Physician Quality and Health Care For the Poor and Uninsured

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Abstract: Many studies have documented adverse health outcomes for uninsured patients. These can be attributed to their health status as well as to the quality of treatment received. A measure of treatment that remains unexplored is the quality of the physicians treating uninsured patients. Using education and training, experience, and board certification to measure physician quality, we find that patients are matched to physician quality based on their ability to pay. We find that uninsured and Medicaid patients are generally treated by lower quality physicians. These effects are particularly pronounced in for-profit hospitals. In addition, we show that physician quality is associated with adverse health outcomes.

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INTRODUCTION

Health care access for the poor and uninsured in the U.S. is an increasingly complex problem. From 2000 to 2005 the number of uninsured persons rose from 39.6 to 46.6 million while hundreds of hospital emergency rooms, the primary source of healthcare for many of the uninsured, were closed. Since uninsured patients are less likely to pay for care, increased demand for emergency room services by the uninsured and lower hospital payments from private insurance companies, Medicare, and Medicaid, are increasingly placing financial burdens on hospitals. Thus the poor face a health care system which while superficially guaranteeing access, has strong incentives to limit the quantity and quality of care.

A large body of empirical evidence documents adverse health outcomes for the uninsured. Baker et al. (2001) and Lichtenberg (2001) find that adult mortality and morbidity were higher for the uninsured relative to the insured. The common explanations that are advanced to explain these adverse outcomes rely on the fact that the uninsured generally use fewer preventive and screening services and are generally sicker when diagnosed. Kozak, Hall, and Owings (2001) and Pappas et al. (1997) show that the uninsured have higher rates of avoidable hospitalizations.

Adverse health outcomes for the poor and uninsured can also occur because the quality of acute and therapeutic care received by the uninsured may be worse than that received by insured patients. To determine whether the uninsured are treated differently by health providers than the insured, the majority of research has compared outcomes such as mortality rates or complication rates, or ‘treatments’ such as total charges, length of stay, or receipt of a specific procedure across insured and uninsured patients (Canto et al. 2000; Currie and Gruber 1996). Our study focuses on a previously unexplored aspect of care – the quality of physicians treating the under-uninsured. We study how physician quality as measured by quality of schooling and residency, years of experience, and board certification varies based on the patient's ability to pay. In particular we are interested in whether poor or uninsured patients are less likely to be treated by higher quality physicians. As a corollary we also examine whether our measures of physician quality are related to patients' health outcomes.

The actual or perceived quality of the physician treating a patient may be correlated with patient outcomes for a number of reasons. Most obviously physicians with higher quality training are expected to provide better care. In a study of coronary artery bypass surgery in New York, Jha and Epstein (2006) show that treatment by the 'best' physicians, as measured by risk-adjusted mortality rates and volume, can reduce mortality in two common cardiac procedures by as much as 50%. In addition to providing better therapeutic care, more skilled physicians may have priority access to test results, operating rooms, and better nurses. There could be placebo effects if patients are reassured that they are under the care of the 'best' physician. There is certainly a presumption that the quality of physicians is important to patients even if the effects on the outcome are not measured. Hospitals and physician groups often advertise where their new hires were trained, and many insurance companies attempt to provide information about physician attributes to prospective patients.

The sorting of underinsured patients to lower quality physicians may occur at the physician level or at the hospital level. The reasons for physicians to discriminate against uninsured patients are widely known. Physicians receive payments from Medicare, Medicaid, and privately insured companies, yet payment from uninsured patients is not guaranteed. Medicaid patients may also be discriminated against since Medicaid fees paid to physicians in Florida for all services were 65% of Medicare fees, on average in 2003 (Zuckerman et al. 2004). Higher quality physicians are more likely to have choices regarding how many and which patients to treat, while newer, lesser known physicians are likely to treat all patients, at least in the early stages of their careers. Also, since insured patients pay far less than 100% of costs, their demand for medical care is more inelastic than uninsured patients' demand for care. Thus physicians may induce more care from insured patients.

While hospitals are required to treat all patients who seek emergency care, anecdotal evidence suggests that hospitals are well informed about the exact nature of a patient's insurance coverage; any visit to a hospital typically begins with an inquiry about insurance coverage. If a hospital has financial incentives to attract insured patients over poor and uninsured patients, the hospital may sort patients not only by diagnoses but also by insurance status when assigning physicians to treat patients. Although patients cannot typically observe the quality of physician they receive upon entering a hospital, the hospital staff and administration are well informed of the physicians' quality. Thus hospitals may be able to establish formal and/or informal policies regarding treatment of the poor. For instance, in a survey of more than 2,000 physicians at U.S. health centers, 13 percent of responding faculty reported formal practice policies limiting care to uninsured patients (Weissman et al. 2003).

Although the uninsured typically pay for less than 100% of their hospital care, hospitals may receive payments from government sources to help offset the costs of uncompensated care. Based on our calculations from the 2004 Florida hospital data, non-federal short-term general hospitals provided $1.9 billion in uncompensated care, but received over $251 million from state and local tax appropriations.[1] Yet government payments may not change hospitals' financial incentives for sorting patients since they are not related to the quality of care provided to the uninsured.

Our empirical goal is to test whether there is sorting of physician quality by patients' ability to pay, where patients are classified as uninsured (including charity), on Medicaid, on Medicare, or privately insured. Two challenges need to be addressed. The first is that unobserved heterogeneity in illness and other patient health characteristics can drive the physician allocation decision. If uninsured patients are healthier we might expect them to be treated by lower quality physicians. We use a number of patient characteristics to account for such heterogeneity.

The second challenge is that the quality of the physician treating a patient depends on the overall quality of physicians at the attending hospital. If overall quality of physicians is lower at hospitals which treat more uninsured patients, we may see a negative association between physician quality and the treatment of uninsured patients; again this would not constitute evidence of discrimination within a hospital. We use a hospital fixed-effect approach to exploit within-hospital variation in physician quality and treatment and to explicitly control for hospital characteristics that do not vary across patients.

We also examine whether for-profit, non-profit, and government hospitals differ in their treatment of the poor by separating the patient data by these three types of hospital ownership. A number of studies have shown that hospital ownership can affect the care provided to uninsured patients (Norton and Staiger 1994; Sloan et al. 2001). A for-profit hospital may have stronger incentives to maximize cash flows from insured patients than would a non-profit or government hospital. For instance, for-profits have been found to bill more or ‘up code’ patient diagnoses (Sloan et al. 2001; Silverman and Skinner 2004). Sloan et al. (2001) also found that for-profit hospitals were more expensive to Medicare than not-for-profit hospitals, although there were no differences in health outcomes by hospital ownership.

Our findings support our hypotheses of physician sorting by patient payment type for all measures of physician quality. In particular, uninsured and Medicaid patients are treated by physicians from lower ranked schools and residencies, by less experienced physicians, and are less likely to be treated by board certified physicians. Also, even using a somewhat crude measure such as in-hospital mortality to measure the impact of physician quality on outcomes, we find that being treated by physicians from better schools and more experienced physicians is associated with lower in-hospital mortality.

The paper is organized as follows. The next section discusses prior theoretical work on treatment quality and describes a conceptual framework within which to view the sorting of physician quality by patient's ability to pay. The Data and Methods section contains a description of the data, discusses descriptive statistics, and describes the empirical model. Following that, we present and discuss our empirical results. The final section concludes and identifies possible directions for future research.

CONCEPTUAL FRAMEWORK

The disconnect between third-party payers and insured patients in health care markets results in an inherent tension between maintaining quality and minimizing costs. When health care providers are reimbursed for the cost of actual care, quality provision is high but there are few incentives to minimize costs. When reimbursed by fixed payments per treatment, providers will minimize costs but have no incentive to maintain quality. The existing literature on treatment quality has focused on the cost and quality incentives under various payment schemes under two different assumptions of patient demand. When patient demand is a function of quality, patients can enforce the maintenance of quality through their choice of health care providers (Ellis and McGuire 1986; Pope 1989). However, when the patient is not fully informed about the quality of care or when quality is an experience good, the patient's role in maintaining quality is not as effective. Ma (1994) shows that a mixture of cost reimbursement and prospective payment can be used to maintain quality and contain costs. Chalkley and Malcolmson (1998) model the behavior of providers when patient demand is independent of quality and show that either cost reductions or quality improvements are feasible, but not both, and that behavior depends on the benevolence of the providers.

When patients do not pay for health care a simple matching model shows that providing high quality care to non-paying patients is difficult to achieve. Consider a very simple stylized model of the health care market where patient demand is independent of quality. There are two types of physicians, low quality, indexed by L and high quality indexed by H.[1] In common with the literature on quality we assume that the costs are strictly increasing in quality so that the cost of providing care, c_i, i = H, L is such that $c_H > c_L$. Each patient buys one unit of health care from a physician. If the patient is insured the insurance company will pay P_H on her behalf to the

[1] We do not specifically model the relationship between physician ability (knowledge and skills) and physician performance. We assume that our physician quality measures are strong determinants of a physician's abilities. Leonard, Masatu and Vialou (2007) found that years of training is the most important determinant of ability in a study of 80 physicians treating potentially serious outpatient conditions. Leonard et al (2007) also concluded that ability is a significant determinant of physicians' adherence to steps required to diagnose their patients' illnesses properly and to steps required to communicate the diagnosis and treatment to the patient properly. Numerous studies have found that physicians who have more experience with a particular surgery have lower patient mortality rates and fewer complications than physicians with less experience.

physician. An uninsured patient pays $P_L = 0$. Assume that the price paid by the insurance company is set to insure participation by high quality physicians in the plan so that $P_H = c_H$. This ensures that both high and low quality physicians remain in the market. In this simple matching model, there are four possible matches of physicians and patients. The payoffs from all four possibilities can be ordered as follows:

$P_H - c_L > P_H - c_H > P_L - c_L > P_L - c_H$. Given our assumptions on the costs of quality and payments, the payoff is highest when a low quality physician treats an insured patient and lowest when a high quality physician treats an uninsured patient.

In this type of model with fixed payments and quality that is not contractible, clearly both physicians and hospitals have an incentive to reduce quality in order to increase profits. Insured patients may find it possible to avoid the problem of the best payers being treated by the worst physicians by establishing a relationship with a physician, through payment plans which monitor and enforce a certain quality level or through cost reimbursement plans. Uninsured patients do not have the same protections.

Using hospital discharge data, it is not possible to discern whether this sorting behavior can be attributed to hospitals or physicians. Our discussions with local physicians revealed that when an uninsured patient arrives at a hospital emergency room, either the Emergency Room (ER) physician on call or a hospitalist first treats the patient. If a cardiology consult is required, the primary physician then calls in a specialist. Most physicians that we spoke with saw patients when it was their turn – apparently as a result of rotation of ER assignments through the practice, or as a favor to the physician calling them to consult. This suggests that the sorting revealed in this paper could result from network effects. If the initial physician contacted is younger or from a lower ranked school, he or she might arrange a consultation with a physician from the same cohort. In addition, higher quality physicians may be busier and less able to accept new patients. Similar incentives would be at work in hospitals, particularly for their salaried physicians.

DATA AND METHODOLOGY

Our study examines all inpatients treated in Florida hospitals for procedures classified under the major diagnostic category of 'Diseases and Disorders of the Circulatory System,' which are procedures related to the heart. Many previous studies have focused on patients with heart disease to study questions of hospital behavior towards the treatment of patients based on insurance status (Canto et al. 2000; Hadley et al. 1992; Young and Cohen 1991; Kreindel et al. 1997). By focusing on one medical specialty, we avoid potential estimation bias that could result from correlations between the number of uninsured within a specialty and average physician quality across specialties. We use patient and hospital data from all four quarters in 2004, provided by the Florida Agency for Health Care Administration. Florida inpatient hospital records are matched to data on physician and hospital characteristics.

Quality of care is measured by the quality of the operating physician who treats the patient, or if the patient does not have an operating physician, the quality of the attending physician. Data on physicians are provided by the Medical Quality Assurance division of the Florida Department of Health. We use providers' first year in practice, board certification, and medical school and residency attended to construct our measures of physician quality –years of experience, board certification in an area related to cardiac care, and residency and school quality. Our measure of medical school quality is the ranking assigned by the U.S. News & World Report (USNWR), which ranks medical schools in the U.S. (U.S. News & World Report, 2006). Medical schools with the lowest USNWR rankings are expected to produce the highest quality physicians. We measure residency quality by determining whether or not the physician completed a residency at one of the top fifty heart hospitals in the US, using rankings published by the U.S. News and World Report (U.S. News & World Report, 2006).

Board certification has requirements beyond obtaining a M.D. or D.O. and completing a residency program at an accredited school. Physicians must also pass examinations given by a specialty board, and many boards require evaluations from the physicians' medical colleagues.

The exact relationship between years of experience and physician quality is ambiguous. For cardiac-related procedures, several studies have shown that higher volumes of coronary artery bypass graft surgeries by hospitals and physicians are associated with lower mortality rates (Wen et al. 2006; Agency for Healthcare Research and Quality 2004). While physicians with more experience may have more learning-by-doing, younger and less experienced physicians may be more familiar with the latest technologies in cardiac care.

A patient's Diagnosis Related Grouping is a key measure of the patient's clinical need for care. Within each of the four categories of DRGs created by the authors based on diagnosis severity, the average years of experience was sixteen. Years of experience and patients' survival probabilities (measured by the ICISS) are compared in Table 1, along with the other physician quality measures. Physicians' years of experience is significantly negatively correlated with patients' survival probability at diagnosis (ICISS), suggesting that physicians with more years of experience are typically assigned to patients with lower survival probabilities.

Summary statistics are shown in Table 2. The patient records indicate the primary source of expected reimbursement to the hospital for service. We group the payment categories into four payment types: uninsured, Medicare, Medicaid, and private insurance.

There are 479,670 inpatient records with heart-related diagnoses that match data on hospitals and physicians. We only include patients in general or teaching hospitals and who the hospital has prioritized as an emergency or urgent admission, as opposed to an elective admission, since patients who have time to schedule appointments with physicians may be able to wait for treatment by their personal physician or obtain recommendations for a particular physician. After merging all patient, physician, and hospital data meeting these categories we have 405,177 inpatient records in our sample. Our final exclusion is to include records only if the data indicate the hospital treated at least 5 patients, and there are at least three physicians working in the hospital. After these final exclusions we have 405,168 observations for our estimated model.

Empirical Methodology

The mean comparisons of physician quality in Table 2 provide mixed results on insurance-based discrimination. By conditioning on observed patient characteristics, comparisons can be made while controlling for health severity. We also use hospital fixed effects to exploit within-hospital variation in the quality of physicians available. Although much research has looked at the determinants of a patient's choice of hospital, there has been very little work on the variance in patients' treatment within a hospital (an exception is Doyle 2005). By using fixed effects, hospital characteristics that are constant across patients within the hospital, such as administrative policies, available technology, and average physician quality, are held constant.

As mentioned before, an uninsured patient may be treated by a lower quality physician because of screening by physicians or hospitals, or because of the hospital and location choices of patients and physicians. To estimate a patient's treatment within a hospital, our level of observation is patient-physician-hospital specific. We estimated the continuous measures of physician quality, experience and medical school score as OLS regressions. For person *i* treated by physician *p* in hospital *h*, the estimated equations are:

$$qual_{pih} = \beta_0 + \beta_1 Uninsured + \beta_2 Medicaid + \beta_3 Commerical + \beta_4 Patient\ Characteristics + \mu_h + \varepsilon_{ih} \quad (1)$$

where $qual_{pih}$ is the physician's years of experience or ranking of the physician's medical school; coefficients β_1, β_2, and β_3 measure the relationships between the patient payment type of uninsured, Medicaid, or commercially insured, respectively, and physician quality. The omitted patients are Medicare patients. In addition to the patients' characteristics described in Table 2, we include indicators for day admitted (Sunday–Thursday). Finally, μ_h represents the hospital fixed effects.

When physician quality is measured by the quality of medical schools, we are faced with the problem that U.S. News & World Report Rankings are unavailable for international medical graduates (IMGs). This issue is addressed with a selection model by using the Heckman two step method. We estimate a probit model where the dependent variable is an indicator for whether the patient was treated by a physician who graduated from a U.S. medical school. From the probit model we obtain the linear predictors in order to calculate the Mill's ratio, λ. The inverse Mill's ratio is then incorporated into equation (1) where the dependent variable is the USNWR Ranking of the medial school attended by the physician treating the patient. We then estimate equation (1) only on patients who were treated by physician graduates of U.S. medical schools.[2]

A physician's residency site is also an important measure of physician quality. A physician

[2] The probit and regression models for domestically-trained physicians and medical school rankings, respectively, are only estimated for hospitals who have data on physicians' medical schools for at least two-thirds of their inpatients.

who graduates from the top of the class at a lower ranked school and completes a high quality residency is comparable to a physician who graduates at the bottom of the class at a top ranked school and completes a residency at a poor hospital. Thus we also estimate a probit model where the dependent variable equals one if the patient is treated by a physician who completed a residency at one of the top 50 heart hospitals with residencies:

$$\begin{aligned} top\_qual_{pih} = \alpha_0 + \alpha_1 Uninsured + \alpha_2 Medicaid + \alpha_3 Commerical \\ + \alpha_4 Patient\ Characteristics + \chi_h + \upsilon_{ih} \end{aligned} \tag{2}$$

where top_qual_{pih} is the indicator variable.

When our measure of quality is whether a physician is board certified, we estimate a probit model where the dependent variable equals one if the patient is treated by a physician who is board certified in an area related to cardiac care, and 0 otherwise:

$$\begin{aligned} brd_{pih} = \gamma_0 + \gamma_1 Uninsured + \gamma_2 Medicaid + \gamma_3 Commercial \\ + \gamma_4 Patient\ Characteristics + \phi_h + \nu_{ih} \end{aligned} \tag{3}$$

where brd_{pih} is an indicator for whether or not the physician treating the patient is board certified. Letting Q represent all right-hand side variables and using the usual exogeneity assumptions: $E(\varepsilon_{ih} \mid Q) = E(\upsilon_{ih} \mid Q) = E(\nu_{ih} \mid Q) = 0.$

As frequently discussed in the literature, there is a strong likelihood that the researcher does not observe all indicators of patient health that are perceived by hospital staff and used in treatment decisions. If there are unobserved health differences between the uninsured and insured patients' health that influence treatment decisions, estimated results could be biased.

In addition to patient demographic information such as age and race, we include three controls for patients' health. First, within the primary cardiac diagnosis code, we categorize diagnosis related groupings (DRGs) according to average charges per case. We create four diagnoses severity indicators: 'very severe', 'severe', 'somewhat severe' and 'mild,' where the latter is the omitted category.[3] We expect patients with 'highest' and 'high' severity of diagnoses to be treated with higher quality physicians, all else equal.

Second, we control for 11 secondary diagnoses which would indicate the health status of the patient at the time of admission, following Baker et al. (2001): diabetes, hypertension, cancer, dementia, stroke, vascular disease, an old myocardial infarction, other heart disease, pulmonary disease, respiratory disease, and obesity.

We also construct a measure of survival risk, the ICD-9 Injury Severity Score (ICISS). For each of the patient's ICD-9 diagnoses (one primary and up to nine secondary), survival risk ratios (SRRs) are derived by dividing the number of survivors in each ICD-9 code by the total number of patients with the same ICD-9 code. ICISS is calculated as the simple product of the SRRs for each of the patient's diagnoses. The ICISS has been shown to outperform other standard measures of patient severity in recent empirical work by Osler et al. (1996); Rutledge et al. (1998); and Huynh et al. (1998). We use the entire population of 2,512,406 inpatients to construct the ICISS.

Hospital Ownership Status

Since we are including hospital fixed effects in our estimation, we cannot obtain the effects of hospital characteristics on the sorting of uninsured patients by physician quality. The ownership and teaching status of hospitals are the hospital characteristics most commonly discussed in both theoretical and empirical literature.

Hospitals with different ownership status may have different incentives for treating poor

[3] See Table A1 in the Appendix for a list of DRGs in each of the four categories.

patients, as mentioned previously. Since government hospitals are typically mandated to provide care to the poor, a greater percentage of their patients may be poor, limiting the hospitals' capacity to sort patients by insurance status to different quality physicians. In order to determine whether there are differences in patient sorting by physician quality across hospital ownership types, we split our sample and run equations (1) – (3) on all patients in each of the four hospital types: government, not-for-profit, teaching, and for-profit hospitals. Teaching hospitals are not included in the other three ownership categories because amongst both providers and patients, there is a perception that teaching hospitals a) have the highest quality physicians; and b) have a greater percentage of uninsured patients than (non-teaching) not-for-profit and for-profit hospitals. In our sample the range of physician quality was smaller in teaching hospitals than in non-teaching hospitals, and the average quality much higher when measured by medical school ranking. Of the 13 teaching hospitals in our sample, 11 are not-for-profits and 2 are government-owned.

We chose to separate the sample by ownership status rather than to include right-hand side indicators for three of the four ownership types because previous research has indicated that hospital ownership status is related to characteristics of the hospital's location, some of which are not observable to the researcher (Norton and Staiger 1994). If these unobserved location characteristics also affect the mean quality of physicians, then hospital ownership is endogenous and the results would be biased.

Mortality

To test the effect of physician quality on patient outcomes, we estimate a Cox proportional hazards model on inpatient mortality. We are interested in how the conditional probability a patient dies within the hospital given survival to time *t* relates to physician quality and other covariates, including patients' health and insurance status, and to hospital characteristics. The number of days from the admission date is the duration measure. The proportional hazard is written as

$$h(t \mid z) = h_0(t)\exp\{\beta^T z\}$$

where the baseline hazard $h_0(t)$ is common to all patients and the individual hazard functions differ proportionately based on observed covariates, *z*. The vector of regression coefficients is $\beta = (\beta_1, ..., \beta_k)^T$. Estimated hazard ratios will be reported in the Results section. There are no time-varying covariates in the model and all covariates are assumed to be strictly exogenous.

Compared to equations (1) – (3), the Cox proportional hazard model includes hospital characteristics rather than hospital fixed effects, and only includes patients who were discharged home or who died within the hospital. This excludes patients discharged to hospice or other institutions. The vector of covariates *z* includes all patient characteristics used in estimating equations (1) – (3), and hospital characteristics. Hospital characteristics that are specific to the hospital are number of hospital beds, number of open heart cases the previous year, number of full time nurses, and indicators for ownership status of government, for-profit, or teaching (non-profits are omitted comparison category). We also include the Herfindahl index (based on hospitals' volume of inpatients) for the hospital's county to proxy for the level of competition within the county; and the total population and median income in the hospital's county to proxy for demand for care.

RESULTS

Tables 3 and 4 report results from estimating equations (1) – (3). Results in Table 3 show that relative to Medicare patients, uninsured patients are more likely to be treated by physicians who are international medical school graduates or from lower quality U.S. medical schools, and Medicaid patients are more likely to be treated by physicians from lower quality U.S. medical schools or whose residency was not completed at a top ranked heart hospital; all results are significant at the one or five percent level of significance. Both uninsured and Medicaid patients are more likely to be treated by physicians who have fewer years of experience, and who are less likely to be board certified, again all results are significant at the one or five percent level of significance.

In the cardiac care category that we are studying, Medicaid payments are significantly lower than private insurance payments, and often below costs (Florida Hospital Association 2006). Since providers are guaranteed a payment rate lower than that received by Medicare and by private insurance companies, higher quality physicians may be unlikely to accept Medicaid patients.

The results in column (3) of Table 3 present the estimated coefficients for the probit model, where the dependent variable is an indicator the physician is board certified. Relative to Medicare patients, being uninsured decreased the probability of receiving a board certified physician by 7.1 percentage points. Having Medicaid decreases the probability of receiving a board certified physician by 6.4 percentage points, relative to Medicare patients.[4]

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[4] We obtained the predicted values when the uninsured (Medicaid) indicator equals zero, and when it equals one. The Medicaid (uninsured) and commercial insurance indicators were set to zero and means of all other right-hand side variables used. The predicted value of an uninsured, Medicaid, or Medicare patient receiving a board certified physician is 0.61, 0.39, or 0.68, respectively. Using the cumulative standard normal distribution function evaluated at each of the

Next we divide the sample by hospital ownership to determine if this sorting process varies across different hospital ownership types. In Table 4 all hospital types treat uninsured patients with lower quality physicians, using at least one measure of physician quality (these models include the same independent variables shown in Table 3, but only the coefficients on ability to pay are presented). In not-for-profit hospitals, the most common type of hospital in Florida, uninsured cardiac inpatients are treated by less experienced physicians and are less likely to be treated by a board certified physician. However the schooling effect is most pronounced – as might be expected – in for-profit hospitals. For-profit hospitals consistently use physicians from worse schools, less experienced physicians and physicians who are less likely to be board certified in treating uninsured and Medicaid patients.

Effects of Physician quality on in-hospital mortality

Correlations in Table 1 indicate that patients with the worse health are treated by physicians from the top medical schools and more experienced physicians. Board-certified physicians tend to treat patients with lower survival probabilities but there is no correlation with patient mortality. Physicians with residencies from the top heart hospitals tend to treat patients with *higher* survival probabilities and lower mortality risks. (Note however that these correlations do not take the physician or hospital locations into account) In Table 5 the effect of physician quality on in-hospital mortality is estimated by conditioning on observable patient and hospital characteristics to (partially) control for patient health and hospital resources. Coefficient results

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predicted values, the marginal effect of being uninsured or on Medicaid is -0.024 or -0.021, respectively.

for patient payment status and hospital characteristics are shown. Full results with all patient characteristics are available from the authors upon request.

In column (1) of Table 5 when no physician quality measures are included in the model, uninsured patients are more likely and Medicaid patients less likely to die within the hospital than Medicare patients, conditional on patient characteristics. After physician characteristics are added, uninsured patients still have a higher mortality risk. However, the mortality risk associated with being uninsured is lower when physician characteristics are incorporated which suggests that part of the reason uninsured patients have worse outcomes is lower physician quality. Hospitals with more nurses and teaching hospitals are consistently associated with lower mortality risk.

Since the physician characteristics are closely correlated with each other (see Table 1), we estimated the model with each aspect of physician quality separately as well as with all characteristics included (column 6 in Table 5). Physicians from worse ranked schools were associated with significantly higher mortality hazard. Residency at a top 50 heart hospital and more experience lowered mortality risk. Only school ranking is significant when all measures of physician quality are included.

CONCLUSION

Using cardiac patients requiring urgent care, we compared the quality of physicians treating patients of different insurance status within a hospital. Overall there is strong evidence that patients who are uninsured or on Medicaid are significantly more likely to be treated by lower quality physicians. Controlling for patient characteristics and the quality and availability of other physicians within a hospital using hospital fixed effects, uninsured and Medicaid patients are more likely to be treated by physicians who are not board certified, are from lower quality medical schools and residency hospitals, and who have fewer years of experience. After separating our data by hospital ownership type, we further find that all types of hospitals treat uninsured patients with lower quality physicians by at least one measure of physician quality.

We also determined that in each hospital type Medicaid patients were discriminated against using at least one of the physician quality measures. Since Medicaid patients provide some level of payment to providers whereas the uninsured may not, there is a question of why Medicaid patients are at least as likely to be discriminated against. One answer is that hospitals can be altruistic, and therefore derive utility from the provision of care to the uninsured but this altruism may not extend to Medicaid patients. Frank and Salkever (1991) argue that even for-profit hospitals have an incentive to provide care to the uninsured because the provision of such care may have a positive impact on the hospital's rapport with regulatory agencies. This effect may also be illustrative of the unintended consequences that result when moral incentives to do charity work are replaced by minimal economic incentives - good physicians no longer feel obligated to treat poor patients covered by Medicaid but are still willing to treat uninsured patients.[5]

Previous studies have found that the uninsured receive less medical care than the insured (Currie and Thomas 1995; Doyle 2005; Spillman 1992). Our results suggest that sorting uninsured and Medicaid patients to lower quality physicians is another result of poor access to quality health care. Our finding that the quality of physicians treating uninsured patients is lower has implications for health outcomes. Using admittedly limited data on in-hospital mortality we

[5] Or as one physician put it – he would rather treat uninsured patients who are grateful for the care received than Medicaid patients who view it as their due even though they are not paying the full costs of care.

show that physician quality as measured by education, experience and training all have an impact on patient mortality.

Numerous states have attempted to develop plans for near universal health care coverage within the state. As these plans are implemented states should carefully consider how their provider payment design affects the incentives for providers to provide not only access to care but quality care to the poor.

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Table 1. Pairwise Correlations: Physician Quality and Patient Severity Measures, Year = 2004.

	US News & World Report Rankings of U.S. Medical Schools	Years of Experience	Board Certified	Residency at Top 50 Heart Hospital	ICISS– Survival Probability
US News & World Report Rankings of US Medical Schools	1.000				
Years of Experience	–0.083 (0.000)	1.000			
Board Certified	–0.073 (0.000)	0.223 (0.000)	1.000		
Top 50 Residency Heart Hospital	–0.198 (0.000)	0.059 (0.000)	0.100 (0.000)	1.000	
ICISS – Survival Probability	0.007 (0.004)	-0.013 (0.000)	0.010 (0.000)	0.015 (0.000)	1.000
Patients' Mortality	–0.004 (0.009)	0.008 (0.000)	–0.001 (0.545)	–0.006 (0.001)	–0.410 (0.000)

Table 1 shows pairwise correlation coefficients with significance level in parentheses.
A physician is coded as having board certification if certified in one of the following fields: Anesthesiology, Cardiac, Emergency, Family, Internal Medicine, Non Surgical-other, Other Surgical, Pathology, Pediatrics, or Radiology.

Table 2. Patient, Physician, and Hospital Characteristics, by Patient Payment Type, Year = 2004.

	Min	Max	Overall	Uninsured	Medicaid	Commercial	Medicare
Number of Persons:	0	1	310,067	26,175	24,689	90,459	253,922
Physician Characteristics:							
Median Medical School	1	125	59	59	60	60	59
Residency at Top 50	0	1	23	23	22	23	22
Median Years of Experience	0	1	14	14	14	14	14
Board Certified (%)[4]	0	1	75	72	73	76	76
International medical school	0	1	35	36	36	36	35
Hospital Characteristics:							
Not for Profit (%)	0	1	42	35	33	43	44
Government (%)	0	1	10	16	10	9	9
For-profit (%)	0	1	40	36	42	39	41
Teaching (%)	0	1	8	13	15	9	6
Patient Characteristics:							
Deceased (%)	0	100	2.3	1.3	1.6	1.1	2.9
Age Indicators (%):							
Age 0-2 yrs	0	1	< 1	< 1	2	< 1	0
Age 3-39 yrs	0	1	5	16	17	10	1
Age 40-49 yrs	0	1	10	30	24	22	2
Age 50-59 yrs	0	1	15	31	28	34	5
Age 60-69 yrs	0	1	19	16	20	23	17
Age 70-79 yrs	0	1	25	3	6	6	37
Over 79 yrs	0	1	26	2	3	4	38
Female (%)	0	1	50	40	57	44	52
Black (%)	0	1	14	25	31	15	11
Hispanic (%)	0	1	13	20	28	12	11
ICISS (patient survival risk)	0	1	79	85	80	85	76
DRG Severity (%):							
Very Severe	0	1	7	6	5	7	7
Severe	0	1	17	13	11	17	19
Somewhat Severe	0	1	30	23	33	22	33
Mild	0	1	46	59	51	54	42
Secondary Diagnoses (%):							
Diabetes	0	1	16	16	22	16	16
Cancer	0	1	2	1	2	2	3
Dementia	0	1	2	< 1	1	1	3
Hypertension	0	1	36	37	35	40	34
Stroke	0	1	2	1	2	1	3
Vascular Disease	0	1	2	1	2	2	3
Pulmonary Disease	0	1	19	13	21	11	22
Respiratory Disease	0	1	5	3	4	3	5
Prior Myocardial Infarction	0	1	3	4	3	4	3
Obese	0	1	17	18	19	19	15
Other Heart Disease	0	1	30	21	22	21	34

1. Based on the US News & World Report Rankings of Medical Schools, Select rank, in 2005
2. There are 177,394 patients treated by physicians with data on school ranking: 12,119 uninsured, 11,177 on Medicaid, 113,007 on Medicare, and 41,091 with private insurance.
3. There are 257,513 patients treated by physicians with data on residencies: 17,984 uninsured, 16,756 on Medicaid, 163,802 on Medicare, and 58,971 with private insurance.
4. There are 269,487 patients treated by physicians with data on board certification: 18,660 uninsured, 17,400 on Medicaid, 171,925 on Medicare, and 61,502 with private insurance.,593 on Medicaid, 186,110 on Medicare, and 68,000 with private insurance.

Table 3. Patient Payment Type and Physician Quality

	Domestically Trained		Medical School Ranking		Years of Experience		Board Certification		Residency at Top 50 Hospital	
	(n =292,753)		(n =177,394)		(n =310,067)		(n =269,487)		(n =257,513)	
Payment Type:										
Uninsured	-0.038***	(0.011)	0.787**	(0.342)	-0.676***	(0.076)	-0.078***	(0.012)	0.005	(0.013)
Medicaid	-0.016	(0.012)	1.025***	(0.344)	-0.340***	(0.077)	-0.068***	(0.013)	-0.031**	(0.014)
Private Insurance	0.004	(0.008)	0.584**	(0.233)	-0.114**	(0.052)	0.016*	(0.009)	0.023**	(0.009)
Patient										
Age 0-2 years	-0.144**	(0.067)	1.633	(1.959)	-0.529	(0.440)	0.246***	(0.075)	0.423***	(0.067)
Age 3-39 years	-0.020	(0.014)	-0.215	(0.416)	0.439***	(0.094)	-0.004	(0.015)	0.047***	(0.016)
Age 40-49 years	-0.015	(0.011)	0.580*	(0.335)	-0.547***	(0.075)	0.005	(0.012)	-0.009	(0.013)
Age 50-59 years	-0.009	(0.010)	0.354	(0.297)	-0.409***	(0.067)	0.003	(0.011)	-0.001	(0.012)
Age 60-69 years	-0.009	(0.008)	0.487**	(0.241)	-0.458***	(0.055)	0.011	(0.009)	-0.019**	(0.010)
Age 70-79 years	-0.011	(0.007)	0.183	(0.207)	-0.304***	(0.048)	0.012	(0.008)	0.003	(0.008)
Female	0.001	(0.005)	-0.180	(0.149)	0.035	(0.034)	-0.016***	(0.006)	0.006	(0.006)
Black	-0.040***	(0.008)	0.481**	(0.235)	-0.263***	(0.053)	-0.028***	(0.008)	-0.009***	(0.009)
Hispanic	-0.031***	(0.010)	0.577**	(0.292)	-0.334***	(0.064)	-0.032***	(0.011)	0.026**	(0.011)
ICD 9 Injury	-0.043**	(0.018)	-0.067	(0.583)	-0.232*	(0.135)	0.232***	(0.022)	0.037	(0.023)
DRG Severity:										
Very Severe	0.089***	(0.011)	-4.952***	(0.321)	-0.379***	(0.078)	0.012	(0.330)	-0.102***	(0.014)
Severe	0.070***	(0.007)	-0.154	(0.221)	0.143**	(0.050)	0.257***	(0.008)	-0.030***	(0.009)
Somewhat Severe	0.020***	(0.006)	0.037	(0.189)	-0.053	(0.043)	0.135***	(0.007)	-0.031***	(0.007)
Secondary Diagnoses:										
Diabetes			0.060	(0.200)	-0.034	(0.045)	-0.004	(0.007)	-0.016**	(0.008)
Cancer			-0.782	(0.481)	0.294***	(0.111)	-0.004	(0.018)	0.019	(0.019)
Dementia			1.278**	(0.506)	-0.196*	(0.117)	0.010	(0.018)	-0.012	(0.019)
Hypertension			-0.124	(0.162)	-0.101***	(0.037)	0.007	(0.006)	0.005	(0.006)
Stroke			0.119	(0.496)	-0.019	(0.114)	0.032*	(0.019)	0.014	(0.020)
Vascular Disease			-0.210	(0.473)	0.038	(0.107)	0.054***	(0.018)	-0.036*	(0.019)
Previous Myocardial			0.380	(0.390)	0.243***	(0.091)	0.057***	(0.015)	-0.005	(0.015)
Obese			-0.332*	(0.198)	0.078*	(0.045)	-0.003	(0.007)	-0.000	(0.007)
Other Heart Disease			0.141	(0.167)	0.116***	(0.038)	-0.002	(0.006)	-0.001	(0.007)
Foreign					2.512***	(0.036)	-0.103***	(0.006)	-0.250***	(0.006)
Inverse Mills Ratio			-13.910***	(0.565)						
Constant	-42.169***	(0.503)	56.294***	(1.191)	19.319***	(0.204)	0.560***	(0.042)	-0.148***	(0.043)
Pseudo R-squared	0.06		0.10		0.06		0.05		0.07	

Models include hospital fixed effects and indicators for days of the week. Robust standard errors are in parentheses.
Omitted are patients who are on Medicare, aged over 79, and with mild DRGs.

Table 4. Patient Payment Type and Quality of Physician, by Hospital Type

Payment Type	*Hospital Type*			
A. Domestically Trained				
	Government	Not for	Investor Owned	Teaching
Uninsured	-0.214***	-0.007	-0.035*	0.082**
	(0.031	(0.019)	(0.019	(0.035)
Medicaid	-0.073**	-0.005	-0.004	-0.024
	(0.037)	(0.020)	(0.018)	(0.032)
Commercial Insurance	-0.060**	0.046***	-0.005	-0.085***
	(0.026	(0.012)	(0.012)	(0.027)
Number of	28,99	124,576	117,300	22,055
Pseudo R-squared	0.10	0.07	0.06	0.06
B. Medical School Ranking				
	Government	Not for Profit	Investor Owned	Teaching
Uninsured	1.304	-1.210**	2.536***	1.531
	(1.005)	(0.537)	(0.550)	(1.142)
Medicaid	-0.297	0.079	2.245***	-0.136
	(1.150	(0.567)	(0.523)	(1.033)
Commercial Insurance	0.131	0.782**	0.673*	-0.876
	(0.808	(0.353)	(0.360)	(0.915)
Number of	16,977	75,145	73285	11,801
Pseudo R-squared	0.11	0.12	0.09	0.03
C. Physician's Years of Experience				
	Government	Not for Profit	Investor	Teaching
Uninsured	-1.922***	-0.340***	-0.516***	-0.505**
	(0.210)	(0.127)	(0.120)	(0.228)
Medicaid	-1.177***	-0.204	-0.280**	-0.217
	(0.259)	(0.133)	(0.114)	(0.216)
Commercial Insurance	-0.430**	-0.084	-0.047	-0.218
	(0.183)	(0.083)	(0.079)	(0.179)
Number of	29,931	130,891	125,169	23,753
R-squared	0.08	0.07	0.06	0.04
D. Indicator Physician is Board Certified				
	Government	Not for Profit	Investor Owned	Teaching
Uninsured	-0.090***	-0.057***	-0.055***	-0.185***
	(0.033)	(0.021)	(0.020)	(0.038)
Medicaid	-0.055	-0.063***	-0.065***	-0.100***
	(0.040)	(0.022)	(0.019)	(0.035)
Commercial Insurance	0.088***	-0.031**	0.039***	0.057*
	(0.029)	(0.014)	(0.014)	(0.031)
Number of	26,237	113,026	109,393	20,532
Pseudo R-squared	0.06	0.04	0.05	0.04
E. Physician Completed Residency or Fellowship in Top 50 Cardiac Hospital				
	Government	Not for Profit	Investor	Teaching
Uninsured	-0.037	0.013	0.028	-0.040
	(0.037)	(0.021)	(0.022)	(0.042)
Medicaid	-0.031	0.003	-0.081***	0.338
	(0.044)	(0.023)	(0.021)	(0.040)
Commercial Insurance	0.056*	0.019	0.024	0.008
	(0.031)	(0.014)	(0.014)	(0.034)
Number of	24,444	108,580	105,296	18,908
Pseudo R-squared	0.08	0.06	0.09	0.09

Models include hospital fixed effects. Robust standard errors in parentheses.
All results are relative to Medicare patients. Models were estimated using all variables shown in Table 3. Results for all variables available from authors upon request.

Table 5: Effect of Physician Quality on In-Hospital Mortality. Cox Hazard Ratio estimates with robust standard errors in parenthesis.

	(1)	(2)	(3)	(4)	(5)	(6)
Physician Quality						
School Ranking		1.001**				1.002***
Top Residency			0.936*			0.963
Board Certification				1.008		0.992
Experience					0.993*	0.999
Experience x Experience					1.000**	1.000
Payment type						
Uninsured	1.336***	1.249**	1.369***	1.411***	1.502***	1.262**
Medicaid	0.820***	0.852*	0.865*	0.849**	0.820***	0.914
Private Insurance	1.043	1.072	1.011	1.007	0.988	1.057
Hospital Characteristics						
Number of Beds	1.000**	1.000	1.000**	1.000**	1.000**	1.000
Cases of Open Heart surgeries	1.000	1.000	1.000	1.000	1.000	0.999
FTE Nursing Staff	0.999***	0.999**	0.999***	0.999***	0.999***	0.999**
Herfindahl index	0.742***	0.826	0.874	0.882	0.838	0.845
For Profit Hospital	0.973	0.999	1.020	0.989	1.009	0.988
Government Hospital	1.030	1.096	1.071	1.054	1.006	1.088
Teaching Hospital	0.876*	0.766***	0.895	0.895	0.891	0.749***
N	302,487	143,723	202,221	208,688	219,616	120,529
Wald chi2	23695.98	44	16662.45	17177.09	17877.73	10089.21
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

All models include county and patient demographics, ICD injury severity score and indicators for secondary patient diagnoses and days of the week. Estimation results for all included variables are available from the authors upon request.

Table A1. Diagnosis Related Groupings and Four Categories of Severity

DRG	MDC	TYPE	DRG TITLE	WEIGHTS	DRG Severity
139	05	MED	CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS W/O CC	0.5234	Mild
140	05	MED	ANGINA PECTORIS	0.5275	Mild
133	05	MED	ATHEROSCLEROSIS W/O CC	0.5411	Mild
143	05	MED	CHEST PAIN	0.5643	Mild
131	05	MED	PERIPHERAL VASCULAR DISORDERS W/O CC	0.5655	Mild
145	05	MED	OTHER CIRCULATORY SYSTEM DIAGNOSES W/O CC	0.5850	Mild
136	05	MED	CARDIAC CONGENITAL & VALVULAR DISORDERS AGE >17 W/O CC	0.5902	Mild
142	05	MED	SYNCOPE & COLLAPSE W/O CC	0.5929	Mild
134	05	MED	HYPERTENSION	0.6091	Mild
132	05	MED	ATHEROSCLEROSIS W CC	0.6428	Mild
524	01	MED	TRANSIENT ISCHEMIA	0.7414	Mild
128	05	MED	DEEP VEIN THROMBOPHLEBITIS	0.7475	Mild
141	05	MED	SYNCOPE & COLLAPSE W CC	0.7617	Mild
137	05	MED	CARDIAC CONGENITAL & VALVULAR DISORDERS AGE 0-17	0.8249	Mild
138	05	MED	CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS W CC	0.8413	Mild
135	05	MED	CARDIAC CONGENITAL & VALVULAR DISORDERS AGE >17 W CC	0.9264	Mild
130	05	MED	PERIPHERAL VASCULAR DISORDERS W CC	0.9566	Mild
122	05	MED	CIRCULATORY DISORDERS W AMI W/O MAJOR COMP, DISCHARGED ALIVE	1.0127	Mild
129	05	MED	CARDIAC ARREST, UNEXPLAINED	1.0346	Mild
127	05	MED	HEART FAILURE & SHOCK	1.0390	Mild
125	05	MED	CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH W/O COMPLEX DIAG	1.1146	Somewhat Severe
530	01	SURG	VENTRICULAR SHUNT PROCEDURES W/O CC	1.1945	Somewhat Severe
144	05	MED	OTHER CIRCULATORY SYSTEM DIAGNOSES W CC	1.2502	Somewhat Severe
117	05	SURG	CARDIAC PACEMAKER REVISION EXCEPT DEVICE REPLACEMENT	1.3529	Somewhat Severe
124	05	MED	CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH & COMPLEX DIAG	1.4564	Somewhat Severe
123	05	MED	CIRCULATORY DISORDERS W AMI, EXPIRED	1.5421	Somewhat Severe
121	05	MED	CIRCULATORY DISORDERS W AMI & MAJOR COMP, DISCHARGED ALIVE	1.6200	Somewhat Severe
118	05	SURG	CARDIAC PACEMAKER DEVICE REPLACEMENT	1.6751	Severe
518	05	SURG	PERC CARDIO PROC W/O CORONARY ARTERY STENT OR AMI	1.7509	Severe

Table A1., cont'd.

DRG	MDC	TYPE	DRG TITLE	WEIGHTS	DRG Severity
517	05	SURG	PERC CARDIO PROC W NON-DRUG ELUTING STENT W/O AMI	2.1106	Severe
529	01	SURG	VENTRICULAR SHUNT PROCEDURES W CC	2.2165	Severe
120	05	SURG	OTHER CIRCULATORY SYSTEM O.R. PROCEDURES	2.3051	Severe
527	05	SURG	PERCUTNEOUS CARDIOVASULAR PROC W DRUG ELUTING STENT W/O AMI	2.3282	Severe
116	05	SURG	OTHER PERMANENT CARDIAC PACEMAKER IMPLANT	2.3561	Severe
111	05	SURG	MAJOR CARDIOVASCULAR PROCEDURES W/O CC	2.4488	Severe
126	05	MED	ACUTE & SUBACUTE ENDOCARDITIS	2.6051	Severe
516	05	SURG	PERCUTANEOUS CARDIOVASC PROC W AMI	2.6457	Severe
526	05	SURG	PERCUTNEOUS CARDIOVASULAR PROC W DRUG ELUTING STENT W AMI	2.9741	Severe
115	05	SURG	PRM CARD PACEM IMPL W AMI/HR/SHOCK OR AICD LEAD OR GNRTR	3.5928	Very Severe
109	05	SURG	CORONARY BYPASS W/O PTCA OR CARDIAC CATH	3.9450	Very Severe
110	05	SURG	MAJOR CARDIOVASCULAR PROCEDURES W CC	3.9587	Very Severe
108	05	SURG	OTHER CARDIOTHORACIC PROCEDURES	5.1702	Very Severe
107	05	SURG	CORONARY BYPASS W CARDIAC CATH	5.3757	Very Severe
515	05	SURG	CARDIAC DEFIBRILLATOR IMPLANT W/O CARDIAC CATH	5.4339	Very Severe
105	05	SURG	CARDIAC VALVE & OTH MAJOR CARDIOTHORACIC PROC W/O CARD CATH	5.7937	Very Severe
536	05	SURG	CARDIAC DEFIB IMPLANT W CARDIAC CATH W/O AMI/HF/SHOCK	6.2417	Very Severe
528	01	SURG	INTRACRANIAL VASCULAR PROC W PDX (Principal Diagnosis) HEMORRHAGE	6.8481	Very Severe
106	05	SURG	CORONARY BYPASS W PTCA	7.3062	Very Severe
535	05	SURG	CARDIAC DEFIBRILLATOR IMPLANT W CARDIAC CATH W AMI/HF/SHOCK	7.6973	Very Severe
104	05	SURG	CARDIAC VALVE & OTH MAJOR CARDIOTHORACIC PROC W CARD CATH	7.9180	Very Severe
525	05	SURG	OTHER HEART ASSIST SYSTEM IMPLANT	11.3749	Very Severe
103	PRE	SURG	HEART TRANSPLANT OR IMPLANT OF HEART ASSIST SYSTEM	19.5514	Very Severe

Source: Federal Register, Table 5. Vol. 70 FR 47617, August 12, 2005.