DOI: 10.1111/j.1475-6773.2006.00634.x

Does the Market Value Racial and Ethnic Concordance in Physician–Patient Relationships?

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Objective. To determine if the market-determined earnings per hour of physicians is sensitive to the degree of area-level racial/ethnic concordance (ALREC) in the local physician labor market.

Data Sources. 1998–1999 and 2000–2001 Community Tracking Study Physician Surveys and Household Surveys, 2000 U.S. Census, and the Area Resource File.

Study Design. Population-averaged regression models with area-level fixed effects were used to estimate the determinants of log earnings per hour for physicians in a two-period panel (N= 12,886). ALREC for a given racial/ethnic group is measured as the percentage of physicians who are of a given race/ethnicity less the percentage of the population who are of the corresponding race/ethnicity. Relevant control variables were included.

Principal Findings. Average earnings per hour for Hispanic and Asian physicians varies with the degree of ALREC that corresponds to a physician's race/ethnicity. Both Hispanic and Asian physicians earn more per hour in areas where corresponding ALREC is negative, other things equal. ALREC varies from negative to positive for all groups. ALREC for Hispanics is negative, on average, due to the small percentage of the physician workforce that is Hispanic. This results in an average 5.6 percent earnings-per-hour premium for Hispanic physicians. However, ALREC for Asians is positive, on average, due to the large percentage of the physician workforce that is Asian. This results in an average 4.0 percent earnings-per-hour discount for Asian physicians. No similar statistically significant results were found for black physicians.

Conclusions. The market-determined earnings per hour of Hispanic and Asian physicians are sensitive to the degree of ALREC in the local labor market. Larger sample sizes may be needed to find statistically significant results for black physicians.

Key Words. Racial disparities, physician earnings, racial concordance

The issue of racial/ethnic concordance in medical care is growing in importance as the issue of racial disparities in health care becomes more prominent. Research has examined the choice of a racially/ethnically concordant physician–patient relationship, including whether patients tend to select physicians of the same race/ethnicity, and whether physicians tend to locate in areas where more of the population shares their race/ethnicity. The potential effects of racially/ethnically concordant relationships have also been examined, such as whether racial/ethnic concordance is correlated with health care utilization and patient satisfaction.

This research will focus on a significant gap in the literature: does the market reward physicians who may potentially provide physician–patient relationships that are racially/ethnically concordant? We focus on black, Hispanic, and Asian physicians.

We begin with a review of the literature in the following section, lay out our conceptual model and empirical specification in the third section, describe our data in the fourth section, explain our statistical approach in the fifth section, describe our major empirical findings in the sixth section, and discuss the significance of these findings in the final section.

Related Literature

The literature on racial/ethnic concordance can be organized into four categories: utilization/outcomes of health care, patient satisfaction, patient choice of physician, and physician choice of location.

Arguably, the fundamental value of racial/ethnic concordance is improved communication. When physicians and patients share culture and/or language, patients can communicate better with their physicians; physicians can communicate better with their patients; and both patients and physicians can have more confidence in the interaction. Communication is improved when a physician and patient share the same language. Shared cultural knowledge further improves communication and reduces the chances for misunderstandings to occur.

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Racial and ethnic groups vary significantly by the proportion of individuals within each group who are immigrants to the United States and by their language preferences. Foreign-born individuals are likely to be significantly influenced by the culture of their country of origin as well as speak languages other than or in addition to English. According to the U.S. Census Bureau (2004), 7.6 percent of blacks, 39.2 percent of Hispanics, and 65.9 percent of Asian/Pacific Islanders (hereafter referred to as "Asians") are foreign born. Of the foreign-born, 49.8 percent of blacks, 3.9 percent of Hispanics, and 11.0 percent of Asians speak only English. Of the native born, 97.1 percent of blacks, 56.1 percent of Hispanics, and 37.4 percent of Asians speak only English.

While blacks, Hispanics, and Asians are assumed to be relatively homogeneous groups for the purposes of this analysis, the above statistics show that each grouping clearly represents disparate sets of populations, cultures, and languages in varying degrees. However, we might consider that within a given physician labor market there may be greater homogeneity between physicians from each group and the corresponding population group relative to what exists at the national level.

This suggests that when measuring racial/ethnic concordance in physician–patient relationships we are largely measuring the potential for cultural and/or language concordance, especially for Hispanics and Asians. Conversely, studies of non-English language concordance (hereafter referred to as "language concordance") are often also measuring racial/ethnic concordance, especially for Hispanics and Asians. Because of this, we include studies of language concordance in our literature review.

Adult patients in racially/ethnically concordant physician–patient relationships, adults with bilingual physicians, and adults with medical interpreters tend to utilize more health services relative to those in racially/ethnically nonconcordant physician–patient relationships, those without bilingual physicians, and those without needed medical interpreters, respectively. LaVeist, Nuru-Jeter, and Jones (2003) found that white, black, Asian, and Hispanic patients in racially concordant relationships were more likely to use needed services and less likely to postpone seeking care. While Konrad et al. (2005) did not find racial concordance to be a large factor in the management of hypertension, King et al. (2004) found that racial concordance shortened the time until HIV-positive black patients received appropriate drug therapy. Lasser et al. (2005) found that white, black, and Asian patients in racially or language concordant physician–patient relationships were less likely to miss appointments. In a major review of the literature on medical interpreter services that was current of January 2003, Flores (2005) found that interpreter services resulted in higher rates of preventive screening, more office visits, and more prescriptions filled. Clark, Sleath, and Rubin (2004) found that language concordance for Hispanics improved physician–patient agreement with regard to physician-recommended changes in patient-health behavior. Green et al. (2005) found that Asian patients who used interpreters avoided asking questions they wanted to ask more often than patients in language-concordant relationships. Mehler et al. (2004) reported better results for Russian-speaking diabetes patients after a bilingual English–Russian speaking physician joined a physician practice. Wilson et al. (2005) found that language-concordant relationships (examining 11 different languages) resulted in less trouble understanding medical situations, fewer problems understanding medication labels, and fewer adverse drug reactions.

In view of this, we would expect that patient satisfaction would tend to be higher in racially/ethnically concordant physician–patient relationships. We generally find this to be the case. LaVeist and Nuru-Jeter (2002) and LaVeist and Carroll (2002) found that whites, Hispanics, blacks, and Asians, reported the highest levels of satisfaction when racial/ethnic concordance occurred and when they had the ability to choose their provider. Saha et al. (1999) found similar results among blacks and Hispanics. Cooper et al. (2003) found that concordance for whites and blacks was associated with more positive affect. However, Aruguete and Roberts (2002) found that communication style was far more important than race in patient satisfaction among whites and blacks. Flores (2005) found that patients who needed interpretive services had the highest satisfaction with bilingual physicians and telephone interpreters, lower satisfaction with ad hoc interpreters, and the lowest satisfaction when there was no interpreter. Cooper-Patrick et al. (1999) found that black patients tend to rate their physician's style of communication more highly when seeing a black physician.

It is therefore not surprising that many studies show that patients tend to prefer physicians who are of their own race/ethnicity. Gray and Stoddard (1997) found this to be the case and determined that it was not the result of black and Hispanic physicians being more likely to provide care to blacks and Hispanic populations, respectively, but due to physician or patient choice. Saha et al. (1999, 2000) found that among a sample of white, black, and Hispanic patients surveyed who were able to choose their own physicians; patients were more likely to choose physicians of their own race/ethnicity. Garcia et al. (2003) also found that black and Hispanic patients tend to prefer physicians from their own racial/ethnic group.

There is also evidence that physicians tend to serve patients from their own racial/ethnic group. Stinson and Thurston (2002) found that the most important cause of racial matching among black and Hispanic physicians was physicians' choice of location. Cantor et al. (1996) found that black and Hispanics physicians tend to serve patients from their respective racial/ethnic groups. Komaromy et al. (1996) also found that black (Hispanic) physicians were more likely to locate in communities where the percentage of black (Hispanic) residents was higher. Cohen et al. (1990) found similar results.

In sum, racially/ethnically concordant physician–patient relationships tend to result in better utilization of health care services and higher patient satisfaction. It is also the case that patients tend to choose racially/ethnically concordance physician–patient relationships and that physicians tend to locate in areas where such relationships are more likely to be formed. A clear gap in the literature is the issue of whether racial/ethnic concordance may be tied to physician earnings. We address this issue below, focusing on blacks, Hispanics, and Asians.

THEORETICAL FRAMEWORK AND EMPIRICAL SPECIFICATION

Physician earnings per hour are determined in the physician labor market and are the outcome of the supply of and demand for physicians. The demand for physicians is a derived demand based on the consumer demand for health services, which is largely mediated by health plans. Health plans contract with medical groups, hospitals, and individual physicians. Health plans also compete for individual and group subscribers.

Consumers who value racially/ethnically concordant physician–patient relationships will typically value them more when they also include language and/or cultural concordance. Consumers who value racially/ethnically concordant physician–patient relationships can express their preferences in at least two ways. First, they can directly choose such relationships independent of health insurance, through self-pay. Second, they can choose health plans where the participating physicians are likely to be racially/ethnically concordant to them and then choose their physician to the extent that their health plan allows.

In the first case, if consumers prefer racially/ethnically concordant physician–patient relationships, then this will directly result in higher demand for physicians who provide these relationships in those areas where consumers who desire such relationships are located, other things equal. This higher demand can be expressed as a higher willingness to pay to see a physician who can provide racially/ethnically concordant services, or as the willingness to accept a shorter visit length with such a physician.

In the second case, if consumers prefer racially/ethnically concordant physician–patient relationships and choose health plans where the participating physicians are more likely to be racially/ethnically concordant to them, then this will indirectly result in higher demand for physicians who can provide these relationships in those areas where consumers who desire such relationships are located, other things equal. In this case, physician groups and hospitals will have a higher demand for such physicians, other things equal, in order to successfully compete for contracts with health plans. Health plans will prefer hospitals and physician groups who can provide racial/ethnic concordant physician–patient relationships in proportion with the demand for such relationships by potential subscribers. The demand for physicians who can provide racially/ethnically concordant physician–patient relationships will be even higher when these physicians are also bilingual as in this situation such physicians can do the job of both a physician and a medical translator (translation is required by Title VI of the Civil Rights Act). Once a consumer has chosen a health plan, they may also be able to pay more or accept shorter visit lengths in order to see a particular physician within their health plan, depending on the plan.

In each of the cases above, consumer preference for racially/ethnically concordant physician–patient relationships will result in higher demand for physicians who can provide such relationships. How much higher demand will be will vary in part by how sensitive health plans are to this issue and in part by how directly most consumers are able to express their preferences.

Given the demand for racially/ethnically concordant physician–patient relationships in a given area, whether or not an earnings-per-hour premium will exist for physicians who provide such relationships will depend on the supply of physicians who offer such relationships, other things equal. In areas where the supply is low, earnings per hour will be higher. In areas where the supply is high, earnings per hour will be lower. The earnings-per-hour premium received by such physicians depends on demand and supply in the local physician labor market.

The less competitive the physician labor market is the weaker the relationship between earnings per hour and potential racial/ethnic concordance is likely to be. In the United States, physician labor markets and physician services markets are not fully competitive. Federal and state governments exercise a degree of monopsony power through their price-setting activities in

Medicaid and Medicare (Lee and Hadley 1981). A degree of monopoly power is also exercised by physicians in group practices (Rosenthal, Landon, and Huskamp 2001). In addition, many physicians are paid salaries that do not vary with their performance. The price or copay paid (if any) by many insured patients for a physician visit/procedure often does not vary according to the physician they see. Finally, the ability to choose a physician also varies with the type of financing mechanism involved. Individuals under self-pay, indemnity insurance, and preferred provider organization plans typically have the widest choice, those with health maintenance organization (HMO) plans have a narrower choice, and those covered by public insurance often have the narrowest choice.

However, these deviations from competition are only partial. The monopsony power of Medicare and Medicaid systems is not complete, nor is the monopoly power of physician groups, and the majority of physicians are paid in a way that reflects their performance to a greater or lesser degree (Center for Studying Health System Change 2006). In addition, in most health plans, there is at least some ability to choose one's physician, even under Medicaid (Temkin-Greener and Winchell 1991). Thus, the physician labor market can be said to be sufficiently competitive such that it is reasonable to assume that earnings-per-hour premiums exist, albeit in a form attenuated relative to what they would be in a purely competitive market.

Given the likelihood that earnings-per-hour premiums exist for racially/ethnically concordant physician–patient relationships, how should we measure the degree of potential racial/ethnic concordance in a given physician labor market? Computing the ratio of the percentage of the population made up of members of a specific racial/ethnic group to the percentage of the local physician workforce that is of that same group is one approach. However, when using ratios, small changes in the denominator will result in wide swings in the value of the ratio. If the denominator is measured with error, using a ratio will amplify the error. An alternative approach is to use the difference between the percentage of the local physician workforce comprised of a specific group and the percentage of the population who are members of that group (e.g., [percentage of the local physician workforce who are Hispanic]—[percentage of population who are Hispanic]). This measure is more stable in that it is less sensitive to any lack of precision in either of the percentages making up the difference. If the sign of the difference measure were negative, the interpretation would be the percentage of the respective minority population who are unable to easily see a physician who is of their own race/ethnicity.

We estimate a model of earnings determination using an updated version of the Mincer log-earnings-per-hour equation in order to conform to recent criticisms of the potential biases resulting from using the traditional model (Mincer 1974; Heckman, Lochner, and Todd 2003). To do this, we relax the linearity assumption, allowing for nonlinearity in schooling and specialty by including dummy variables for specialty, for individuals with Doctor of Osteopathy (D.O.) degrees, and for those with foreign medical training. We avoid assuming parallelism of experience levels by interacting experience levels with race/ethnicity and with being board certified in one's specialty. Although, we do not include tuition and taxes, as recommended by Heckman, Lochner, and Todd (2003), the effects of these would be largely picked up by individual random effects, and our model is asymptotically equivalent to this. In addition, we include area-level fixed effects to control for unobserved area-level heterogeneity. The equation to be estimated is

$$\begin{aligned}\mathrm{Ln}\,\boldsymbol{W} = {} & \beta_0 + \beta_1\boldsymbol{F} + \beta_2\boldsymbol{R} + \beta_3\boldsymbol{E} + \beta_4\boldsymbol{ED} + \beta_5\boldsymbol{I} \\ & + \beta_6\boldsymbol{D}_p + \beta_7\boldsymbol{M} + \beta_8\boldsymbol{D}_m + \beta_9\boldsymbol{E}\times\boldsymbol{R} + \beta_{10}\boldsymbol{E}\times\boldsymbol{ED} \\ & + \beta_{11}\boldsymbol{D}_p\times\boldsymbol{R} + \beta_{12}\boldsymbol{D}_m\times\boldsymbol{R} + \beta_{13}\boldsymbol{A} + \varepsilon. \end{aligned} \tag{1}$$

Ln $\boldsymbol{W}$ is the natural log of implicit earnings per hour, where implicit earnings per hour (1999 dollars) is defined as annual earnings before taxes from medical activities divided by the product of hours/week and weeks/year worked in medicine. $\boldsymbol{F}$ denotes female. $\boldsymbol{R}$ is a vector of physician race/ethnicity dummy variables, including black, Hispanic, and Asian status. $\boldsymbol{E}$ is a vector including years of experience and its square. $\boldsymbol{ED}$ is a vector of educational variables which includes a set of variables that collapses all possible specialty categories into five groups (family medicine, internal medicine, pediatrics, medical specialties, and surgical specialties); being board certified in one's specialty; whether one is a D.O.; and whether one attended a medical school outside of the United States or Canada. $\boldsymbol{I}$ is a vector of insurance variables including the percentages of the population that are covered by private insurance, public insurance, or Medicare. Private insurance is defined as private insurance from an employer, from direct purchase, or from someone outside the family. This category also includes military insurance. Public insurance includes Medicaid and other public coverage, excluding Medicare and military insurance. Medicare includes Medicare alone and in conjunction with private supplemental insurance. $\boldsymbol{D}_p$ is a vector of the percentage of the population that is black, the percentage of the population that is Hispanic, and the percentage of the population that is Asian. $\boldsymbol{M}$ contains median income. $\boldsymbol{D}_m$ is the percentage of the local physician workforce that is black, the percentage of the local physician workforce that is Hispanic, and the percentage of the local physician workforce that is Asian. $\boldsymbol{E} \times \boldsymbol{R}$ is a vector of the interaction of $\boldsymbol{E}$ and $\boldsymbol{R}$. $\boldsymbol{E} \times \boldsymbol{ED}$ is a vector of the interactions of both experience and experience squared with being board certified in one's specialty. $\boldsymbol{D}_p \times \boldsymbol{R}$ is a vector of the interaction of $\boldsymbol{D}_p$ and $\boldsymbol{R}$. Every variable is interacted with physicians who are of the corresponding race/ethnicity ($\boldsymbol{R}$) (e.g., [percentage of population that is black] $\times$ [black physician]). $\boldsymbol{D}_m \times \boldsymbol{R}$ is a vector of the interaction of $\boldsymbol{D}_m$ and $\boldsymbol{R}$. Every variable is interacted with physicians who are of the corresponding race/ethnicity ($\boldsymbol{R}$) (e.g., [percentage of the local physician workforce that is black] $\times$ [black physician]). $\boldsymbol{A}$ is a vector of dummy variables for $N_a - 1$ of the relevant geographical areas. The error term is denoted by ε. The reference group is male, non-Hispanic white, specializing in internal medicine, not board certified, an M.D., and trained in a medical school in the United States or Canada.[1]

The difference measure discussed above is computed using estimated parameters corresponding to each component of the measure. If the difference were estimated using as a single variable, then that would imply that the effects of changes in each component are identical which is unlikely to be the case. We are only interested in the difference measure that relates to physicians of the corresponding race/ethnicity. We expect the components of the measure to behave as follows:

$$\delta^2 \mathrm{Ln} \boldsymbol{W} / (\delta \boldsymbol{R} \, \delta \boldsymbol{D}_p) > 0 \tag{2}$$

$$\delta^2 \mathrm{Ln} \boldsymbol{W} / (\delta \boldsymbol{R} \, \delta \boldsymbol{D}_m) < 0. \tag{3}$$

Equation (2) states that the second partial derivative with respect to physician race/ethnicity and the percentage of the population of the corresponding race/ethnicity will be positive. In other words, other things equal, as the absolute value of the difference between the percentage of the local physician workforce who of a given racial/ethnic group and the percentage of the population are from the corresponding racial/ethnic group becomes greater, where the change in the difference measure is only due to increases in the percentage of the population of the corresponding race/ethnicity, the greater the premium in earnings per hour will be. Equation (3) states that the second partial derivative with respect to physician race/ethnicity and the percentage of the physician workforce of the corresponding race/ethnicity will be negative. In other words, other things equal, as the absolute value of the difference between the percentage of the local physician workforce who of a given racial/ethnic group and the percentage of the population are from the corresponding racial/ethnic group becomes smaller, where the change in the difference measure is only due to increases in the percentage of the local physician workforce of the corresponding race/ethnicity, the smaller the premium in earnings per hour will be.

DATA

The primary data sets used for this project are the restricted versions of the Community Tracking Study Physician Surveys (CTS-PS) for the years 1998–1999 and 2000–2001. The Community Tracking Study is a national, stratified, probability sample of physicians located in 60 sites across the United States, which also includes a sample of physicians outside of these 60 sites. We merged this data with data on median income from the 2000 U.S. Census, data on the percentage of the population from each racial/ethnic group from the Area Resource File, and with data on insurance from the Community Tracking Study Household Survey for the years 1998–1999 and 2000–2001. All variables were matched by year. Median income was only available for 1999. In this case, the 1999 data were used for both periods (adjusted for inflation when replicated).

The CTS-PS are the most current and complete data available to answer our questions of interest. The panel contains 15,446 individual observations. We eliminated 96 observations that had missing variables, 1,172 observations due to physicians not being located in one of the 60 CTS sites, and 214 observations for physicians who only appeared once in the panel. This left us with a sample of 13,964 (12,886 in metropolitan areas).

To save as many observations as possible, we imputed values of annual income to physicians whose income values appeared to be in error or whose income was only reported for a single year. The income questions required that interviewers record income to the nearest $1,000. A number of interviewers appear to have recorded only three digits, omitting the three trailing zeroes. These values were simply multiplied by 1,000. When physicians reported income for 1 year, but did not report for another year, we imputed the value of the income for the year they reported to the year they did not report. Income was imputed for 56 observations.

Extreme, but still plausible, values of annual income and implicit earnings per hour were retained to avoid throwing away valid information. The survey top-coded annual income at $400,000. The low value of annual income was $1,000. As many physicians are very altruistic and may have income from other sources, it seemed that the low values of annual income were not sufficient reason to discard these observations.

The highest level of implicit earnings per hour reported was \$1,375. This is approximately \$2.75 million dollars per year, assuming 2000 annual hours of work. This is a reasonable figure for some very successful physicians. The low value of implicit earnings per hour was \$0.34. As noted above, it does not appear unreasonable that some altruistic physicians work for almost nothing (and do not report their time worked as charity care). The resulting log earnings-per-hour distributions were almost perfectly normally distributed. Earnings per hour were transformed to 1999 dollars before taking the natural log.

We prepared two other versions of the data. Version two omits the observations with imputed income values. Version three retains the imputations, but omits observations with earnings per hour less than \$7.50 or greater than \$500. We expect no change between versions one and two, but as version three cuts off the ends of the earnings-per-hour distribution at arbitrary places, it may bias the results.

The data used to calculate the population portion of our difference measure come from the Area Resource File. The percentage of the local physician workforce from each minority group is calculated by taking site-level means from each of the 60 sites of the CTS-PS. The CTS-PS data include a sample of all physicians who are located in each site, have completed their medical training, work at least 20 hours/week, are involved in direct patient care, are not federal employees, and are not foreign medical graduates temporarily licensed in the United States.

Definitions of each variable are listed in Table 1. Descriptive statistics for each variable were generated using *SUDAAN* 8.02 and are listed in Table 2.[1]

STATISTICAL MODELS AND ESTIMATION

We estimate our models using a generalized estimating equations approach. We estimate a within and between population-averaged regression with exchangeable correlation. Estimating individual fixed effects is not possible because this will result in our main variables of interest, race/ethnicity, being swept out of the model. Within and between population-averaged regressions with exchangeable correlation is asymptotically equivalent to a random effects model with random effects for individuals (Horton and Lipsitz 1999; Stata 2001). The advantage of the population-averaged model is that the estimated parameters of the time invariant variables are consistent whether or not

Table 1: Variable Definitions

Variable	*Definition*	*Source*
Individual level		
Female	Female physician	CTS-PS
Black	Black physician	CTS-PS
Hispanic	Hispanic physician	CTS-PS
Asian	Physician who is Asian/Pacific Islander	
Experience	Experience as a physician in years	CTS-PS
$(\text{Experience})^2$	$(\text{Experience})^2/100$	CTS-PS
Family practice	Specialty in family medicine	CTS-PS
Pediatrics	Specialty in pediatrics	CTS-PS
Medical specialty	Specialty in medical specialty	CTS-PS
Surgical specialty	Specialty in surgical specialty	CTS-PS
Board certified	Board certified in specialty	CTS-PS
D.O.	Doctor of Osteopathy	CTS-PS
Non-U.S., non-Canadian	Attended medical school outside of U.S. or Canada	CTS-PS
LnW	Natural log of implicit earnings per hour = Ln([annual income]/[(hours/week)(weeks/year)])	CTS-PS
Site level		
B—population	Percent of the general population that is black	ARF
H—population	Percent of the general population that is Hispanic	ARF
A—population	Percent of the general population that is Asian/Pacific Islander	
B—workforce	Percent of physician workforce that is black	CTS-PS
H—workforce	Percent of physician workforce that is Hispanic	CTS-PS
A—workforce	Percent of physician workforce that is Asian/Pacific Islander	CTS-PS
Public insurance	Percent of population enrolled in Medicaid or other public insurance	CTS-HS
Private insurance	Percent of population enrolled in private or military insurance	CTS-HS
Medicare	Percent of population enrolled in Medicare	CTS-HS
Median income	Median family income for the general population ($1,000s)	USC

CTS-PS, Community Tracking Study, Physician Survey; CTS-HS, Community Tracking Study, Household Survey; USC, U.S. Census; ARF, Area Resource File; D.O., Doctor of Osteopathy.

unobserved heterogeneity across individuals is correlated with the observed explanatory variables. This is in contrast to the standard random effects model, where estimates of the time invariant parameters will only be consistent if the unobserved heterogeneity across individuals is uncorrelated with the observed explanatory variables. We also include $N_g - 1$ area-level fixed effects in our model to control for omitted time-invariant site-level effects.

Table 2: Descriptive Statistics—Means and Standard Errors of Means

Variables	*All Physicians*	*Black Physicians*	*Hispanic Physicians*	*Asian Physicians*
Individual level				
Annual income	174,316.97 (2,107.70)	143,200.33 (5,823.64)	162,995.62 (10,702.59)	152,244.17 (3,323.51)
Implicit earnings/hour	71.99 (0.86)	61.82 (2.18)	71.36 (6.12)	64.14 (1.39)
Female	0.208 (0.007)	0.318 (0.041)	0.274 (0.046)	0.3020 (0.0192)
Black	0.032 (0.003)	—	0.016 (0.008)	—
Hispanic	0.046 (0.022)	0.024 (0.015)	—	0.015 (0.004)
Asian	0.116 (0.009)	—	0.039 (0.016)	—
Experience	15.705 (0.149)	14.355 (0.842)	14.588 (0.5927)	13.856 (0.473)
Family practice	0.171 (0.006)	0.165 (0.026)	0.164 (0.022)	0.127 (0.012)
Pediatrics	0.085 (0.004)	0.133 (0.025)	0.151 (0.025)	0.114 (0.013)
Medical specialty	0.331 (0.008)	0.230 (0.032)	0.331 (0.036)	0.328 (0.022)
Surgical specialty	0.285 (0.009)	0.289 (0.047)	0.184 (0.033)	0.218 (0.022)
Board certified	0.844 (0.009)	0.750 (0.029)	0.725 (0.039)	0.781 (0.023)
D.O.	0.058 (0.005)	0.034 (0.013)	0.022 (0.015)	0.013 (0.003)
Non-U.S., non-Canadian	0.199 (0.020)	0.174 (0.031)	0.624 (0.096)	0.726 (0.026)
Site level				
Public insurance	7.5529 (0.241)	—	—	—
Private insurance	66.907 (0.785)	—	—	—
Medicare	13.837 (0.184)	—	—	—
Median income	54.716 (0.977)	—	—	—
B—population	13.084 (0.735)			—
H—population	10.671 (2.587)	—	—	—
A—population	3.8264 (0.323)			—
B—workforce	3.420 (0.155)	—	—	—
H—workforce	5.036 (1.928)	—	—	—
A—workforce	11.791 (0.687)	—	—	—

Standard error of each mean in parentheses.

Standard errors computed using *SUDAAN* 8.02 incorporating all aspects of the complex survey design.

D.O., Doctor of Osteopathy.

The survey design used to collect data on CTS physicians included probability weighting, stratification, clustering, and other design factors. We used *SUDAAN* 8.02 to estimate our models, which allowed us to take into account all aspects of the complex survey design when using the panel subsample of CTS physician data and so correctly estimate standard errors (Schaefer et al. 2003). We used *Stata* 7.0 and 8.0 to prepare the data.

The clustering in the sample is done at the level of the individual physician in metropolitan areas (51 sites, 12,886 observations), but clusters all physicians together within each nonmetropolitan area. Because our methodology requires that we have individual clustering in order to obtain results that are asymptotically equivalent to random effects, we are primarily interested in models where clustering is done at the level of the individual physician. Thus, we are mainly interested in the metropolitan subsample, but to check sensitivity we also estimate models using the full sample.

In addition, we test the possibility that practice organization may affect our results by adding to each of the above specifications a set of dummy variables that describe the type of practice a physician works in (solo practice/two physicians, group practice, HMO, medical school, hospital based, other) and whether the physician is full or part owner of the medical practice. These variables are not included in the main equation as they are very likely endogenous. Because of this, it is likely that their parameter estimates are also biased. The purpose for including them as part of the sensitivity analysis is to test whether their inclusion alters the size of any important parameters (a direct test of omitted variable bias). However, it should be noted that when these variables are included, the estimated results would be somewhat less precise (have larger standard errors) due to the reduction of the degrees of freedom. Finally, to test of the sensitivity of our data assumptions, we also estimate each of the area-level fixed-effects specifications using versions two and three of our data set.

As our model is a log-linear model that contains dummy variables, it is important to note that dummy variables in this model cannot be interpreted without transformation. When interpreting the results, we therefore transform the estimated parameters of dummy variables using the following equation:

$$g = 100(\exp(b - V(b)/2) - 1 \qquad (4)$$

where b is the parameter of the dummy variable in question, $V(b)$ is the estimated variance of the dummy variable in question and g is the estimate of the percentage impact of the dummy variable on the dependent variable (Halvorsen and Palmquist 1980; Kennedy 1981).

RESULTS

The main results of our analysis are shown in Table 3. We only describe the results shown in column 3.[1] Our major finding is that Hispanic physicians receive earnings-per-hour premiums when they are located in areas where the percentage of the population that is Hispanic is greater than the percentage of the physician workforce that is Hispanic. The same is also true for Asian physicians. Consistent with the expected sign of equation (2), the interaction of being a Hispanic physician and the percentage of the population that is Hispanic is 0.009 ($p<.01$) and the interaction of being an Asian physician and the percentage of the population that is Asian is 0.011 ($p<.05$). This means that when the absolute value of the difference measure ([percentage of the local physician workforce who are a given race/ethnicity]—[percentage of population who are of the same race/ethnicity]) increases by 1 percentage point due to a 1 percentage point increase in the percentage of the population that is Hispanic or Asian, respectively, Hispanic and Asian physicians receive 0.9 and 1.1 percent more in earnings per hour, respectively.

Consistent with the expected sign of equation (3), the interaction of being a Hispanic physician and the percentage of the physician workforce that is Hispanic is -0.008 ($p<.05$) and the interaction of being an Asian physician and the percentage of the physician workforce that is Asian is -0.007 ($p<.05$). This means that when the absolute value of the difference measure decreases by 1 percentage point due to a 1 percentage point increase in the percentage of the physician workforce that is Hispanic or Asian respectively, Hispanic and Asian physicians receive 0.8 and 0.7 percent less in earnings per hour, respectively.

The average percentage of the population that is Hispanic is 10.67 percent and the average percentage of the physician workforce that is Hispanic is 5.04 percent. This translates into an average earnings-per-hour premium of 5.57 percent ($[10.67 \times 0.9]+[5.04 \times -0.8]$). The average percentage of the population that is Asian is 3.83 percent and the average percentage of the physician workforce that is Asian is 11.79 percent. This translates in an average earnings-per-hour discount of -4.04 percent ($[3.83 \times 1.1]+[11.79 \times -0.7]$). In other words, although both Hispanic and Asian physicians will earn premiums in areas where they are underrepresented relative to their respective racially/ethnically concordant populations, Hispanic physicians are, on average, underrepresented relative to the Hispanic population and Asian physicians are, on average, overrepresented relative to the Asian population. In terms of the CTS sample, Hispanic physicians are underrepresented in 41–42

Table 3: Results—Log Earnings-per-Hour Regressions

	(1) Metropolitan Areas (No Fixed Effects)	(2) Metropolitan Areas (No Fixed Effects)	(3) Metropolitan Areas (With Fixed Effects)*
Individual level			
Female	– 0.127*** (0.019)	– 0.124*** (0.019)	– 0.126*** (0.019)
Black	0.061 (0.088)	0.200 (0.112)	0.159 (0.111)
Hispanic	0.210** (0.100)	0.104 (0.115)	0.101 (0.119)
Asian	0.070 (0.065)	0.121 (0.082)	0.092 (0.084)
Experience	0.024*** (0.008)	0.024*** (0.008)	0.024*** (0.008)
$(\text{Experience})^2$	– 0.052*** (0.015)	– 0.052*** (0.015)	0.005*** (0.015)
Family practice	– 0.044 (0.023)	– 0.045** (0.023)	– 0.048** (0.023)
Pediatrics	0.030 (0.028)	0.029 (0.02)	0.025 (0.027)
Medical specialty	0.158*** (0.028)	0.160*** (0.028)	0.158*** (0.028)
Surgical specialty	0.316*** (0.033)	0.315*** (0.03)	0.312*** (0.032)
Board certified	0.063 (0.096)	0.066 (0.096)	0.060 (0.096)
D.O.	0.035 (0.028)	0.034 (0.028)	0.024 (0.030)
Non-U.S., non-Canadian	– 0.016 (0.022)	– 0.008 (0.023)	– 0.013 (0.023)
Individual-level interactions			
Experience × black	– 0.016 (0.012)	– 0.017 (0.011)	– 0.018 (0.011)
$(\text{Experience})^2$ × black	0.023 (0.030)	0.025 (0.030)	0.028 (0.031)
Experience × Hispanic	– 0.016 (0.012)	– 0.014 (0.013)	– 0.014 (0.014)
$(\text{Experience})^2$ × Hispanic	0.035 (0.028)	0.029 (0.031)	0.030 (0.033)
Experience × Asian	– 0.018 (0.010)	– 0.018** (0.009)	– 0.017 (0.009)
$(\text{Experience})^2$ × Asian	0.040 (0.028)	0.044 (0.027)	0.040 (0.028)
Experience × board certified	0.012 (0.010)	0.011 (0.010)	0.011 (0.010)
$(\text{Experience})^2$ × board certified	– 0.028 (0.020)	– 0.028 (0.020)	– 0.028 (0.020)
Site level			
Public insurance	– 0.005 (0.003)	– 0.005 (0.003)	– 0.008** (0.004)

continued

Table 3. *Continued*

	(1) Metropolitan Areas (No Fixed Effects)	(2) Metropolitan Areas (No Fixed Effects)	(3) Metropolitan Areas (With Fixed Effects)*
Private insurance	– 0.003 (0.003)	– 0.003 (0.003)	0.003 (0.003)
Medicare	– 0.001 (0.004)	– 0.001 (0.004)	0.003 (0.005)
Median income	– 0.001 (0.001)	– 0.001 (0.001)	0.049 (0.043)
B—population	0.002 (0.001)	0.002 (0.001)	– 0.029** (0.014)
H—population	– 0.001 (0.001)	– 0.001 (0.001)	– 0.018 (0.015)
A—population	– 0.006 (0.003)	– 0.008*** (0.003)	0.050 (0.057)
B—workforce	– 0.001 (0.003)	– 0.001 (0.004)	0.005 (0.005)
H—workforce	– 0.005 (0.001)	– 0.004*** (0.002)	– 0.007** (0.003)
A—workforce	0.001 (0.001)	0.002 (0.002)	– 0.001 (0.002)
Individual-site interactions			
B—population × black	—	– 0.009 (0.005)	– 0.007 (0.005)
H—population × Hispanic	—	0.009*** (0.003)	0.009*** (0.003)
A—population × Asian	—	0.011** (0.005)	0.011** (0.005)
B—workforce × black	—	0.004 (0.012)	0.003 (0.012)
H—workforce × Hispanic	—	– 0.010** (0.004)	– 0.008** (0.004)
A—workforce × Asian	—	– 0.007** (0.003)	– 0.007** (0.003)
Constant	4.012*** (0.253)	4.029*** (0.251)	1.753 (1.845)
χ^2 (Wald test)	522,761.45***	533,305.36***	1,464,056.64***
Adjusted R^2	0.138	0.139	0.156
Sample size	12,886	12,886	12,886

Computed using *SUDAAN* 8.02 incorporating all aspects of the complex survey design.

*Parameters of site-level fixed effects not shown.

Standard errors in parentheses are rounded to the third decimal place, *t*-statistics calculated from these values will be incorrect.

**5% statistical significance, two-tailed test.

***1% statistical significance, two-tailed test.

D.O., Doctor of Osteopathy.

of the 60 CTS sites (depending on the year), while Asian physicians are underrepresented in only 4–6 of the 60 CTS sites (depending on the year). The range of the difference measure in the CTS sample is somewhat larger for Hispanic physicians [– 41.4, 12.7] relative to Asian physicians [– 12.9, 33.4], but the difference measure is skewed towards the negative side of Hispanic physicians and the positive side for Asian physicians.

The second major finding is that, after adjusting for the covariates, female physicians earn approximately 13.5 percent less than men. This is not due to the number of hours worked, specialty, board certification, experience, or any of the other characteristics controlled for.

In order to determine the robustness of the above findings, we conducted a sensitivity analysis to determine the effect of a number of changes to the model: (1) changing the assumptions used in generating the earnings-per-hour variable, (2) using the full sample rather than just metropolitan areas, and (3) adding a set of dummy variables that describe the type of practice a physician works in and whether the physician is full or part owner of the practice.

Using version two of the data did not significantly change the results. Using version three of the data, which arbitrarily cut off the ends of both sides of the earnings distribution, resulted in severe bias to the results as expected. It showed that black physicians earn 18.8 percent more than white physicians ($p = .10$), but that their earnings increase with experience at only a fraction of the level of white physicians, other things equal. The main results were also eliminated. We dismiss these results as biased. Using the full sample rather than metropolitan areas only did not alter the main results. Adding practice type and ownership status left the main results intact, but, as expected, increased the p-values of some coefficients (two key parameters increased from $p = .05$ to .06 or .07). As the addition of these variables did not result in a statistically significant change in the size of the key parameter estimates, which suggests no omitted variable bias is occurring due to their exclusion, we consider this expected small increase of some standard errors to be of no economic significance.

DISCUSSION

For both Hispanic and Asian physicians, we find that physicians have higher earnings per hour in areas where the percentage of the local physician workforce who are of a given race/ethnicity is less than the percentage of the population that is of the same race/ethnicity. These results suggest that not only do both Hispanic and Asian patients tend to value racial/ethnic concordance in physician–patient relationships, but that local physician labor markets reward physicians who provide these relationships. This does not mean that every Hispanic or Asian physician who works in an underserved area (with respect to race/ethnicity) receives a wage premium, but that this is true on average.

The lack of statistically significant findings for black physicians suggests some important limitations to the current study. The lack of statistically significant findings does not imply that black patients do not value racially concordant physician–patient relationships, as our measurement of these relationships is only approximate. An over-sample of black physicians is likely needed in order to detect a statistically significant earnings-per-hour effect for black physicians.

A second limitation is that our measures of racial/ethnic concordance aggregate a number of ethnic and linguistic groups together under the respective terms "black," "Hispanic," and "Asian." The proportion of each measure that reflects cultural concordance relative to language concordance cannot be determined.

Finally, because our main model was estimated using metropolitan areas, this study may not be generalizable to rural areas. Although our sensitivity analysis included nonmetropolitan areas and showed no change to our findings, caution in generalizing is nonetheless warranted.

ACKNOWLEDGMENTS

This study was supported by a grant from the W. K. Kellogg Foundation to Duke University. The authors thank our editors, Ann B. Flood and Phillip R. Kletke, as well as two anonymous reviewers for their valuable input. We also thank Jacob L. Vigdor and William H. Dow for providing reviews of an earlier version of this paper. Vikram Pathania also provided helpful advice. Any remaining errors are the authors' responsibility.

NOTE

1. Because both black and Asian are considered racial groupings and Hispanic an ethnic grouping, there is slight overlap between the groups (see Table 2).

REFERENCES

Aruguete, M. S., and C. A. Roberts. 2002. "Participants' Ratings of Male Physicians Who Vary in Race and Communication Style." *Psychological Reports* 91: 793–806.

Cantor, J. C., E. Miles, L. C. Baker, and D. C. Barker. 1996. "Physician Service to the Underserved: Implications for Affirmative Action in Medical Education." *Inquiry* 33 (2): 167–80.

Center for Studying Health System Change. 2006. "CTSonline" [accessed on May 1, 2006]. Available at http://ctsonline.s-3.com/

Clark, T., B. Sleath, and R. H. Rubin. 2004. "Influence of Ethnicity and Language Concordance on Physician–Patient Agreement about Recommended Changes in Patient Health Behavior." *Patient Education and Counseling* 53 (1): 87–93.

Cohen, A. B., J. C. Cantor, D. C. Barker, and R. G. Hughes. 1990. "Young Physicians and the Future of the Medical Profession." *Health Affairs* 9 (4): 138–48.

Cooper, L. A., D. L. Roter, R. L. Johnson, D. E. Ford, D. M. Steinwachs, and N. R. Powe. 2003. "Patient-Centered Communication, Ratings of Care, and Concordance of Patient and Physician Race." *Annals of Internal Medicine* 139 (11): 907–15.

Cooper-Patrick, L., J. J. Gallo, J. J. Gonzales, H. T. Vu, N. R. Powe, C. Nelson, and D. E. Ford. 1999. "Race, Gender and Partnership in the Physician–Patient Relationship." *Journal of the American Medical Association* 282 (6): 583–9.

Flores, G. 2005. "The Impact of Medical Interpreter Services on the Quality of Health Care: A Systematic Review." *Medical Care Research and Review* 62 (3): 255–99.

Garcia, J. A., D. A. Paterniti, P. S. Romano, and R. L. Kravitz. 2003. "Patient Preferences for Physician Characteristics in University-Based Primary Clinics." *Ethnicity and Disease* 13: 259–67.

Gray, B., and J. J. Stoddard. 1997. "Physician–Patient Pairing: Does Racial and Ethnic Congruity Influence Selection of a Regular Physician?" *Journal of Community Health* 22 (4): 247–59.

Green, A. R., Q. Ngo-Metzger, A. T. Legedza, M. P. Massagli, R. S. Phillips, and L. I. Iezzoni. 2005. "Interpreter Services, Language Concordance, and Health Care Quality. Experiences of Asian Americans with Limited English proficiency." *Journal of General Internal Medicine* 20 (11): 1050–6.

Halvorsen, R., and P. Palmquist. 1980. "The Interpretation of Dummy Variables in Semilogarithmic Equations." *American Economic Review* 70: 474–5.

Heckman, J., L. Lochner, and P. Todd. 2003. "Fifty Years of Mincer Earnings Regressions," NBER Working Paper 9732.

Horton, N., and S. Lipsitz. 1999. "Review of Software to Fit Generalized Estimating Equation Regression Models." *American Statistician* 53: 160–9.

Kennedy, P. 1981. "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations." *American Economic Review* 71: 801.

King, W. D., M. D. Wong, M. F. Shapiro, B. E. Landon, and W. E. Cunningham. 2004. "Does Racial Concordance between HIV-Positive Patients and their Physicians Affect the Time to Receipt of Protease Inhibitors?" *Journal of General Internal Medicine* 19 (11): 1146–53.

Komaromy, M., K. Grumbach, M. Drake, K. Vranizan, N. Lurie, D. Keane, and A. B. Bindman. 1996. "The Role of Black and Hispanic Physicians in Providing Health Care for Underserved Populations." *New England Journal of Medicine* 334 (20): 1305–10.

Konrad, T. R., D. L. Howard, L. J. Edwards, A. Ivanova, and T. S. Carey. 2005. "Physician–Patient Racial Concordance, Continuity of Care, and Patterns of Care for Hypertension." *American Journal of Public Health* 95 (12): 2186–90.

Lasser, K. E., I. L. Mintzer, A. Lambert, H. Cabral, and D. H. Bor. 2005. "Missed Appointment Rates in Primary Care: The Importance of Site of Care." *Journal of Health Care for the Poor and Underserved* 16 (3): 475–86.

LaVeist, T. A., and T. Carroll. 2002. "Race of Physician and Satisfaction with Care among African–American Patients." *Journal of the American Medical Association* 94 (11): 937–43.

LaVeist, T. A., and A. Nuru-Jeter. 2002. "Is Doctor–Patient Race Concordance Associated with Greater Satisfaction with Care?" *Journal of Health and Social Behavior* 43 (3): 296–306.

LaVeist, T. A., A. Nuru-Jeter, and K. E. Jones. 2003. "The Association of Doctor–Patient Race Concordance with Health Services Utilization." *Journal of Public Health Policy* 24 (3–4): 312–23.

Lee, R. H., and J. Hadley. 1981. "Physicians' Fees and Public Medical Care Programs." *Health Services Research* 16 (2): 185–203.

Mehler, P. S., R. A. Lundgren, I. Pines, and K. Doll. 2004. "A Community Study of Language Concordance in Russian Patients with Diabetes." *Ethnicity and Disease* 14 (4): 584–8.

Mincer, J. 1974. *Schooling, Experience, and Earnings.* New York: NBER Press.

Rosenthal, M. B., B. E. Landon, and H. A. Huskamp. 2001. "Managed Care and Market Power: Physician Organizations in Four Markets." *Health Affairs* 20 (5): 187–93.

Saha, S., M. Komaromy, T. D. Koepsell, and A. B. Bindman. 1999. "Physician–Patient Racial Concordance and the Perceived Quality and Use of Health Care." *Archives of Internal Medicine* 159 (9): 997–1004.

Saha, S., S. H. Taggart, M. Komaromy, and A. B. Bindman. 2000. "Do Patients Choose Physicians of Their Own Race?" *Health Affairs* 19 (4): 76–83.

Schaefer, E., F. Potter, S. Williams, N. Diaz-Tena, J. D. Reschovsky, and G. Moore. 2003. "Comparison of Selected Statistical Software Packages for Variance Estimation in the CTS Surveys." Community Tracking Study Technical Publication No. 40.

Stata Corporation. 2001. *Stata (Version 7.0) Reference Manual Su-Z.* "xtgee".

Stinson, M. H., and N. K. Thurston. 2002. "Racial Matching among African–American and Hispanic Patients and Physicians." *Journal of Human Resources* 38 (2): 411–28.

Temkin-Greener, H., and M. Winchell. 1991. "Medicaid Beneficiaries under Managed Care: Provider Choice and Satisfaction." *Health Services Research* 26 (4): 509–29.

U.S. Census Bureau. 2004. "American Community Survey" [accessed on April 29, 2006]. Available at http://www.census.gov/acs/www/

Wilson, E., A. H. Chen, K. Grumbach, F. Wang, and A. Fernandez. 2005. "Effects of Limited English Proficiency and Physician Language on Health Care Comprehension." *Journal of General Internal Medicine* 20 (9): 800–6.