passed successfully, chances of longer-term survival increasingly depend on the patients' and doctors' ability to adapt the treatment and lifestyles to counter the progression of the disease. Short-term (one-year) mortality is more likely to be influenced by the patient's initial physical condition at diagnosis, while longer-term survival would be more sensitive to medical therapy and the ability of the patient and the doctor to coordinate the management of the disease.

Table 10 contains the results form a linear probability model of one year survival. I find no racial differences in one- and two-year survival rates. This is consistent with previous studies using Medicare or VA data (Krumholz 2003, Alexander, 1999; Deswal, 1999) No other study has followed patients for more than 2 years or considered the effect of outpatient care on CHF mortality. The largest estimate of the racial mortality gap in CHF was reported by the CDC - 7.8% [6]. This is a very crude benchmark of the yearly mortality rate, unadjusted for the number of years since diagnosis or differences in access and co-morbidities. The closest estimate of the gap to the one I find is reported using Medicare data by Dries at al (1999) at 3.1 % after two years of follow-up. I argue that at least two thirds of this mortality gap is attributable to differences in patient attitudes to health, and not to variations in quality, physician discrimination, or institutional barriers to accessing health care.

Table 1 shows that on average black patients are about 25% poorer. The differences in income reported in the sample are close to those observed in Census data for the same age group[7]. White patients are more likely to be married. On average they are 6 years older. The VA outpatient datasets contain data on all coexisting health conditions. I include controls for conditions picked to correspond closely to the conditions used Charlson-Deyo index of co-morbidities, which is the standard reference in the health literature [Charlson, 1987][8]. I do not compute an index, but include the conditions as separate controls. The data do not supply an indicator of CHF severity, which is likely to differ across patients. However, there is significant information on other cardio-vascular co-morbidities. CHF

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[6] MMWR Weekly, August 7, 1998; 47(30), 663-7

[7] About 15% of income values every year were coded as 0s. Whenever possible, I impute income by assigning the mean value of income for the years in which it is available. The VA may have coded zeros for a missing value. Alternatively, it could be a code for administrators indicating veterans who are eligible for care regardless of their income levels. Since I do not know the rule which was used, I flag the observations with a zero coded as income. I control for missing income values in all regression specifications which control for income.

[8] I include controls for old myocardial infarction, lymphoma, leukemia, pulmonary failure, diabetes, renal failure, colon cancer, angina, cardiomyopathy, ischemic heart disease, prostate cancer, liver disease, dysrhythmias, other cardiovascular disease, other cancers.

usually occurs as a result of, or in conjunction with some of these conditions. I include indicators for other cardiovascular diseases as proxies for the severity of CHF.

The sample covers the period from October 1998 to October 2004. Patients join the sample throughout this period. The largest numbers of new patients enter in years 2001 and 2002. This coincides with the period of largest expansion of the VA health care system. There was a significant increase in the number of patients per clinic over the examined period. The average number of patients per clinic goes up from 33 in 1999 to 117 in 2003. The years 1998 are 2004 are incomplete, since 1998 includes data from the last three months of the year and 2004 ends in September. A potential concern is that the patients joining the VA health system after 1998 could have an advanced stage of CHF at the time of first diagnosis *within* the VHA. I control for such sources of bias by including cohort dummies. Most of the new patients who joined the VHA after 1998 are white patients of higher income. Therefore, any discrepancy in severity at first diagnosis would work against finding racial differences in survival and bias the coefficient on black race in the survival regressions downwards.

Clinics vary in size from 1000 visits per year to 300000 visits per year. In this study clinics are divided into small (below 10000 visits per year), medium (between 10000 and 20000 visits per year) and large (above 20000 visits per year) categories. The ratio of black patients in the clinic is defined as the ratio of visits by black patients in a year divided by the total number of visits to the clinic in that year[9]. Black patients are more likely to be treated in large urban clinics (92% in urban and 55% in large clinics), while white patients are more likely to go to small and medium-sized clinics. Table 1 breaks down the racial profile of the clinic by clinic size and race of the patient.

An important variable which is missing from the data is education. In the population over 65 years of age educational differences between races are especially large. Forty-seven percent of black males over the age of 65 did not graduate from high school, compared to 22% of whites. Numerous studies have shown that more educated people have better health and the belief that more education leads to better understanding of one's health needs is common sense. Differences in income should

[9] The data allow the construction of two measures of clinic racial mix. The other possibility is the ratio of black to total patients. The proportion of visits is a measure of the intensity of black patients' presence at the clinic. It can be understood as the likelihood of meeting a black patient in the waiting room. While there may be significant number of blacks registered at the clinic, they may not utilize it as much as the rest of the patients. Using the alternative measure of blackness based on the proportion of black patients corresponds to the question "What is the probability that I will select a black patient if I randomly pick a name from the clinic's patient list?" The correlation between the two measures is 0.72.

The measure based on the number of visits is more appealing for several reasons. First, it measures the intensity of utilization. There may be a number of black patients who showed up once at the clinic and never came back, who will be accounted for in the patient-based measure. Having more black patients without more black patient visits does not add to the "blackness" of the clinic.

control for some of the differences in education between black and white veterans. Any remaining bias after controlling for income is likely smaller than in previous studies using Medicare data.

Doctors' adherence to treatment guidelines

I use the prescriptions data and the clinical guidelines put out by the American College of Cardiology to evaluate physicians' prescription patterns. The clinical guideline recommends prescribing Angiotensin Converting Enzyme inhibitors (ACE inhibitors, or ACEIs) and beta blockers (BBs) to all patients with Chronic Heart Failure. Widely publicized clinical trials in the 90s showed that patients with CHF benefit from these medications. These groups of medications have been proved to improve the function of the heart and slow down the progression of the condition. The VA have issued clinical guidelines suggesting to all providers that ACEIs and BBs must be considered in the course of therapy. All patients in this sample are eligible because they are diagnosed with congestive heart failure. The only exceptions may come from allergies. There is no evidence that black patients are more likely to suffer from allergies to ACEIs and beta blockers[10].

The rate of prescribing the recommended drugs provides an independent benchmark against which I can assess the doctor's clinical abilities. The measure of providers' adherence to clinical guidelines is constructed as the ratio of patients who encountered the provider in the year and were prescribed ACE inhibitors and beta blockers by that doctor over the total number of patients seen by the doctor.

Adherence ratio = ((N patients with ACEIs-BBs)/(Total N patients))

A higher adherence ratio means stricter compliance with the recommended therapy. Summary statistics by clinic size and race of patient are presented in Table 1. I use the adherence ratio as a signal of doctor quality. Doctor quality, doctor competence and doctor adherence are used interchangeably in the text. This measure is directly estimated from data, and it is based on the actual decisions taken by the physician. It is a more adequate description of quality than, for example, medical school test scores or board examination scores, because it reflects the practical side of physician competence. Another important concern is that doctor quality measured in this way can be affected by policy. “Quality” in

[10] However, at least one guideline suggests that finding the correct dosage may be harder with African American patients and hence more careful patient monitoring is advised.

the sense used here refers to the doctor's abilities as a clinician, and does not explicitly measure other relevant, but unmeasurable doctor characteristics such as cultural competence.

Patients see more than one doctor every year. The weighted mean of doctor quality for every patient is calculated. The weights are based on the number of prescriptions written by the doctor for the patient. For example, if a patient is seeing 2 doctors, and he has 5 prescriptions from the doctor of quality 1 and 2 prescriptions from the doctor with quality 0, his weighted doctor quality will be 5/7.

The relative importance of the quality of clinical care for patient health has not been explored in uncontrolled environments despite numerous clinical trials showing that medicines recommended in clinical guidelines have a significant impact on mortality and morbidity. Most medical care studies are based on inpatient data, where it is impossible to identify the treating physician(s). In a hospital setting, a patient is seen by a multitude of doctors and it is very problematic to disentangle the parts of the therapy directed by different individuals. Moreover, medical therapy is highly personalized and depends on the idiosyncratic health needs of the patients. Few medical conditions have developed clinical guidelines at the level of CHF. These two problems make measuring the quality of health care difficult in the general population.

A problem arises if doctors of higher quality are matched to patients of better health along dimensions not captured by the controls. Then the coefficients on doctor quality will be biased upwards. Positive matching of doctors to patient populations would be more likely at the clinic level, i.e. doctors would choose a clinic based on the clinic population. It is less likely that doctors would choose patients within the clinic. The upwards bias on the doctor quality coefficient arising from doctor-clinic matching is addressed by including clinic fixed effects. The inclusion of clinic fixed effects guarantees that the effects on patient survival are identified only by the variation across groups of doctors within the same clinic, and not by how doctors are distributed among clinics. However, it is still possible that doctors are non-randomly matched to patients within clinics. I use an instrumental variables approach to help eliminate the potential residual bias from assortative matching between doctors and patients *within* clinic[11].

Patient compliance measures

[11] The education literature offers the closest type of problem to the one discussed here. Studies attempt to estimate the importance of teacher quality on students' performance independently from the effect of schools, selection into schools, and students' family background. Rivkin, Hanushek and Kain (2005) provide an excellent review of the problem in the education context and discuss the challenges to obtaining robust empirical estimates of the effect of teacher quality.

A common drawback of studies evaluating racial and SES disparities in preventable hospitalizations and mortality is that they do not include controls for access to pharmaceuticals. Regular and unobstructed oral medications therapy is especially important for the management of chronic conditions such as Heart Failure. Access to pharmaceuticals data gives this study a considerable advantage over previous work. All veterans who utilize the VA health care system are eligible to receive prescription medications through VA pharmacies. Only prescriptions called in by VHA physicians are filled in the pharmacies.

I use data on prescription refills to define a measure of patient compliance with therapy. The VA pharmacy data contain a "days supply" variable attached to each prescription, as well as the time when the first dose was dispensed and the time of subsequent refills. Using the "days supply" variable I can determine whether the prescription was refilled on time. I use a generous definition of a “timely” refill as a refill called within 3 days of the expiration of the previous days’ supply. The adherence measure is defined as the number of prescriptions which were not re-filled on time over the total number of prescriptions. The same technique is used to formulate aggregate patient compliance per year and individual patient compliance for every patient-doctor pair.

Compliance ratio = ((N prescriptions filled on time)/(Total N prescriptions))

Table 1 shows the summary statistics by race. The average compliance rate in the sample is 50%, and black race is associated with a 3% -5% decrease in the ratio of compliant refills. In a study of HIV patients Goldman and Smith (2002) find that black race is associated with a 33% decrease in the probability of strict adherence to therapy. However, their measure of compliance is much stricter. They consider a patient compliant if she has taken all of her HIV medications correctly in 7 out of the past 7 days. The measure I use is less stringent. I consider a patient compliant if he picked up the prescription within 3 days of the expiration of the previous fills’ days supply. Different time windows were considered ranging between 1 and 7 days. The results were very similar across measures. To the extent that I do not observe whether medication was taken correctly on the occasions when it was taken, my measure overestimates compliance for all patients.

4. Empirical Strategy

This paper aims to evaluate the effect of clinic and physician characteristics on the racial gap in survival from Chronic Heart Failure. All patients who visit the same clinic will be subjected to the same common clinic quality. However, if there is assortative matching between patients and doctors, patients visiting the same clinic may be treated differently. Finally, patients of the same physician in the same clinic could have different outcomes if the doctor treats them differently based on their personal characteristics. In most general terms, individual survival is influenced by the quality of the clinic, the quality of the doctors, the personal characteristics of the patient and interactions between these variables.

Survival = F(clinic characteristics, provider quality, provider quality|patient characteristics, patient characteristics)

There are three types of variables in this model: 1) patient characteristics and doctor quality which change across patients and time; 2) clinic characteristics such as the clinic location which are constant over time; 3) clinic characteristics which change over time. I include a physician quality variable for each patient.

Let X_{gtm} be a vector of characteristics for patient m who goes to clinic g at time t. Let B_{gt} be a vector of clinic characteristics which vary between clinics and years, but have the same value attached to patients in the same clinic in the same year and μ be the clinic fixed effect. A series of models are estimated. The basic model relating patient characteristics co-morbidities to outcomes is:

Model 1:

$$y_{gtm} = \alpha + \beta X_{gtm} + \varepsilon_{gtm}$$

Here the coefficient on race would capture some of the omitted variables' influence on survival outcomes and will be biased downward if black patients are treated in worse clinics or by worse doctors.

Next, the basic model is expanded by adding clinic fixed effects to capture the unobserved clinic characteristics which do not vary by year. In addition, the ratio of black patient visits per year and the total number of patient visits per year are added as controls. Patient cohort dummies are included to control for the differing characteristics of patients being diagnosed in different years and for changes in the aggregate technology of treatment which affect all patients.

Model 2:

$$y_{gtm} = \alpha + \beta X_{gtm} + \delta B_{gt} + \mu_g + \eta_t + \varepsilon_{gtm}$$

The model is further complicated by adding the mean doctor quality per patient and the interaction term of doctor quality and black race. The addition of the interaction term allows me to distinguish whether black patients visit lower quality doctors or benefit less from the same physician quality.

Model 3:

$$y_{gtm} = \alpha + \beta X_{gtm} + \delta B_{gt} + \gamma D_{gm} + \theta * black * D_{gm} + \mu_g + \eta_t + \varepsilon_{gtm}$$

I assume that

$\varepsilon_{gtm} \sim [0, \sigma^2_{gtm}]$,

which allows for heteroskedasticity of unknown form[12].

The empirical model is:

P(survival) = α + β(patient demographics, co-morbidities, physician quality) + γ(patient race∗physician quality) + δ(clinic ratio black) + year dummies + clinic dummies + ε

The weighted average quality of the providers per patient is included as a patient-level variable in X_{gtm}. Linear probability models of one-year and three-year survival (conditional on 2-year survival) rates from the time of initial diagnosis are estimated. While one-year survival rates are a common health care indicator in the literature, they are more appropriate for acute conditions such as stroke or AMI (acute myocardial infarctions, or heart attacks). CHF is a chronic condition which may be contained or worsen over time given the prescribed therapy and the patients' compliance with it. Longer-term survival horizons are better suited to capture the effect of quality of care over time.

5. Results

[12] The inclusion of a cluster-specific fixed effect μ_g is assumed sufficient to control for any error correlation within a cluster. Wooldridge (2002, 2003, 2006) shows the derivation of a robust variance estimator which adjusts for clustering of standard errors and Bertrand, Duflo and Mullainathan (2002) show the importance of correcting for serial correlation at the group level. In all estimations I cluster the data at the clinic level and use a robust variance estimator.

Medium-term survival

Table 2 reports the results of a linear probability regression of the probability of surviving the third year after initial diagnosis, conditional on surviving the first two. Taking a group of patients who have already survived two years of treatment selects those patients who have had less severe conditions and survived the first year. Estimating medium-term survival probabilities is intended to partially offset potential differences in severity at first diagnosis. Different specifications were estimated including the square of age, as well as using age cohorts rather than a continuous measure of age. These yielded similar results. A logistic regression for model (1) was also estimated and revealed identical estimates. Columns (1)-(4) reports results from different specifications. In column (1) I include only controls for age and co-morbidities, similarly to many studies using private care data. On average, black patients are 2% less likely to survive the 3rd year of treatment.

In column (2) I include income and marital status, as well as the ratio of black patients in the clinic in every year, the number of visits to the clinic, and a clinic fixed effect. The coefficient on the race dummy does not change. Differences in clinic quality do not explain the difference in the survival rate between blacks and whites. Numerous studies using data from the private health care system have found the opposite result. Yet the quality of the facilities is more likely to vary according to geographic location in the private health system. Because of geographic segregation, which is also related to differences in SES among residential areas, hospitals in predominantly black neighborhoods are underfunded and often understaffed. The case is different in the VA, where clinics are funded on the basis of their patient load. Hence using VA data effectively controls for differences in access to quality care in explaining the black/white mortality gap.

The model in column (3) includes a measure of mean doctor quality per patient. The effect of quality is large and statistically significant. Competence levels do vary within clinics, and they have an independent effect on survival. However, a surprising result it that including controls for doctor competence does not change the coefficient on black race, implying that blacks and whites are subjected to similar average doctor quality in the VHA. Differential sorting into less competent doctors is not the driving factor behind lower black survival rates. The coefficient on the black race dummy in the model in column (3) is still negative and statistically significant.

The regression in column (4) adds an interaction term between doctor quality and black race. The estimates reveal that the difference in survival rates captured by the negative coefficient on the black race dummy is in fact a difference in the effect of doctor quality by race. Black patients benefit from quality doctors half as much as white patients do. In practical terms this means that reassigning a white patient from doctors with average quality mix in the lowest quintile (<0.2) to doctors with average quality in the top quintile (>0.4) will increase his chances of medium-term survival by 8%. An equivalent exercise for a black patient will increase his chances of survival only by 4%. This is a puzzling new result and it motivates the rest of the empirical investigation.

Unobserved characteristics of doctors, patients, and the doctor-patient pair may determine selection into doctors over the course of 3 years. This selection could influence blacks and whites differently and drive the result. The quality of the first doctor, however, is less likely to be influenced by a selection process. In table 2 columns (5) and (6) I include the quality of the first doctor instead of the mean doctor quality. The results are the same. Black patients benefit from quality about half as much as whites do.

Figure 1 shows a histogram of the distribution of black and white patients within doctor quality quintiles. Blacks are more likely to see doctors in the bottom and third quintile, and less likely to see doctors in the top 2 quintiles. Figure 2 plots the coefficients on doctor quintile dummies. The omitted category is the lowest quintile. The biggest racial difference in benefits occurs in the middle range of the doctor quality distribution, even though blacks benefit less at all doctor quality levels.

Table 3 demonstrates the decomposition of the survival gap. Coefficients for white patients are taken as the base. Controlling for unobservable clinic characteristics increases the difference due to different coefficients, suggesting that black patients on average visit better clinics but benefit less from this increase in quality. Controlling for doctor competence does not alter the relative size of the gaps. This confirms the descriptive evidence that there is no difference in the average quality of physicians seeing blacks and whites.

Is there differential treatment?

I test for differences in treatment using data on doctor-patient pairs. In table 6 I report a series of linear probability regressions testing the probability that a patient would be prescribed a combination of ACEIs and BBs by their doctor. Column (1) reports the basic specification controlling for black race and co-morbidities only. Column (2) adds controls for income and marital status. After controlling for SES, on average black patients appear less likely to be prescribed the recommended therapy. There are two possibilities. First, they may be treated differently by all doctors. Second, they may be seeing a different mix of doctors. In Column (3) I test the first of these possibilities. After controlling for doctor fixed effects, blacks and equally likely to be prescribed the same treatment regimen. Two patients visiting the same physician are treated equally regardless of race.

Table 1 shows that there are very small differences in the quality of the first doctor, the most frequently visited (main) doctor, and the time to meeting the main doctor by race. Black patients see more doctors at any point in time, and they seem to gravitate towards physicians who see more minority patients. Patients may see more doctors for two reasons: because they are looking for a second opinion or because their preferred doctor is not present. These are two different types of discontinuity of care, which may affect outcomes differently through their effect on mean doctor quality and independently. These effects may also differ by race. To test the effect of discontinuity of care on doctor quality I use the number of months in which the main doctor for each patient was missing from the clinic. Table 5 reports the coefficients from a regression of mean doctor quality on main doctor absences and other controls. The results show that if the patient's preferred doctor was gone for 10 months the resulting drop in mean doctor quality will be a third of a standard deviation. This small but significant effect emphasizes the importance of continuity of care underlined by medical studies.

The effect of main doctor absences appears to be stronger for black patients. The interaction term of doctor absences and black race is negative and almost statistically significant at the 10% level. Discontinuities of care are especially harmful for patients who are less educated and are not able to communicate their entire medical history to a new doctor. It is also possible that black patients are less able to distinguish between doctors and end up with lower quality doctors as substitutes. Table 6 shows the results from a regression testing the effect of doctor absences on medium-term survival independently. The coefficient on the main term is small and statistically insignificant. The coefficient on the interaction term of black race and doctor absences in negative, but not precisely estimated. Regression results reported in tables 5 and 6 suggest that the negative coefficient on black race in the pooled regression in model (2) table 4 may be partly due to the larger number of doctors seen by black patients and the fact that more doctors suggest lower rather than higher mean doctor quality. There are statistically weak but economically significant indications that black patient's mortality response to discontinuities of care is worse.

Is there difference in patients' response to treatment?

A measure of patient compliance was constructed for every patient-doctor pair as well as yearly over all encounters for the patient. Tables 7 and 8 report a series of regressions estimating the effect of demographic characteristics on yearly and per-doctor patient compliance. I first examine the yearly compliance of patients are detect a negative association between black race and compliance. In Table 8 I zoom in on individual doctor-patient pair. It is possible that differences between doctors account for the observed black/white differences in the aggregate. For example, some doctors may be better at inducing blacks to follow the medication regimen. Controlling for unobserved doctor characteristics would then attenuate the black-white gap in compliance. The difference persists after controlling for unobserved doctor characteristics in model (3) (table 8). Black patients are between 3 and 5% less likely to regularly adhere to treatment. Figure 4 plots the coefficient obtained on the black dummy for a series of regressions estimating compliance over different number of prescriptions. The empirical model across the range of prescriptions is model (3) in table 8. The solid line traces the coefficient on the black dummy for the average doctor. The dotted line denotes the black dummy coefficient in a regression restricted to the most frequently visited (main) doctor. The dashed line denotes the average coefficient on the black dummy for a regression restricted to the least visited doctor. Black patient compliance is between .04 and .08 lower than white patient compliance. With a mean patient compliance of .5, this translates into 8-16% relative difference in patient compliance by race. This is the most significant racial difference among all dimensions considered so far.

If patient compliance accounts for the difference in benefiting from doctor quality then including a measure of compliance in the survival regressions should influence black and white survival differently. To get an idea about the joint effect of compliance and doctor quality I include the patient's compliance with the first doctor who prescribed CHF medication in the medium-term survival regression. This is a lagged measure of compliance that is less likely to be influenced by doctor-patient matching on unobservables.

As demonstrated in tables 7 and 8, patient compliance in itself is determined by some of the variables included in the survival regression. Including compliance by itself should not significantly alter the survival outcomes. It may, however, have an impact through its interaction with doctor quality. In table 9 I include a measure of the compliance with the first doctor who prescribed medication for CHF. The coefficient is positive but not significant. Because of the nature of the variable and the importance of compliance for survival, it is possible that only the patients who are at the top levels of compliance do better than the rest. The effect of compliance may not be linear and a minimum level of compliance must be reached before it has a significant impact on survival outcomes. For example, a patient who takes his medication on time only 40% of the time may benefit much less than a patient who is regular 60% of the time. To test the hypothesis that only the top patients exhibit a benefit I create an indicator equal to one if the patient was compliant more than 90% of the time. Column (2) in table 9 reports the regression estimates. In columns (3) and (4) I include interaction terms with mean doctor quality and with black race. The interaction with mean doctor quality is not statistically significant and it takes away from the power of the level of full compliance. The interaction with black race is positive and large even though it is not statistically significant. These results imply that patient compliance with therapy works in a binary manner for mortality. Black patients who are at the top levels of compliance appear especially likely to benefit from strictly following the medication regimen.

Next I divide the sample into compliant and non-compliant patients based on where their compliance levels fall relative to the mean. The idea is to test whether the observed lower benefits of doctor quality for black patients are isolated for non-compliant patients. Table 10 reports the results. Slicing the sample into such small groups causes loss of statistical power, however there is evidence that the observed reduced effect of doctor quality on black patient outcomes is restricted to black patients who are below the mean compliance level. The puzzling result that black patients are less susceptible to physician interventions is due to the group of blacks who have low levels of patient compliance.

The results in this section have several important implications. First, blacks are less compliant regardless of who is their doctor. Second, patient discipline yields positive results only at its best, i.e. only the most disciplined patients show better survival chances. Black patients are less likely to be in this group. Third, should a black patient fall below the mean level of patient compliance, he experiences lower benefits from doctor quality. Sending a non-compliant black patient to the top doctor would result in the same survival benefit as sending a compliant black (or white) patient to a second-quintile doctor.

6. Policy implications

Patient compliance

Designing and implementing policies that improve physicians' awareness of clinically recommended therapies and patients' self-management will have first-order effect on mortality and the black-white survival gap. Numerous techniques for improving patient compliance have been suggested. However, few offer a cost-benefit analysis of the proposed interventions. The Asheville project involved patients with diabetes mellitus, another chronic, common, and potentially fatal disease associated with high hospitalization costs and decrease in quality of life. The Asheville project recruited pharmacists to monitor and assess the compliance of diabetic patients over 12 months. Pharmacists were compensated to initially assess patient compliance, evaluate intermediate outcomes and perform routine visits lasting no more than 20 minutes. The town of Asheville paid 75$ for the first pharmacy consultation, 45$ for the intermediate, and 20$ for routine visits. During the next 12 months inpatient claims went down by 40%.

The annual hospital costs of CHF have been estimated at $8 billion and the overall annual cost of managing CHF at $12 to $20 billion (Alexander et al, 1999). Achieving the efficiency of the Asheville project would reduce impatient CHF costs by $3.2 billion per year. About 550000 new CHF cases are diagnosed every year. The cost of an identical program for heart failure patients will be about 400$ per patient in the first year of treatment, and the effect could last much longer than the initial 12 months. If *every* patient is given the type of pharmacy counseling used in Asheville, the total bill will be 220 million dollars, which is less than 10% of the total savings from preventable hospitalizations *only*.

Direct monitoring or telemonitoring by health staff are another, even cheaper option for improving compliance. With electronic patient record systems of the type implemented by the VA, it will be easy to monitor whether re-fills are called in and picked up on time.

Closing the mortality gap requires equalizing black and white therapy compliance rates. Increasing black patient compliance by 5% and equalizing it with white patients' compliance will reduce absolute medium-term black mortality by 1.5 %. Values of statistical life-years range between 50K and 150 K. Using a very conservative value of life year estimate of 50K per patient, increasing mean black compliance to the level of white patients would result in expected savings of $1000 per black patient per year. There are about 700000 African Americans with heart failure in the US, and this number is expected to grow to 900,000 by 2010. Potential reductions in the cost of care and benefits to society are in the order of billions of dollars.

The VA is a leader in encouraging and facilitating both doctor compliance with clinical guidelines and patient compliance with therapy. A computerized patient records system (CPRS) has been set up in VA medical centers and outpatients clinics, with clinical reminders of recommended guidelines for physicians. In a related study I evaluate the effect of implementing the CPRS on compliance with clinical guidelines and outpatient outcomes in the VA. The VHA already has the technology to monitor routine compliance electronically. Further reductions in costs could be achieved by utilizing the TeleNurse system or other telephony-based communication projects already underway in most VA medical centers. The Oregon branch of the VHA is experimenting with equipping patients with Personal Digital Assitant (PDA) devices, which aid them in complying with therapy regimens and monitoring vital signs. The results from this pilot project will determine whether this patient compliance program will be implemented in other VHA sites.

7. Conclusions

Equalizing access for patients and financial incentives for physicians is not sufficient to close the racial mortality gap. It is demonstrated that differences in mortality persist even in an equal-access system where physicians are salaried. The process of health care is a joint venture between the physician and the patient. I show that personal or institutional prejudice do not account for the observed disparities in medium-term health outcomes in a sample of patients suffering from chronic heart failure, the most expensive chronic condition in the elderly. Rather, divergent patient attitudes to health appear to cause differences in mortality. Public health policy should focus on eliminating the sources of patients', not doctors', preconceptions impeding the process of healing.

One obvious policy recommendation is to invest in changing the compliance patterns of minority patients. Interventions of this type have yielded cost savings of up to 40% from inpatient claims, or 3.2 billion dollars yearly. Gross societal gains from increasing minority compliance rates to the level of white patients range from 0.7 billion taking the value of a statistical life-year at 50K to 2.1 billion using a value of 150K.

Important educational and cultural differences exist between elderly minorities and whites. Compliance with the therapy regimen is one channel through which these differences affect the process of managing a chronic disease. But there are more subtle ways in which they get in the way of effective treatment. The communication between doctors and patients, which is crucial in maintaining an adequate therapy regimen, is impeded by mistrust and disparate attitudes to one's health and the role of the health care system. These differences increase the gaps caused by discontinuities of care and the amount of time a doctor needs to spend with a patient before an optimal level of trust and coordination is achieved. By reducing the effect on both these dimensions, new medical technology has the potential to benefit minority patients a great deal.

References:

Alexander, Mark; Grumbach, Kevin; Remy, Linda; Rowell, Richard; Massie, Barry M. Congestive heart failure hospitalizations and survival in California: Patterns according to race/ethnicity**.** American Heart Journal. 137(5):919-927, May 1999.

Allison JJ, Kiefe C, Centor RM, et al (1996) "Racial Differences in the Medical Treatment of Elderly Medicare Patients with Acute Myocardial Infarction," Journal of General Internal Medicine, 1996; 11: 736-743

American Heart Association. *Heart Disease and Stroke Statistics — 2007 Update*. Dallas, Texas: American Heart Association; 2007.

Angrist, Joshua and Alan Krueger (2001) "Instrumental Variables and the Search for Identification: from Supply and Demand to Natural Experiments," NBER Working Paper 8456, September 2001

Anita Deswal, Nancy J. Petersen, Julianne Souchek, Carol M. Ashtonand Nelda P. Wray, "Impact of race on health care utilization and outcomes in veterans with congestive heart failure" J Am Coll Cardiol, 2004; 43:778-784

Antonio Trujillo et al (2005) "Race and Health Disparities Among Seniors in Urban Areas in Brazil," NBER Working Paper No 11690, October 2005

Arch G. Mainous III et al (2001) "Continuity of Care and Trust in One′s Physician: Evidence From Primary Care in the United States and the United Kingdom" Family Medicine, Vol 33 No. 1: 22-27

Ashish V. Joshi, Anna O. D'Souza, S. Suresh Madhavan**, "**Differences in Hospital Length-of-Stay, Charges, and Mortality in Congestive Heart Failure Patients"

Bach, Peter et al (2004) "Primary Care Physicians Who Treat Blacks and Whites," The New England Journal of Medicine, Volume 351: 575-584

Baicker, Katherine, Amitabh Chandra, Jonathan Skinner and John Wennberg (2004) "Who You are and Where You Live: How Race and Geography Affect the Treatment of Medicare Beneficiaries" Health Affairs, October 7th, 2004

Balsa, Ana, Thomas G. McGuire and Lisa S. Meredith (2004) Testing for Statistical Discrimination in Health Care ?

Barnato, Amber E. et al (2005) "Hospital-level Racial Disparities in Acute Myocardial Infarction Treatment and Outcomes," Medical Care, Volume 43, Number 4, April 2005

Barnett et al (2001) Mean and heart disease: an atlas of racial and ethnic disparities in mortality. First edition. Morgantown, WV: West Virginia University. Available at http://www.cdc.gov/dhdsp/library/maps/cvdatlas/atlas_mens/mens_download.htm.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan (2002) "How Much Should We Trust Differences-in-Differences Estimates?" NBER Working Paper 8841, March 2002

Bindman Andrew et al (1995) "Preventable Hospitalizations and Access to Health Care, " JAMA; 1995: 274:305-311

Blustein, Jan, Karla Hanson, and Steven Shea (1998) "Preventable Hospitalizations and Socioeconomic Status," Health Affairs, March/April 1998

Bradley, E.H. et al (2004) " Racial and Ethnic Differences in Times to Acute Reperfusion Therapy for Patients Hospitalized with Myocardial Infarction." Journal of the American Medical Association 292 (13): 1563-72

Brown, Steven "No Free Lunch: Institutional Preparations for CPRS" Veterans Affairs Medical Center, Nashville TN, Report available at http://www.amia.org/pubs/symposia/D005320.PDF

Card, David, Carlos Dobkin and Nicole Maestas "The Impact of Nearly Universal Insurance Coverage on Health Care Utilization and Health: Evidence from Medicare", NBER Working Paper 10365, March 2004

Chandra, Amitabh and Jonathan Skinner (2003) "Geography and Racial Health Disparities," NBER Working Paper 9513, February 2003

Charles T. Clotfelter, Helen F. Ladd and Jacob L. Vigdor "How and Why Do Teacher Credential Matter for Student Achievement?" NBER Working Paper No. 12828, January 2007

Charlson ME, Pompei P, Ales KL, MacKenzie CR. (1987) "A new method of classifying prognostic comorbidity in longitudinal studies: development and validation." J Chronic Dis. 1987;40(5):373-83.

Cutler, David M., E.L. Glaeser, and J.L. Vigdor (1997), "Are Ghettos Good or Bad?" Quarterly Journal of Economics, 112, no. 3: 827-872

Davis, Sharon, Yong Liu and Gary Gibbons (2003) "Disparities in Trends of Hospitalization for Potentially Preventable Chronic Conditions Amond African Americans During the 1990s: Implications and Benchmarks," American Journal of Public Health, March 2003, Vol 93, No. 3

Dimitri Christakis et al (2001) "Association of Lower Continuity of Care With Greater Risk of Emergency Department Use and Hospitalization in Children," Pediatrics 2001; 107: 524-529

GAO Report to Congressional Requesters "VA Community Clinics: Networks^Efforts to Improve Veterans′ Access to Primary Care Vary", June 1998 (GAO/HEHS-98-116)

Gaskin, Darrell and Catherine Hoffman (2000) "Racial and Ethnic Differences in Preventable Hospitalizations across 10 States," Medical Care Research and Review, Vol. 57 Supplement 1, (2000): 85-107

Goldman, Dana and James P. Smith (2002) "Can Patient Self_management Help Explain the SES Health Gradient?" Proceedings of the National Academy of Sciences, vol. 99, no 16, August 6th, 2002

Groeneveld, Peter et al (2005) "Technology Diffusion, Hospital Variation, and Racial Disparities Among Elderly Medicare Beneficiaries 1989-2000" Medical Care, Volume 43, Number 4, April 2005

Iglehart, John K. (1996) "Reform of the Veterans Affairs Health Care System" New England Journal of Medicine, Volume 335:1407-1412 October 31, 1996 Number 18

Insitute of Medicine, "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care" Washington: National Academies Press, 2002

Institute of Medicine, "Leading Health Indicators for Healthy People 2010: Final Report," Washington: National Academies Press, 1999

JH Wasson et al (1984) "Continuity of Outpatient Medical Care in Elderly Men" JAMA, 1984; 252:2413-2417

Klein, R.E. 2001 The Changing Veteran Population, 1990-2020. Washington, DC:US Department of Veterans Affairs.

Klein, R.E., and D.D. Stockford. 2001. Data on the Socioeconomic Status of Veterans and VA Program USage. Wahsington, DC: U.S. Department of Veterans Affairs

Laura Petersen et al (1998) "Nonurgent Emergency Department Visits: The Effect of Having a Regular Doctor," Medical Care, 36(8): 1249-1255

LaVeist, Thomas, Kim Nickerson and Janice Bowie(2000) "Attitudes about Racism, Medical Mistrust, and Satisfaction with Care Among African American and White Cardiac Patients," Medical Care Research and Review, Vol 57 Supplement 1: 146-161

Mainous, Arch and J M Gill (1998) "The importance of continuity of care in the likelihood of future hospitalization: is site of care equivalent to a primary clinician?," Am J Public Health. 1998 October; 88(10): 1539—1541

Meer, Jonathan, Douglas Milles and Harvey Rosen (2003) "Exploring the Health-Wealth Nexus" NBER Working Paper 9554, March 2003

Mensah, George et al (2005) "State of Disparities in Cardiovascular Health in the United States," Circulation, 111, 1233-1241

Mukamel, L, Murthy, A, Weimer D "Racial Differences in Access to High-quality Cardiac Surgeons," American Journal of Public Health, November 2000, Vol. 90, No. 11

Muntwylera, J. ,G. Abetelb, C. Grunera and F. Follath (2002) "One-year mortality among unselected outpatients with heart failure" European Heart Journal Volume 23, Number 23 Pp. 1861-1866

Pappas, Gregory, Wilbur Hadden, Lola Kozak, and Gail Fisher (1997) "Potentially Avoidable Hospitalizations: Inequalities in Rates Between US Socioeconomic Groups," American Journal of Public Health, May 1997, 87:5

Rathore, SS, Berger AK, Weinfurt, KP, et al "Race, Sex, Poverty, and the Medical Treatment of Acute Myocardial Infarction in the Elderly," Circulation. 2000; 102:642-648

Rivkin, Steven G., Eric Hanushek and John Kain "Teachers, Schools, and Academic Achievement," Econometrica, Vol. 73, No. 2, (March, 2005), 417-458

Rothenberg, Barbara, et al (2004) "Explaining Disparities in Access to High-Quality Cardiac Surgeons," The Annals of Thoracic Surgery, Volume 78, Issue1, July 2004

S. Arday et al "HCFA's Racial and Ethnic Data: Current Accuracy and Recent Improvements," Health Care Financing Review 21, No. 4(2000): 107-116

Saif S. Rathore, MPH; JoAnne M. Foody, MD; Yongfei Wang, MS; Grace L. Smith, MPH; Jeph Herrin, PhD; Frederick A. Masoudi, MD, MSPH; Pamela Wolfe, MS; Edward P. Havranek, MD;

Diana L. Ordin, MD, MPH; Harlan M. Krumholz, MD, SM "Race, Quality of Care, and Outcomes of Elderly Patients Hospitalized With Heart Failure" JAMA. 2003;289:2517-2524.

Simeonova, Emilia "Did the Electronic Patient Records System Improve Health Outcomes?" Working Paper, October 2007

Skinner, Jonathan et al (2005) "Mortality after Acute Myocardial Infarction in Hospitals That Disproportionately Treat Black Patients," Circulation, October 25th, 2005

Williams, David and Pamela Braboy Jackson (2005) "Social Sources of Racial Disparities in Health," Health Affairs, Volume 24, Number 2, March/April 2005

Tables and Graphs

Table 1: Variable definitions and means

	White patients			*Black patients*		
Variable	Obs	Mean	Std.	Obs	Mean	Std. Dev.
Yearly income	45512	24890	20000	3460	18644	10500
Age	45512	73	9	3460	67	12
Marital	45512	0.70	0.46	3460	0.50	0.50
Patient compliance	41436	0.49	0.28	3074	0.53	0.28
% Survived the first year	45512	84%	0.37	3460	0.87	0.34
% Survived the 2nd year|surviving 1st	26365	86%	0.43	2141	0.88	0.41
% Survived the 3rd year|Surviving 2nd	17681	89%	0.46	1566	0.90	0.44
Ratio black in clinic	45167	5.57%	7%	3455	15.13%	12%
% in Small clinics	45512	25.53%	44%	3460	16.82%	37%
% in Large clinics	45512	34.63%	48%	3460	54.57%	50%
% in Rural clinics	45314	11.77%	17%	3385	7.79%	14%
Doctor ratio black	40639	0.06	0.078	3243	0.245	0.18
Mean doctor quality	40639	0.29	0.09	3243	0.28	0.09
First doctor's quality	40639	.34		3243	.33	
Time to meeting main doctor	40639	254	421		303	478
doctors /year	40639	1.6	.2	3243	1.8	.2
prescriptions/doctor	40639	8.5	.3	3243	8.2	.4
main doctor absent	40639	2.8	3.87	3243	2.8	3.66
Small clinics						
Doctor ratio black	10631	0.04	0.06	545	0.28	0.24
Mean doctor quality	10631	0.3	0.09	545	0.3	0.1
Medium clinics						
Doctor ratio black	15775	0.05	0.06	896	0.19	0.008
Mean doctor quality	15775	0.29	0.087	896	0.28	0.04
Large clinics						
Doctor ratio black	14233	0.09	0.09	1802	0.26	0.17
Mean doctor quality	14233	0.29	0.09	1802	0.27	0.09

Table 2: Three-year survival conditional on two-year survival. Linear probability models. The dependent variable equals one if the patient survived the third year after diagnosis. All standard errors are adjusted for clinic-level clustering. Clinic Fixed effects and patient co-morbidities included.

	(1)	(2)	(3)	(4)	(5)	(6)
Black	-0.022**	-0.019**	-0.018**	0.036	-0.019**	0.054
	(2.41)	(2.09)	(1.90)	(1.06)	(-2.06)	(1.34)
Age	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*
	(15.69)	(16.19)	(15.46)	(15.76)	(-14.88)	(-14.86)
Income		0.002	0.002	0.002	0.002	0.002
		(1.11)	(1.08)	(1.00)	(1.47)	(1.48)
Marital		0.029*	0.026*	0.026*	0.027*	0.028*
		(4.16)	(4.12)	(3.75)	(4.04)	(4.05)
Mean doctor quality			0.375*	0.398*		
			(7.42)	(7.62)		
First doctor quality					0.37*	0.4*
					(8.04)	(8.27)
Black*mean doctor quality				-0.193+		
				(1.80)		
Black*first doctor quality						-.21**
						(-1.98)
Clinic FE	NO	YES	YES	YES	YES	
Obs		11463	11463	11463	11463	
R-s		0.032	0.034	0.035	0.036	
Number of clusters		241				

Robust t statistics in parentheses;

Figure 1: Mean doctor quality by patient race. Black indicates African American patients. Red indicates white patients, black denotes black patients. Doctor quality is measured as the weighted average of the individual adherence measures of all doctors who treated the patient during the period. Adherence to clinical guidelines is constructed as the N of patients who were prescribed ACEIs and beta blockers/ total N patients treated by the doctor.

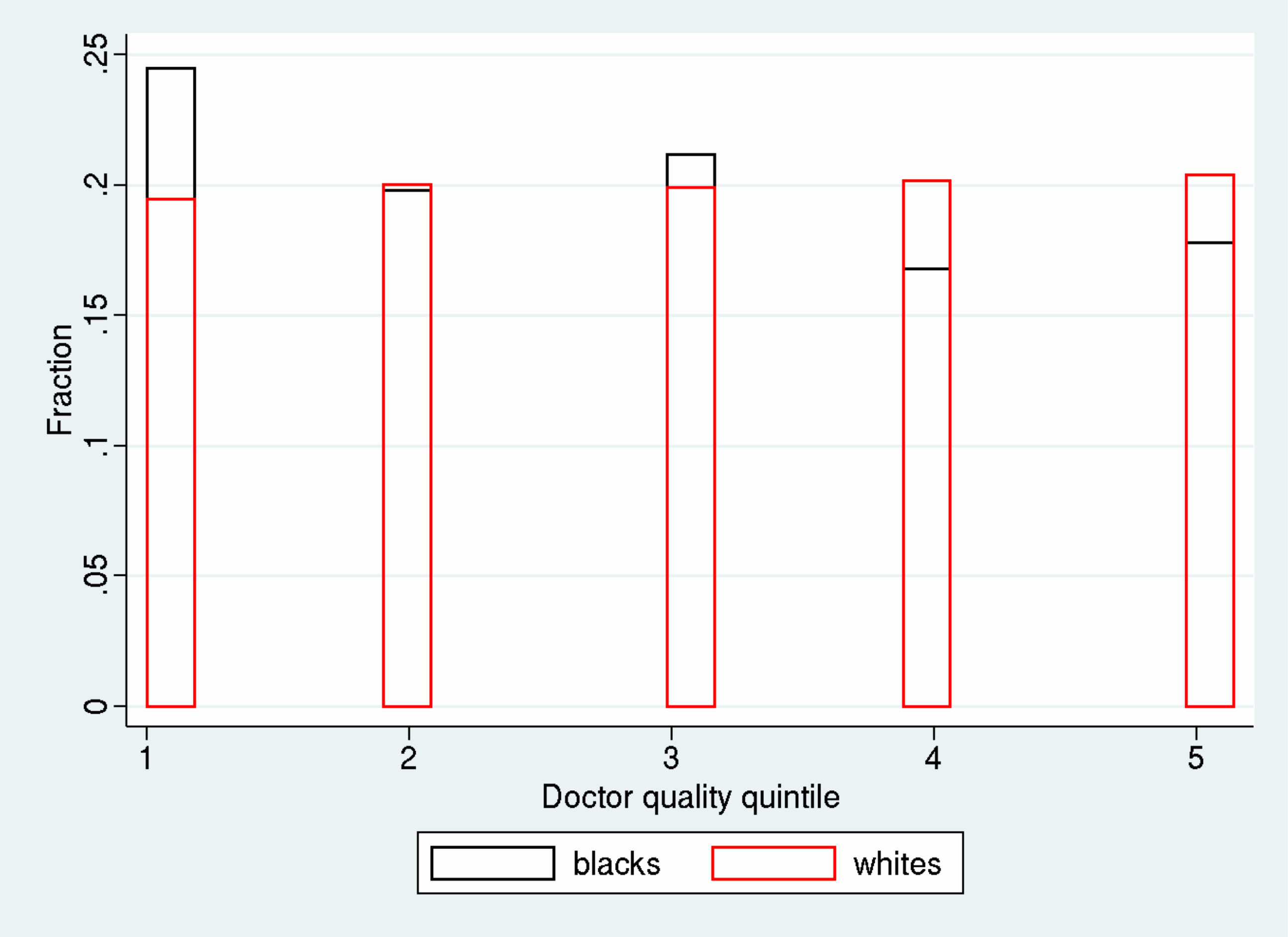

Figure 2: Effect of doctor quality on patient survival. Red line indicates white patients. Black line indicates African American patients. Doctor quality is measured as the weighted average of the individual adherence measures of all doctors who treated the patient during the period. Adherence to clinical guidelines is constructed as the N of patients who were prescribed ACEIs and beta blockers/ total N patients treated by the doctor. Large markers indicate significance of 80% and above.

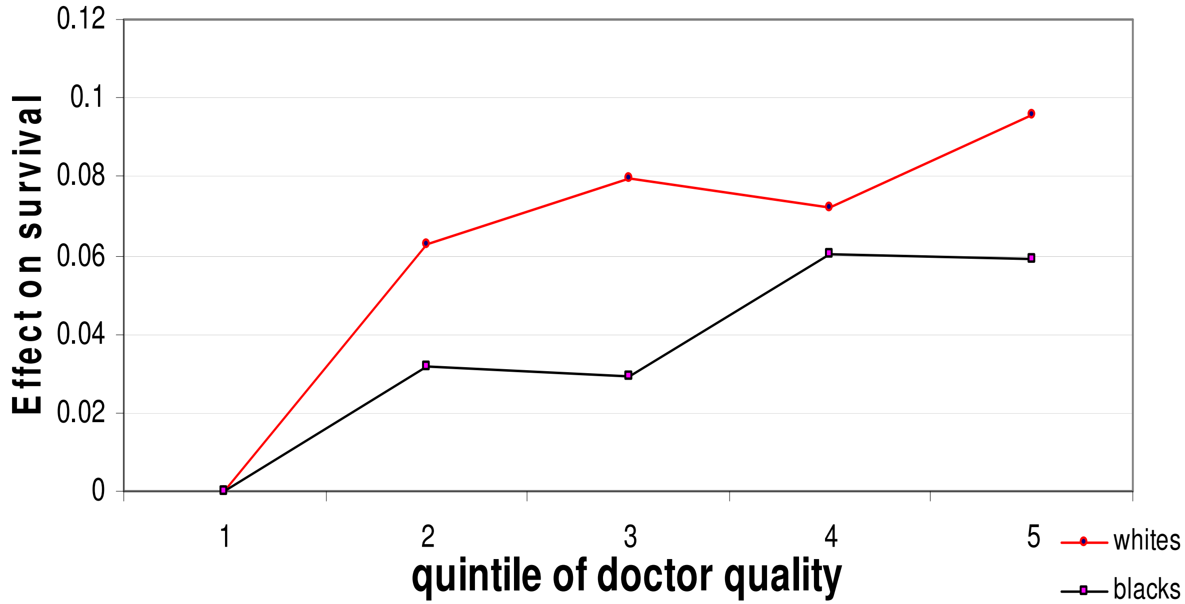

Table 3: Decomposing the black-white survival gap. Coefficients for whites taken as base.

Variables	Gap due to difference in means	Gap due to difference in coefficients
Age, co-morbidites	-0.03	0.022
Income, marital status	-0.06	0.058
Doctor quality measures	-0.06	0.058

Table 4: Probability of being treated with recommended therapy by a doctor. The unit of observation is the doctor-patient pair. Linear probability models. Controls for co-morbidities and year fixed effects included, not reported. Errors are clustered at the patient level.

	Treated with ACEIs-BBs		
	Pooled	Pooled	Doctor FE
	(1)	(2)	(3)
Black	-0.003	-0.009+	0.003
	(-0.77)	(-1.75)	(0.55)
Age		-0.003	-0.003
		(-16.72)	(-22.78)
Married		0.005	0.002
		(1.9)	(0.87)
Income		0.003	0.001
		(3.78)	(1.54)
N obs	167346	157469	157469
Rsq	0.0116	0.029	0.027

Robust t statistics in parentheses
+ significant at 10%; ** significant at 5%; * significant at 1%

Table 5: Effect of doctor absences on mean doctor quality. Clinic fixed effects and patient co-morbidities included.

	(1)	(2)
Age	0.000	0.000
	(0.44)	(0.40)
Main_doc_missing	-0.003*	-0.003*
	(7.17)	(6.69)
Black	-0.002	0.002
	(0.86)	(0.41)
Income	0.000	0.000
	(0.83)	(0.85)
Married	0.006*	0.006*
	(4.65)	(4.64)
Black*main_doc_missing		-0.001
		(1.61)
Constant	0.293*	0.292*
	(30.44)	(30.45)
Observations	11463	11463
Number of clusters	241	241
R-squared	0.035	0.036

Robust t statistics in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 6: Effect of doctor absences on survival. Three-year survival conditional on two-year survival. All standard errors are adjusted for clinic-level clustering. Included are controls for co-morbidities, cohort dummies and clinic fixed effects

	(1)
Age	-0.005*
	(15.70)
Main_doc_missing	0.001
	(0.95)
Black*main_missing	-0.004
	(1.31)
Black	0.054
	(1.44)
Income	0.002
	(1.01)
Married	0.026*
	(3.75)
Mean_doc_quality	0.404*
	(7.45)
Black*doc_quality	-0.219**
	(1.97)
Constant	1.116*
	(26.65)
Observations	11463
Number of clusters	241
R-squared	0.039

Robust t statistics in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 7: Patient compliance with therapy. Yearly measures. The dependent variable is the ratio of compliant re-fills (re-fills which were picked up within 2 days of expiration of the supply of medication from the previous re-fill). T-statistics are reported under the coefficients. Included but not reported are patient co-morbidities and cohort dummies

	(1)	*(2)*	*(3)*
Black	-.027*	-.036*	-.038*
	(-8.23)	(-6.82)	(-7.13)
Age	.0002**	.0003**	.0003**
	(2.76)	(2.71)	(2.74)
Marital		.007*	.007*
		(4.00)	(4.05)
Income		-.0003	-.0003
		-0.82	-0.77
Co-morbidities	NO	YES	YES
N observations	43844	43276	43276
Clinic fixed effects	NO	YES	YES

Robust t statistics in parentheses
+ significant at 10%; ** significant at 5%; * significant at 1%

Table 8: Patient compliance with therapy. Patient-doctor pairs. The dependent variable is the ratio of compliant re-fills for every patient-doctor match. Included but not reported are patient co-morbidites and cohort dummies.

	Pooled	Pooled	Doctor FE
	(1)	(2)	(3)
Black	-0.035*	-0.038*	-0.056*
	(-9.64)	(-9.02)	(-14.09)
Age		0**	0
		(-2.79)	(0.37)
Marital		0.003	0.002
		(1.23)	(1.14)
Income		-0.002*	-0.001*
		(-4.49)	(-3.11)
N obs	284509	269632	265680
R sq	0.007	0.009	0.01

Robust t statistics in parentheses
+ significant at 10%; ** significant at 5%; * significant at 1%

Figure 3: Difference in black/white compliance rate by doctor and N prescriptions. Solid line indicates plot the black coefficient from regressions of compliance with any doctor at the given level of prescriptions. The dotted line plots the black coefficient on from regressions of compliance with the most preferred doctor (the doctor with the highest number of prescriptions). The dashed line plots the black coefficient from regressions of compliance with the least visited (bottom) doctor. Controls for income, marital status, age and co-morbidities. Corresponds to regression (6) in table (3)

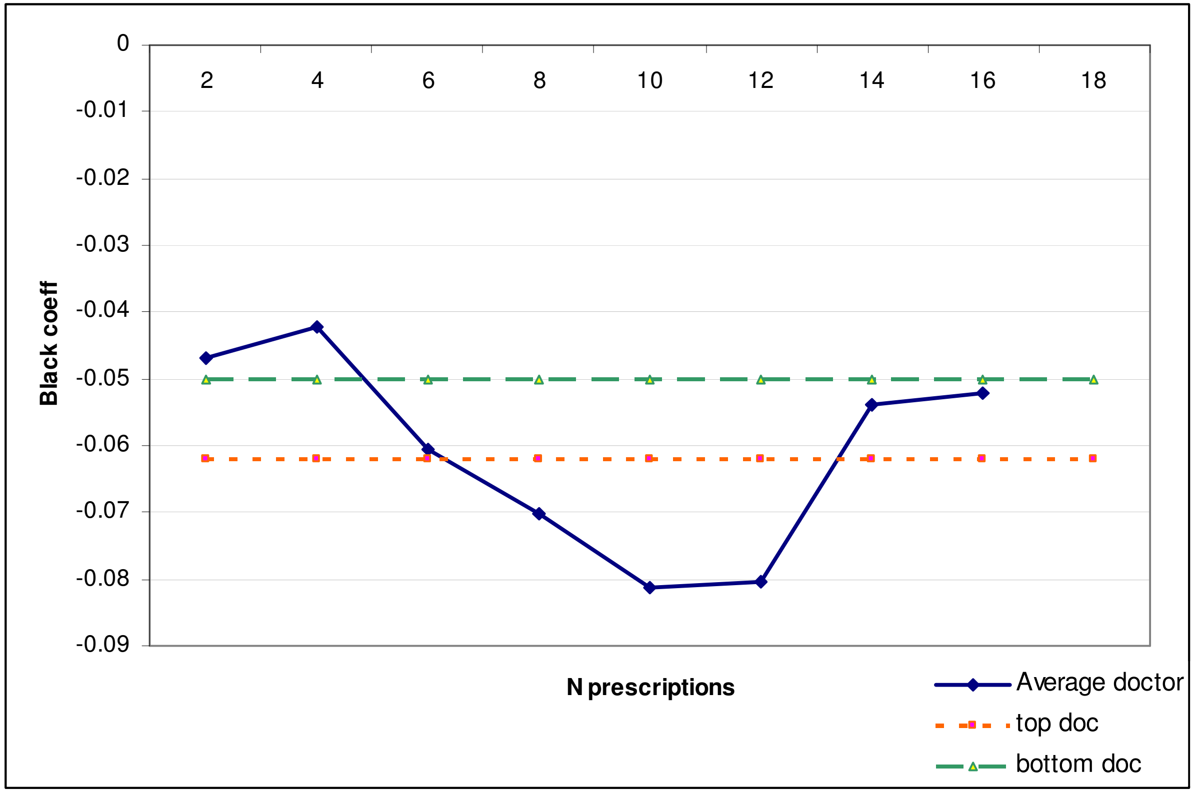

Table 9: Three-year survival conditional on two-year survival. All standard errors are adjusted for clinic-level clustering. Included are controls for co-morbidities, cohort dummies and clinic fixed effects

	(1)	(2)	(3)	(4)
Black	0.036	0.035	0.035	0.029
	(1.07)	(1.05)	(1.04)	(0.87)
Age	-0.005*	-0.005*	-0.005*	-0.005*
	(15.76)	(15.74)	(15.76)	(15.78)
Compliance	0.010			
	(0.88)			
Income	0.002	0.002	0.002	0.002
	(0.99)	(0.97)	(0.96)	(0.97)
Married	0.026*	0.027*	0.027*	0.027*
	(3.75)	(3.75)	(3.75)	(3.75)
Mean_doc_quality	0.399*	0.401*	0.409*	0.401*
	(7.63)	(7.66)	(7.38)	(7.66)
Black*doc_quality	-0.192+	-0.190+	-0.189+	-0.179+
	(1.79)	(1.77)	(1.76)	(1.68)
Fully Compliant		0.018**	0.036	0.015+
		(2.17)	(1.13)	(1.69)
Fully_compliant*doc_quality			-0.067	
			(0.61)	
Black*fully_compliant				0.038
				(1.46)
Constant	1.116*	1.118*	1.116*	1.118*
	(26.83)	(27.48)	(27.02)	(27.55)
Observations	11463	11463	11463	11463
Number of clusters	241	241	241	241
R-squared	0.039	0.039	0.039	0.040

Robust t statistics in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 10: The effect of different levels of patient compliance by race. Non-compliant is 1 if the patient was below the mean level of compliance with his first doctor. Three-year survival conditional on two-year survival. All standard errors are adjusted for clinic-level clustering. Included are controls for co-morbidities, year dummies and clinic fixed effects

	(1)	*(2)*	*(3)*
Black	0.034	0.046	0.003
	(1.02)	(1.29)	(0.06)
Age	-0.005*	-0.005*	-0.005*
	(15.74)	(15.70)	(15.70)
Non_compliant	0.005	0.001	-0.007
	(0.74)	(0.03)	(0.30)
Income	0.002	0.002	0.002
	(1.01)	(1.00)	(1.02)
Married	0.026*	0.026*	0.026*
	(3.73)	(3.73)	(3.72)
Mean_doc_quality	0.397*	0.389*	0.376*
	(7.58)	(6.26)	(5.73)
Black*doc_quality	-0.192+	-0.197+	-0.041
	(1.79)	(1.84)	(0.28)
Non_compliant*doc_quality		0.019	0.047
		(0.26)	(0.57)
Non_compliant_black		-0.016	0.059
		(0.65)	(0.90)
Non_compliant*black*doc_qual			-0.271
			(1.26)
Constant	1.119*	1.122*	1.125*
	(27.85)	(27.49)	(27.17)
Observations	11463	11463	11463
Number of new_sta5a_outp	241	241	241
R-squared	0.039	0.039	0.039

Robust t statistics in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 11: Flexible specification, interaction terms with black race for all variables included. Three year survival based on two year survival, linear probability regressions. Patient co-morbidities included, not reported

	(1)	(2)
Age	-0.005*	-0.005*
	(15.22)	(15.19)
Black*age	-0.001	-0.001
	(1.16)	(1.16)
Mean_doc_quality	0.401*	0.403*
	(7.67)	(7.70)
Black*doc_quality	-0.210+	-0.196+
	(1.93)	(1.81)
Income	0.002	0.002
	(1.16)	(1.13)
Black*income	-0.009	-0.009
	(0.90)	(0.90)
Married	0.028*	0.028*
	(3.73)	(3.74)
Black*married	-0.012	-0.011
	(0.90)	(0.80)
Full_compliance		0.015+
		(1.69)
Black*full_compliance		0.040
		(1.54)
Constant	1.104*	1.102*
	(27.17)	(27.01)
Observations	11463	11463
Number of new_sta5a_outp	241	241
R-squared	0.040	0.040

Robust t statistics in parentheses

+ significant at 10%; ** significant at 5%; * significant at 1%

Table 12: One year survival probability. The dependent variable is 1 if the patient was alive one year after diagnosis. OLS linear probability model estimated.

	(1)	(2)	(3)	(4)	(5)
Black	-0.004	0.000	0.001	0.001	0.001
	(0.42)	(0.04)	(0.12)	(0.12)	(0.06)
Age	-0.006*	-0.006*	-0.006*	-0.006*	-0.006*
	(30.47)	(30.39)	(29.21)	(29.21)	(29.30)
Income		0.003*	0.003*	0.003*	0.003*
		(2.88)	(3.18)	(3.18)	(3.11)
Married		0.009**	0.011**	0.011**	0.011**
		(1.97)	(2.53)	(2.53)	(2.50)
Small*ratio			0.608*	0.608*	0.609*
black			(3.55)	(3.55)	(3.53)
Med*ratio			-0.245	-0.245	-0.228
black			(0.80)	(0.80)	(0.73)
Large*ratio			-0.301**	-0.301**	-0.310**
black			(2.04)	(2.04)	(2.12)
Prov quality					0.083*
					(3.47)
Black*prov_quality					-0.001
					(0.01)
Clinic FE	NO	NO	YES	YES	YES
Obs	37952	37952	37406	37406	37406
R-sq	0.028	0.029	0.028	0.028	0.029

Robust t statistics in parentheses
+ significant at 10%; ** significant at 5%; * significant at 1%