

Differential Impact of Physicians' Racial Group on Patients' Outcomes*

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This study examines the differential effects of physician per patient ratios on hospitalization procedures and patient safety issues, as a result of the unequal distribution of physicians among different racial groups in different communities, which may result in unequal outcomes. A generalized linear model (GLM) was applied with the use of log link and Poisson distribution on a California County-level dataset. The findings show that differences in physician per patient ratios across racial groups play a significant role in patient outcomes. A higher inequality in physician per patient ratios among racial groups is positively associated with the number of hospitalization procedures and patient safety issues.

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1. INTRODUCTION

The persistency of health disparities has been well reported by different groups around the world. Racial and ethnic minority populations experience worse health outcomes than those of the majority population (NCHS, 2016; NIH, 2016). These disparities are influenced by many factors, including socio-economic status and environmental and occupational exposures (Kington and Nickens, 2001). Among the varying factors, one of the most crucial factors is the background of the healthcare provider. Whether or not a physician's racial background matches that of the patient, has attracted much recent attention as an important determining factor in the poor quality of health care among underserved populations. In order to address these issues, governments and other groups have suggested increasing the racial diversity of health providers in order to alleviate the social frictions occurring during healthcare provision.

Previous studies (Strumpf, 2011; Alsan, Garrick, and Graziani, 2019) have examined the effect of individual doctor-patient matching on the quality of care and health outcomes. They have focused on the interactions between the racial matching of physicians and patients and the subsequent impact it has on care quality. However, this study aims to examine whether increasing the numbers of physicians from under-represented groups would lead to better health outcomes for a minority population. In other words, we focus on the effect of the differences in physician per patient ratios across different racial groups on health outcomes, as the large difference in this ratio amongst different racial groups possibly limits patients' choices and therefore may result in unequal health outcomes.

2. BACKGROUND

Cultural factors related to patients' perceptions of health, illness, and the health care system play a significant role in patients' health care-seeking behavior, treatment adherence, and usage of preventive services. For example,

some racial groups may seek care from physicians only in the case of serious illness (Armstrong *et al.*, 2007), or they may distrust information given to them by physicians. Therefore, the broader identity of health care providers plays a critical role in driving patients' understanding of health problems and treatment options, as well as ensuring their adherence to treatment plans and preventive services.

The level and quality of communication between patients and health care providers has been found to greatly impact patients' overall health outcomes, their adherence to health care providers' recommendations, and their trust in healthcare systems (Ferrera *et al.*, 2015). During a visit, patients who identify as a member of a minority group may have negative communication experiences, due to language barriers, a lack of common interpersonal communication culture, and a higher likelihood for limited information disclosure (Cuevas, O'Brien, and Saha, 2016). Studies have reported that non-English speaking patients are less likely to visit a physician or receive preventive care (Feinberg *et al.*, 2002; Fiscella *et al.*, 2002). Communication problems caused by language barriers often lead to frustration and dissatisfaction on the patient's part. In some cases, doctor-patient racial concordance appears to play a role in the level of bias in a health care provider's practice, consequently affecting patient satisfaction and their utilization of health services. For example, implicit racial bias among oncologists is negatively associated with the quality of communication with patients. Oncologists with higher implicit racial bias have shorter interactions with patients, and their patients have greater difficulty in remembering the contents of the interaction, as well as reduced confidence in the recommended treatments (Penner *et al.*, 2002). These studies emphasize the importance of the patient-physician relationship, and underscore the need for culturally competent health care providers.

The fact that patients prefer physicians from their own racial or ethnic group has been documented in many studies. For example, African American patients who interacted with a racially discordant doctor were less accurate in their risk perceptions than those who interacted with a racially concordant

doctor, thereby impacting their processing of lung cancer risk information (Persky *et al.*, 2013). Somnath, Arbelaez and Cooper (2003) found that Black and Hispanic Americans seek medical care from physicians of their own race due to personal preferences and language reasons, not merely because of geographic accessibility. Overall, studies have found that African Americans and Latinos who perceive racism in the health care system are more likely to prefer a physician of their own race or ethnicity (Chen *et al.*, 2005). Taking these research findings into consideration, a lower number of available physicians from certain racial or ethnic groups will limit the choices of the patients from these groups. In other words, diversity among physicians may lead to more opportunities for minority group patients to choose physicians whom they can trust and with whom they will feel most comfortable, which may then have a positive effect on their health behavior and outcomes.

Previous studies have suggested that the quality of care is expected to increase when physicians and patients share the same race or ethnicity. In other words, increasing the racial and ethnic diversity of physicians in the health care workforce will likely improve access to better-quality health care for underserved populations. In a study examining the role of physician-patient concordance, Strumpf (2001) found that concordance was associated with rates of cholesterol screening that were two to three times higher among Black and Hispanic men compared to White men. In an experimental study investigating the effect of physician diversity on the demand for preventive care among African American men, Alsan, Garrick, and Graziani (2019) found that African American men were much more likely to select every preventive service after having met with a racially concordant doctor. Based on these results, Alsan, Garrick, and Graziani suggested that this increased demand induced by Black doctors could lead to a 19 percent reduction in the Black-White male cardiovascular mortality gap.

Thus, an increasing number of studies have supported the idea that physician-patient racial concordance will provide underserved patients with better health care experiences. However, there have been few studies examining the impact of racial matching between patients and physicians on

their health outcomes. Thus, instead of focusing on individual physician-patient matching, this study examines the relationship between the distribution of physicians of different racial backgrounds among patients populations from different backgrounds, and the patients' subsequent health outcomes. Racial matching between patients and physicians can be expected only when physicians of the same race as the patients are available in the first place. An unequal distribution of physicians among different racial groups would otherwise limit patients' choices and may lead to unequal health outcomes.

3. METHODS

3.1. Data

This study used California County level data from 2015, including data on physician characteristics, patient characteristics, and health quality indicators. First, the data physicians were taken as a subset from the Medical Board of California's Physician Survey of Physicians and Surgeons dataset. The dataset includes the number of licensees by the county where they are practicing, as well as the licensed physicians' racial/ethnic background. Second, the patient dataset provides the number of patients across different racial categories.

Lastly, the health quality indicator dataset provides the number of risk-adjusted observed patients undergoing hospitalization procedures and experiencing patient safety issues.

The hospitalization procedures include Coronary Artery Bypass Grafts (CABG) (Age 40 and over) and Percutaneous Coronary Interventions (PCI) (Age 40 and over). Patient safety issues include instances of Retained Surgical Item or Unretrieved Device Fragment, Iatrogenic Pneumothorax, Central Venous Catheter-Related Blood Stream Infection, Postoperative Wound Dehiscence, Accidental Puncture or Laceration, and Perioperative Hemorrhage or Hematoma.

3.2. Analysis

A generalized linear model (GLM) was applied with log link and Poisson distribution in order to examine the effect of the distribution of physicians per patients among racial groups on the levels of hospitalization procedure and patient safety, measured as the number discharged patients. The quasi-likelihood was used under the independence model criterion (QIC) in order to choose the independent variance model with the smallest QIC from among many possible variance structures (Cui, 2002). Thus, the empirical model is as follows:

$$Y = \beta_D D + \theta_{Ph} Py + \theta_{PT} Pa + \theta_{Une} Une + \theta_{Inc} Inc + \theta_H E + \epsilon .$$

Y represents the risk-adjusted numbers of targeted patients per 100,000 people by age, sex, and case mix. D represents the difference in the physician per patient ratios across races between the minimum and maximum values for physician per patient ratios across races. Thus, a larger D represents larger physician provision inequality across races. Py represents the number of physicians per 1,000 population in the county, Pa is the number of total patients per 1,000 population, Une is unemployment, Inc is Median income in county, E is education measured by the percentage of people with a college education, and ϵ is the error term. The unit of analysis is the county.

4. RESULTS

Table 1 represents the number of physicians, patients, and the ratio of physicians per patient. White physicians constitute the largest group, followed by Asian physicians. Among the physician groups, White patients also constitute the largest group and Black patients constitute the smallest group.

Table 1 Number of Physicians and Patients per County

Variables	Races/ Ethnicity	Mean	Std. Dev.	Min	Max
Physician (A)	Asian	315	621	1	3,521
	Black	44	111	0	703
	Hispanic	80	172	1	1,046
	White	689	1,269	6	7,404
Patients (B)	Asian	9,089	19,699	15	112,070
	Black	8,226	22,544	0	140,872
	Hispanic	29,856	69,003	152	433,362
	White	43,021	66,841	496	381,751
Physician per Patients (A/B)	Asian	0.088	0.122	0.011	0.625
	Black	0.014	0.018	0.003	0.103
	Hispanic	0.004	0.004	0.000	0.020
	white	0.017	0.012	0.001	0.061
Difference		0.085	0.121	0.010	0.605

The physician per patient ratio was calculated by dividing the number of physicians by the number of patients of the same race. The physician per patient ratio for those identifying Asian was the largest, while the physician per patient ratio for those identifying Hispanic was the smallest.

Lastly, the difference measures the maximum distance between physicians per patient among races. For this distribution measure, range was used as the measure of inequality in our model, as it is solely based on the two most extreme values.¹⁾ Thus, the range was calculated by subtracting the smallest

¹⁾ The results obtained with the other two measures (interquartile range and standard deviation) showed similar regression results.

Table 2 Descriptive Statistics of Independent Variables

Variable	Mean	Std. Dev.	Min	Max
Physicians per population of 1,000	2.932	1.332	0.727	7.596
Total Patients per population of 1,000	255.386	98.495	40.095	566.378
Median income (in \$ 10,000)	7.267	2.216	4.508	12.593
Unemployment rate	7.3%	3.6%	3.4%	24.5%
College education	29.7%	12.5%	13.5%	58.8%

value from the largest value of the physician per patient ratios among racial groups. A larger difference represents a larger inequality in physician per patient provision within that particular county.

Table 2 presents the descriptive statistics of the other variables in the dataset. The average number of physicians per population of 1,000 individuals in each county is 2.932. The average number of total patients per population of 1,000 individuals in each county is 255.386. The average median income is \$70,267, the average unemployment ratio is 7.3%, and the average percentage of the population that is college-educated is 29.7%.

Table 3 Hospitalization Procedures

Hospitalization Procedures	Mean	Std. Dev.	Min	Max
Coronary Artery Bypass Graft (CABG) (Age 40 and +)	98	43	0	193
Percutaneous Coronary Intervention (PCI) (Age 40 and +)	180	72	19	338

Table 3 represents different measures of hospitalization procedures. The information on hospitalization procedures is presented as a risk-adjusted rate per population of 100,000 by age, sex, and case mix. Case mix is the average relative DRG weight of a hospital's inpatient discharges, calculated by summing the Medicare Severity-Diagnosis-Related Group (MS-DRG) weight for each discharge, dividing this total by the number of discharges, and then controlling for disease-related risk. For example, the value of 98 for Coronary Artery Bypass Graft represents the average number of Coronary Artery Bypass Graft discharged patients per population of 100,000 individuals, adjusted by age, sex, case mix.

Table 4 Patient Safety

Patient Safety	Mean	Std. Dev.	Min	Max
Accidental Puncture or Laceration	0.63	0.71	0.00	2.56
Central Venous Catheter-Related Blood	5.57	4.22	0.00	19.57
Iatrogenic Pneumothorax	2.77	2.28	0.00	10.20
Perioperative Hemorrhage or Hematoma	1.23	1.90	0.00	9.79
Postoperative Wound Dehiscence	17.41	8.97	0.00	48.71
Retained Surgical Item or Unretrieved	0.07	0.41	0.00	3.03
Transfusion Reaction	24.59	9.78	0.00	58.97

Table 4 represents the observed number of patient safety issues. The information on patient safety is presented as a risk-adjusted rate per population of 100,000, varying by age, sex, and case mix. For example, a value of 17.41 for Postoperative Wound Dehiscence represents the average number of Post-

Table 5 GLM Regression Results-Hospital Procedures

Variables	Coronary Artery Bypass Graft (Age 40 and over)	Percutaneous Coronary Intervention (Age 40 and over)
	Coef. (S.E)	Coef. (S.E)
Difference	1.136***	0.690***
	(0.201)	(0.148)
Physicians per 1000 population	0.055**	0.054***
	(0.024)	(0.018)
Total Patients per 1000 population	0.001***	0.001***
	(0.000)	(0.000)
Unemployment Rate	-0.042***	-0.010*
	(0.007)	(0.005)
Median income (in \$10,000)	-0.016	-0.010
	(0.016)	(0.011)
Percent with College Education	-2.860***	-1.421***
	(0.340)	(0.248)
Constant	5.293***	5.369 ***
	(0.109)	(0.075)

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; 45 county samples used in each regression.

operative Wound Dehiscence issues per population of 100,000, adjusted by age, sex, and case mix.

Table 5 shows the GLM regression results of hospital procedures. In the Coronary Artery Bypass Graft category, the difference of physicians per patient among racial groups is positively associated with the number of hospital procedures. This indicates that the large inequality in the physician-patient

Table 6 GLM Regression Results- Patient Safety

Variables	Retained Surgical Item or Unretrieved Device Fragment	Latrogenic Pneumothorax	Central Venous Catheter-Related Blood Stream Infection	Postoperative Wound Dehiscence	Accidental Puncture or Laceration	Perioperative Hemorrhage or Hematoma
	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)
Difference	0.667 (2.646)	3.746*** (1.118)	0.182 (1.380)	0.109 (2.505)	2.106*** (0.578)	1.858*** (0.490)
Physicians per 1000 population	0.091 (0.536)	-0.216 (0.214)	0.240 (0.287)	0.220 (0.530)	-0.028 (0.117)	0.099 (0.099)
Total patients per 1000 population	-0.001 (0.005)	0.007*** (0.002)	0.000 (0.003)	-0.003 (0.005)	0.003*** (0.001)	0.003*** (0.001)
Unemployment Rate	0.005 (0.091)	-0.151*** (0.045)	-0.048 (0.054)	-0.199 (0.124)	-0.095*** (0.022)	-0.070*** (0.019)
Median income (in \$10,000)	-0.247 (0.196)	-0.052 (0.080)	0.059** (0.105)	-0.154 (0.181)	-0.063 (0.042)	0.000 (0.036)
Percent of population with college education	2.195 (3.831)	0.083 (1.738)	-5.241 (2.217)	-5.872 (4.351)	-1.019 (0.890)	-1.348* (0.777)
CMI	0.031 (1.633)	-0.913 (0.676)	-0.177 (0.855)	-0.175 (1.568)	-0.675* (0.361)	-0.260 (0.293)
Constant	0.759 (2.006)	3.072*** (0.912)	2.284** (1.130)	4.52** (2.242)	4.623*** (0.469)	3.848*** (0.392)

Note: * p<0.05, ** p<0.01, *** p<0.001; 45 county samples used in each regression.

ratio leads to a higher number of risk adjusted patients undergoing hospital procedures. Additionally, higher numbers of physicians per population of 1,000, higher numbers of total patients per population of 1,000, and lower rates of unemployment, and lower rates of college education are all positively associated with hospital procedures.

Table 6 lists the GLM regression results of patient safety issues. For “Latrogenic Pneumothorax,” “Accidental Puncture or Laceration” and “Perioperative Hemorrhage or Hematoma,” the difference in physicians per patient among racial groups is positively associated with a higher number of patient safety issues. This indicates that the large inequality in physician-patient ratios among racial groups leads to a larger number of patient safety issues. For patient safety issues, the results indicated that a higher number of total patients per population of 1,000, a lower unemployment rate, and a lower rate of college education is positively associated with the number of patient safety issues.

5. DISCUSSION

This study is interested in scarce resource allocation within the healthcare system, measured as the distribution of physicians per patient among racial groups, which differs from previous studies which had only examined the individual rates of physician-patient racial matching and its subsequent impact on patients’ health outcomes. More equally-distributed physicians per patient across racial groups would give patients greater choice in choosing physicians with matching racial backgrounds, and a lower likelihood of having unmet health needs, given that previous studies (LaVeist and Nuru-Jeter, 2002) have reported a higher volume of essential health service utilization by patients who are in racial concordant relationships.

Findings show that a difference in the number of physicians per patient among racial groups had a significant impact on health provider’s practices, consequently affecting patient outcomes. Specifically, this study found that a

larger inequality is positively associated with the number of patients undergoing hospitalization procedures and experiencing issues of patient safety. This supports the claim that health conditions often worsen due to a higher number of unmet medical needs, and that this could possibly be related to social frictions occurring within physician-patient relations. This finding corroborates with those other studies which have also shown that disparities in health care quality ultimately result in worse health outcomes for racial minorities (e.g., Alsan, Garrick, and Graziani, 2019; Strumpf, 2011). In addition, higher education results in a lower number of discharged patients, as those with more education are more cautious in healthcare. Lastly, higher unemployment is associated with a lower number of patients, as American health insurance is employment-based. Thus, there is a high likelihood that unemployed patients would not be able to afford any healthcare expenses without a job. However, when looking at the variables affecting hospital procedures, counties with higher numbers of physicians were positively associated with higher numbers of hospital procedures.

We assumed that patients visit physicians in their county based on their residence. In the field of study, a patient is defined as resident of a particular county at the time of each health care visit based on this or her address. Previous literatures calculated the patients' travel distance to the treating facility, using the distance from the patient's house zip code centroid to the reporting facility's address (Sinnott, 1984). Moreover, travel time and distance for health care for all adults were reported to 17.5 minutes and 8.6 miles, respectively (Yen, 2013). In addition, patients do not have much choice to access healthcare outside network because the managed care they contracted limits the access out of network to reduce cost (Deb and Trivedi, 2006). However, people might commute by crossing county borders and choose physician near their work to access better health care service. They would not cross country borders to find a worse physician. More options of physicians near patients would provide better chances for satisfaction with the health care service. If there are patients who cross county borders and finding out the

reasons would provide more supportive evidence for this study. However, it is outside the scope of this study.

6. CONCLUSION

This study found that a larger difference in the number of physicians per patient across racial groups is positively associated with worse outcomes for hospital procedures and patient safety issues. These results support the claim that increasing the racial diversity of physicians will lead to better health outcomes, giving patients greater choice and better overall health care experiences.

This study has some limitations. First, the study made use of cross-sectional data. Thus, this study could not control for variables such as hospital and county fixed variables, which may lead to omitted variable bias. Second, this study could not observe the matching between individual physicians and patients. Thus, a lower or higher rate of physician-patient matching could affect the results. However, we assume that greater physician provision per patient leads to increased physician-patient matching across racial backgrounds. Despite the limitations, these findings suggest the need to increase racial diversity among physicians and to pay greater attention to improving the distribution of physicians per patient population in order to address health disparities and improve overall care.

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