ACCESS TO CARE, PROVIDER CHOICE AND RACIAL DISPARITIES IN INFANT MORTALITY*

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July 2004

This paper explores whether the use of different providers explains any of the observed infant health gradients. We exploit an exogenous change in policy that occurred in California in the early 1990s that suddenly increased Medicaid payments to hospitals thereby increasing provider willingness to serve the poor. To characterize the extent to which poor women responded to this increase in access to providers, we calculate hospital segregation indices which measure the extent to which Medicaid mothers delivered in separate hospitals from privately insured mothers residing in the same geographic area. We show that segregation fell sharply after the policy change, suggesting that the lower prices historically paid by Medicaid have been partly responsible for the segregation of poor women in separate hospitals. However we also find that individual choice, not just access, is partially responsible for the observed difference in provider use and health gradients. We find that Black mothers responded *least* to the increase in provider access afforded by the policy change, even though they benefited the most in terms of reduced neonatal mortality and fewer pre-term births. In contrast, other groups with lower initial neonatal mortality moved more and gained less in terms of improvements in birth outcomes.

* Corresponding authors: alleras@princeton.edu, Anna_Aizer@brown.edu. We would like to thank Janet Currie, David Cutler, Sherry Glied, Ellen Meara, Doug Miller, Ann Huff Stevens and the seminar participants at Brown, Princeton, the NBER Health Care Meetings, Harris School at the University of Chicago, UC Davis, and McGill University for their comments and suggestions. We are also very grateful to Janet Currie for providing us with the vital statistics data and Mark Duggan for providing access to his data and answering many of our questions regarding California's DSH program. Aizer thanks the Bendheim-Thoman Center for Research on Child Wellbeing at Princeton University which is supported by grant 5 R01 HD36916 from the NICHD. Lleras-Muney received financial support from the National Institute on Aging, Grant Number K12-AG00983 to the National Bureau of Economic Research.

I. Introduction

Children born to poor parents in the US are more than twice as likely to die within the first year as those born to higher income parents (Gortmaker and Wise, 1997). It has long been hypothesized that these differences are due, in part, to unequal access to care. Previous research has shown that efforts to improve financial access to care for low-income pregnant women through public health insurance expansions have resulted in significant declines in infant mortality among the poor (Butler and Scotch, 1978; Currie and Gruber, 1996), yet income gradients in health remain large. And despite the large expansions in health insurance coverage among low-income families, the poor still largely obtain care in separate facilities than their privately insured counterparts. For example, in California in 1990, neonatal mortality rates for Medicaid births were 33 percent larger than for the privately insured and pregnant women with Medicaid were also 37 percent more likely to deliver in public hospitals relative to their privately insured neighbors. Differential use of providers may explain these differences in health if there are large differences across hospitals in the quality of care which affect infant health. The direct effect of hospital quality on health, however, is very difficult to measure (McClellan and Staiger, 1999).

In this paper we explore whether allowing poor women greater access to those hospitals used by privately insured women results in their choosing to use these hospitals[1] and if so, whether access to care and provider choice explain any of the infant health gradients that we observe. There are two possible (though not mutually exclusive) explanations for why poor women deliver in separate hospitals than their privately

[1] Along similar lines, Chandra and Skinner (2003) have shown that Blacks utilize lower quality hospitals, and suggest they do so due to their geographic proximity to such hospitals.

insured neighbors. First, Medicaid often pays less than private payers.[2] Existing evidence suggests that because of the relatively low rates, many providers may be unwilling to treat Medicaid patients (Yudlowski, 1990; Currie, Gruber and Fisher, 1995). As such, women with Medicaid may be constrained in their choice of provider, and have access to mostly low quality providers. It may also be that even without such a constraint, poor women still choose alternative (lower quality) providers, which would suggest a potential market failure. Whether and to what extent each of these can explain differences in the choice of provider has important (and different) policy implications for improving the health of the poor. If the latter explanation is true, then further expanding access to care among the poor may not necessarily lead to better health.

To answer these questions we exploit an exogenous change in policy that occurred in California in the early 1990s that suddenly increased Medicaid payments to hospitals and increased the willingness of hospitals to serve Medicaid patients.[3] We focus on pregnant women because they constitute a large fraction of the Medicaid population, they have adequate time to choose a hospital for delivery, and because there is evidence that access to high quality hospital care can affect neonatal mortality (Cutler and Meara, 1999).

In order to characterize the extent to which poor women responded to the increase in provider access, we calculate hospital segregation indices both before and after the policy change for each county in California. The hospital segregation index is a measure of the extent to which women with Medicaid delivered in separate hospitals from women

[2] In California in 2000, Medicaid payment rates for maternity care were one half to one third as much as private payment rates (Hunt, Maerki and Tompkins, 2001).
[3] See Duggan, 2000 and Duggan, 2000a for thorough explanation and analysis of this policy change in terms of its impact on the ownership type of hospitals in which Medicaid patients were seen.

with private insurance residing in the same geographic area. We estimate whether hospital desegregation resulted in improved health outcomes, measured by neonatal mortality, premature birth and birth weight. Our approach is based on the idea that gradients in health cannot be attributed to differences in health care access if there are no differences across income in hospital use. Rather than attempt to measure differences in the quality of the hospitals mothers use, we look at whether a more equal distribution of hospital use results in more equal distribution of health.

We focus on different Medicaid populations. The decision to go to a different hospital depends on the costs and benefits associated with the switch. Evidence suggests that even among the poor these costs and benefits might differ significantly. Most births occur without complications. It is only a small percentage of all births that benefit from the availability of modern technology and for which hospital quality will matter. Hispanics tend to have slightly better birth outcomes compared with the general population of Medicaid mothers, while the less educated and, particularly, Blacks have worse birth outcomes.[4] Thus Black and low educated mothers may benefit more from using higher quality hospitals. Also mothers of twins (or higher order births) are generally more likely to have complications, thus they may also benefit more from better hospitals. Finally we also hypothesize that more educated mothers may be better informed both about the newly available hospitals and about their quality (or perhaps

[4] In 1990, the rate of neonatal mortality in California was 4.1 per 1000 births. For Blacks, the figure was more than twice as great (8.6) – which is considerably higher than other low SES groups. For single mothers the rate was 5 per 1000, for high school drop-outs it was 4.6 per 1000 and for Hispanics it was 4 per 1000 for the same period.

about the importance of having access to quality care) and thereby may respond at higher rates.[5]

We find that among those with Medicaid, Black mothers responded *least* to the increase in provider choice afforded by the policy change. This does not appear to be related to residential isolation. Interestingly, Black mothers benefited the *most* from hospital desegregation in terms of reduced neonatal mortality and decreased incidence of pre-term and very low birth weight. The neonatal mortality rate for Black mothers with Medicaid coverage declined from 8.6 to 7.8 per thousand over this period. Our estimates suggest that most (92 percent) of this decline can be attributed to increased access to care. In contrast, other groups with lower initial neonatal mortality moved more and gained less in terms of improvements in birth outcomes. We do not find any evidence that more educated mothers were more responsive than the average Medicaid mother. The finding that women who benefit most from the increase in provider choice do not necessarily take advantage of the availability of higher quality providers suggests that any attempt to improve health outcomes through market-based interventions must consider the fact that the market for health care differs in important ways from other well-functioning markets.

This paper is organized as follows. Section II presents the data. In section III we describe the policy changes that took place in California in 1991 in further detail. We examine changes in hospital choice among Medicaid mothers, and for different socio-economic groups within Medicaid, in section IV. We analyze the impact of changes in hospital choice on neonatal mortality (Section V) and present a series of specification checks (Section VI). We discuss the results in Section VII.

[5] Babies of more educated mothers (in the population) have better health outcomes (e.g. Currie and Moretti 2003). Better access to information and differential use of information have been shown to be predict infants' health (Meara, 2001).

II. Data

We use California Birth certificate data matched to death certificate data from 1989 through 1995. These data contain individual level records of all the births that occurred in California as well as information about the parents. The former includes infant characteristics such as gestational age, birth weight, fetal death, infant mortality by cause and age of death. The latter includes mother's age, education, race, marital status, type of insurance coverage, zip code of residence, previous number of live births, and prenatal care (when initiated and number of visits). The hospital of delivery and its location are also recorded.

We restrict our sample to mothers that had either Medicaid or private insurance.[6] We drop Medicaid mothers with more than a college degree (1.6 percent): they too are likely a very select and unrepresentative group. We also drop teenage moms (12 percent) as teen birth rates are changing over this period for reasons independent of DSH.[7] Finally, we restrict our attention to urban areas, excluding 8.5 percent of the sample residing in very rural areas.[8] Our results are not sensitive to these sample restrictions. Because we focus on changes at the county level, we collapse all the individual births into cells defined by county, year of birth, maternal race, education, age, marital status, twin birth, whether foreign-born and Medicaid status.

Descriptive statistics are presented in Tables I.a and I.b. They indicate that neonatal mortality fell during this period, and it did so more for mothers on Medicaid

[6] We eliminate the small proportion of mothers whose primary source of insurance was listed as Medicare, Worker's Compensation, etc. as they are an unrepresentative group of mothers.
[7] We also drop teens so as to identify the impact of education (whether have a HS degree or not) on birth outcomes independent of age.
[8] Rural was defined as a zip code of which less than 25% of the population lived in an urban area as determined by the 1990 Census.

than others. They also show that during this period some characteristics of mothers changed: the share of mothers on Medicaid, the share Hispanic and the share foreign born rose quite substantially. We discuss our methods to control for these changes in the underlying population of women with Medicaid in the analyses in later sections.

In Table I.b we document the large differences in health outcomes among Medicaid mothers in 1990: all outcomes are worse for children of Black mothers, followed by high school dropouts, whites and then Hispanics.

III. California's Disproportionate Share (DSH) Program

In the 1980s the Federal government passed legislation that allowed the states to compensate hospitals that served a disproportionate share of disadvantaged patients.[9] Under DSH each state was to design and administer its own program, and the Federal government would provide matching funds for DSH reimbursements. (See Baicker and Staiger, 2004 for a national analysis of the implementation and impact of federal DSH subsidies). California's DSH program was created at the end of 1990 and it stipulated that hospitals whose Medicaid (and indigent) related costs (referred to as a hospital's Low Income Number or LIN) exceed 25% in the previous year would receive substantial per diem reimbursements. These reimbursements further increased as a function of LIN above 25%.[10] Funds were first received by hospitals in the fiscal year 1991-1992.

Because of its generosity, the DSH program provided an incentive for many private hospitals to drastically increase the number of Medicaid patients that they served (Duggan 2000a). As a result, in a short period of time, there was a large re-distribution of

[9] See Appendix A for details on the history and functioning of the DSH program.
[10] Because funds distributed under DSH increased from 6 to 39% of total Medicaid funds between 1990 and 1992, and due to suspicions that funds were given to hospitals that did not primarily serve the Medicaid population, in 1993 congress reformed DSH, imposing additional eligibility restrictions to contain costs.

Medicaid patients from public to private hospitals. Figures 1a-c document this change: from 1990 to 1995 the share of Medicaid patients going to public hospitals fell from about 65% to 40%, whereas the share of Medicaid patients going to non-profit hospitals rose from about 22% to more than 40%. This redistribution of patients across hospitals was limited to those with Medicaid: the distribution of patients with private insurance across hospitals stayed constant throughout the period.

Prior to the implementation of DSH, Medicaid mothers were largely seen in separate hospitals from the privately insured. Controlling for location (and thus geographic access to hospitals) women with Medicaid in California were 37 percentage points more likely to go to public hospitals than their privately insured neighbors (of whom only 11% went to public hospitals).[11] After the implementation of DSH, the share of Medicaid births in public hospitals fell between 1990 and 1995 with a corresponding increase in Medicaid births in private hospitals (see figures 2a and 2b). Consistent with these trends, the number of hospitals eligible to receive DSH payments increased over this period, from 13 percent in 1990 to 28 percent in 1994-1995.[12] In California, DSH accounted for 0.2 percent of total Medicaid spending in 1990 and 19.3 percent by 1995.

This suggests that the choice set of Medicaid patients prior to DSH was indeed restricted due to Medicaid payment rates that were lower than private rates and, as the price paid by Medicaid increased, so did competition for these patients. We treat the payment increase introduced by DSH as an exogenous increase in the hospital choice set

[11] Using our sample of mothers, we estimated a linear regression of the probability of delivering in a public hospital as a function of Medicaid status, controlling for zip code fixed effects. We report the coefficient on the Medicaid dummy from this regression.

[12] These are the percentages for hospitals in our hospital data, a sample of 339 hospitals for which the State of California provided numbers (Mark Duggan generously gave us access to this information which he obtained).

for Medicaid patients and especially expectant mothers. Expectant mothers are a particularly interesting group to analyze the impact of expansions in access on hospital choice: they have little uncertainty regarding their future health care needs and they have time to make informed choices. Also, they are a large sample: Medicaid moms make up a large fraction of Medicaid patients (46 percent of all Medicaid patients in California in 1990) and Medicaid covers a large fraction of all expectant mothers (40 percent in California in 1990). Finally because Medicaid covers all birth-related expenses, income and direct costs do not play an important role in determining hospital choice for this sample.

IV. Trends in hospital use

A. Measuring Hospital Segregation

To characterize the change in the distribution of Medicaid deliveries over this period within a mother's market, we calculate a Tauber "segregation" index (Tauber and Tauber, 1965) which measures the extent to which Medicaid mothers deliver in separate hospitals from privately insured mothers. In our sample 94 percent of mothers gave birth within their county. As such, we define a mother's potential choice set as all providers in her county of residence.[13] For each county and year we create a Tauber Hospital Segregation Index[14] (HSI) as follows:

$$\text{HSI}=1/2*\sum_{i=1}^{n}\left|\frac{Mcaid_i}{Mcaid}-\frac{pvtpay_i}{pvtpay}\right|$$

[13] Half of all mothers deliver in a hospital within five miles of her zip code of residence and 85 percent of mothers deliver in a hospital within 16 miles of her zip code.

[14] This index is also known as the dissimilarity index. There are other measures of spatial segregation, such as the index of centralization or isolation, but they do not seem appropriate in the context of the hospital market.

In the expression above, i indexes each hospital in the county. The first term is the number of Medicaid deliveries in hospital i over the total number of Medicaid deliveries in the county in a given year. The second term is similarly defined, but for privately insured deliveries. The segregation index ranges from zero to one, with zero being un-segregated, and one being totally segregated. Levels above 0.6 are considered high (Massey and Denton 1993).

The HSI captures the extent to which Medicaid and privately insured mothers deliver in the same hospitals. Intuitively, the HSI tells us the proportion of Medicaid (or privately insured) mothers who would have to switch hospitals for the county to be un-segregated, i.e. for the share of Medicaid deliveries in each hospital to be equal to the share of Medicaid mothers in the county. The index captures all of the information about the distribution of patients across hospitals within a county, and, importantly, it is NOT a function of the share of Medicaid mothers in the county. If segregation were 0, then health gradients could not be attributed to differential access to care.[15]

The use of the segregation index to characterize the hospital choice set of mothers in a given county is based on the revealed preferences argument: presumably if mothers choose different hospitals after DSH it is because they prefer them along some dimension. We assume throughout this paper that mothers choose the hospital where they deliver. This is based on evidence from patient surveys that suggests that patients play a significant role in choice of hospital either indirectly through the choice of physician or directly in consultation with their physicians.[16] Indeed, while geographic proximity is an

[15] Although the existence of hospital segregation does not per se imply that health gradients are due to health care--this is a necessary but not sufficient condition.

[16] For example, work by Berkowitz and Flexnor (1981) states that roughly half of all individuals surveyed reported that the choice of hospital was at least "a 50/50 collaborative effort" with their physician.

important determinant of hospital choice, most women in California have geographic access to many hospitals and we observe that among neighbors, women often choose different hospitals.[17] Based on the revealed preference argument, the segregation index should decrease more in areas where more and "better" hospitals began serving the Medicaid population after the implementation of DSH. Recall from Figures 1b and 2b that there was almost no change in the type of hospitals chosen by privately insured mothers over this period; therefore we operate under the assumption, which we will test in section VI, that most of the changes in segregation are due to the behavior of Medicaid mothers subsequent to the implementation of the DSH policy.

Because the extent to which a county is segregated in a given year might reflect differences in the underlying characteristics of the Medicaid and privately insured populations that vary across counties, we look at *changes* within county in hospital segregation 1990-1995. We argue that changes over this brief period can be attributed to DSH alone, not to any neighborhood sorting.

B. Trends in Hospital Desegregation: 1989 -1995

Figure 3a shows the trends in hospital segregation throughout the period. Prior to 1991, hospital segregation was rising. But the level of hospital segregation declines from .59 to .51 or 13.5 percent beginning in 1990-1991, coincident with the implementation of DSH. This reflects the fact that pregnant women on Medicaid began delivering in hospitals that previously served mainly privately insured women.

[17] Not only do Medicaid mothers choose different hospitals than their privately insured neighbors, but among Medicaid mothers living in the same zip code we observe different choices. The median number of hospitals used by Medicaid mothers in a given zip code in California is 6 and in 70% of all zip codes Medicaid mothers use at least different two hospitals.

There is considerable variation across counties in the extent to which hospital segregation changed over this period. Most counties (63 percent) experienced a decrease in segregation but segregation remained roughly the same or increased in others. The largest decline occurred in Riverside County (about 35 percentage points) and the largest increase occurred in Fresno. (See Appendix B for individual county trends in segregation over this period). We argue, based on Duggan (2002a), that the extent to which counties become desegregated over this period is not related to underlying characteristics of the Medicaid population, but rather the existing structure of the hospital market and the fact that some hospitals faced greater incentives under DSH to serve Medicaid patients than others. In section VI, we provide some additional evidence to support these claims.

We now calculate the segregation index separately for three different subgroups: Hispanic mothers, Black mothers and mothers without a high school degree.[18] The trends for these segregation indexes are in Figure 3b. Overall, it appears that Hispanic mothers and high school dropouts experience the same decline in segregation as the general population of Medicaid mothers (though the initial levels are higher). Black Medicaid mothers appear to be the exception, experiencing much smaller declines in segregation relative to non-Black Medicaid mothers.

In Tables II and III we examine these patterns more formally. In Table II we present results of a non-parametric analysis of the trend in hospital segregation over this period in which we regress hospital segregation on indicator variables for each year 1989-1995 (with 1991 omitted) as well as indicators for Black, Hispanic and whether a

[18] We hold constant the privately insured distribution (i.e. all the share $pvtpay^i/pvtpay$ is the same for all indexes) and use the group specific distribution across hospitals (so instead of including all Medicaid mothers in the segregation index, we include Black Medicaid or Hispanic Medicaid).

high school dropout and include county fixed effects.[19] This enables us to test both whether the trend appears to break in 1991, as well as whether the trend post 1991 is linear in form. As is evident from the table, hospital segregation seems to be increasing prior to 1991 (though the coefficient estimates are not significantly different from zero) but after 1991 appears to be decreasing in a linear fashion. At the bottom of Table II we provide f-statistics which confirm that the break in trend did occur in 1991, coincident with the launching of DSH. Furthermore there are no significant breaks in the trends in any years other than 1991. We cannot reject the assumption of a linear downward trend post 1991 (f statistic 1.03, p-value 0.379).

To more formally test whether some groups appear to have moved more or less upon the implementation of DSH, we specify a linear trend post-1991 and interact the trend with race and education indicators. This can be written as:

$$HSI_{retc} = \beta_0 + \beta_1 * t + \beta_2 * post91 + \beta_3 * t * post91$$
$$+ \beta_4 * X_r + \beta_5 * t * X_r + \beta_6 * post91 * X_r + \beta_7 * t * post91 * X_{retc} + \gamma_c + e_{retc}$$

where the dependent variable is hospital segregation index for a given race *r*, educational group *e*, year *t* and county *c*. We interact the time trend *t*, the post 91 dummy, *post91*, and the trend after 1991 (t*post91) with *X*, which stands for race and education dummies. We include county fixed effects (γ_c). The three (mutually exclusive) race categories are Black, Hispanic and non-Black/non-Hispanic.[20] The two educational groups are HS drop-outs and HS graduates.

The results are in Table III. Prior to 1991 there does not appear to be any

[19] Thus each cell is a race, education, year, county group.
[20] In California, there are very few Black mothers who report Hispanic ethnicity.

significant trend in segregation (β_1 = 0.0038 and imprecisely estimated) but after 1991, segregation begins to decline significantly (β_3 = - 0.0359). In addition it appears to decline much more slowly for Blacks post-1991 (β_7 = 0.0169), slightly more slowly for Hispanics (β_7 = 0.0026) and slightly faster for HS drop outs (β_7 = - 0.0029). However, only the estimate for Blacks is precisely estimated. In the second and third columns of Table III we control for geographic proximity to private and public hospitals, separating private hospitals into three categories depending on the extent to which DSH increased their incentive to treat Medicaid patients, since this should affect the rate of desegregation.[21] Location and proximity to different type of hospitals do not explain the differences by race that we observe. In fact, racial differences in the rate of desegregation increase once we add these controls. This is not surprising given that Blacks are more likely to live near more private hospitals than other Medicaid groups. Below the table we present the results of tests of significance between the post-1991 trends for Blacks vs. Hispanics and HS drop outs. The coefficient for less than high school does not support the hypothesis that more educated mothers would move at faster rates due to information advantages (if anything it suggest the less educated mothers moved more). There does not appear to be any significant effect for Hispanics either. Overall this evidence does not support the hypothesis (Duggan 2000a) that hospitals attracted only those with good health (since Hispanics and high education mothers were just as likely to move as non-Hispanics and low educated mothers) except to the extent that they sought to attract non-Blacks.

[21] For each zip code in California we calculate the number of public, private and private hospitals with low-income number (LIN) 15-25 and 25-30 within five miles of the zip code centroid. Then for each county race and education group we calculate a weighted average for each county.

Only the post-1991 decline in hospital segregation for Blacks is significantly less steep than it is for other groups. While we might expect that as high risk patients, Black mothers would move more, prior research has found that even conditional on health insurance coverage, Blacks exhibit different patterns of care. For example, Currie and Thomas (1995) find that Black children do not receive as many doctor visits or check-ups as other similarly insured children. Currie and Reagan (1998) find that the probability that Black children receive regular check-ups is more highly dependent on geographic proximity to public providers than other groups with similar health insurance coverage.

V. The effect of hospital desegregation on infant health

Even though we may not expect to find any effects for the average Medicaid birth (we only expect effects for a small subset of births with complications), we start by estimating the impact of hospital desegregation on neonatal mortality for comparison. Our estimates of the impact of hospital desegregation on health outcomes are difference-in-differences estimates in which we compare the differences in birth outcomes for Medicaid mothers vs. privately insured mothers in areas that witnessed large declines in segregations vs. those in areas with small/no declines in segregation. The difference-in-difference estimate is represented by β_1 in the following equation:

$$health_{gtc} = \beta_0 + \beta_1 * \ln(1 - segregation_{tc}) * Medicaid + \beta_2 * Medicaid + \beta_3 * \ln(1 - segregation_{tc}) + I(1995 = 1) + \gamma_c + X\delta + \varepsilon_{gtc}$$

where X is a set of age, race, foreign-born and marital status dummies. The dependent variable is neonatal mortality for a given group g in year t county c. The sample consists of two years of data (1990 and 1995),[22] and we include an indicator for 1995 as well as county fixed effects. We chose *ln(1-segregation)* as our measure of desegregation because changes in desegregation appear to have a greater impact in areas where segregation was initially high, thereby rejecting a linear functional form.[23] If de-segregation results in a decline in neonatal mortality, β_1 (the D-in-D estimate) will be negative. By including an indicator for Medicaid we control for any underlying differences in neonatal mortality between Medicaid and privately insured mothers. County indicators control for differences between counties that may be correlated with changes in segregation and neonatal mortality. And the year dummy controls for state-wide trends in neonatal mortality. Therefore β_1 is identified from changes in segregation within counties over time. This coefficient captures the health benefits that accrued to Medicaid mothers who moved to hospitals that previously served mainly the privately insured. To the extent that they moved to higher quality hospitals, then neonatal mortality should fall more in those counties where mothers moved the most. The standard errors are clustered at the county level. Not surprisingly, the difference-in-differences estimate is small and insignificant (Table IV, Column 1).[24] Thus, consistent with Duggan (2000) we find that on average, even though Medicaid mothers chose to deliver in different hospitals once they were able to access them, there appears to have been no observable

[22] Because the changes in segregation occurred slowly (as shown in previous section), we chose to do the analysis with only two years, one immediately before, and one after.
[23] The log of de-segregation (1-segregation) is concave in de-segregation and therefore convex in segregation.
[24] If we estimate this equation excluding any other controls we still get insignificant results. This specification is similar to the simple differences in means presented in Figures 4a-d and suggests that the larger declines in average neonatal mortality for Medicaid relative to privately insured presented earlier were not statistically significant.

decline in neonatal mortality. However note that we only expect health effects for births with complications. We therefore look within Medicaid groups to see whether mothers that were more at risk benefited more from hospital desegregation.

To test whether expanding access to care matters more for different subgroups defined by education and race, we report triple difference estimates of the impact of a decline in hospital segregation for Black, Hispanic, and poorly educated mothers with Medicaid. For example, the triple difference estimates for Blacks are represented by β_1 in the following equation:

$$health_{gtc} = \beta_0 + \beta_1 * \ln(1 - segregation_{tc}) * Medicaid * Black$$
$$+ \beta_2 * \ln(1 - segregation_{tc}) * Medicaid + \beta_4 * Medicaid * Black$$
$$+ \beta_5 * Medicaid + \beta_6 * Black + \beta_7 * \ln(1 - segregation_{tc}) + I(1995 = 1) + \gamma_c + X\delta + \varepsilon_{gtc}$$

This specification includes all the same controls as the previous one. The estimated coefficients with the triple interactions are in columns two to four of Table IV. For Blacks (column 2), the triple interaction term is negative and significant. The coefficient suggests that a decline in segregation of 0.08 (the average over this period) results in a decline in Black neonatal mortality of 0.000783 percentage points. On a baseline of 0.0086 (neonatal mortality rate among Black Medicaid), this represents a decline of 8.6 percent relative to the level of segregation in 1990.[25] Black neonatal mortality among Medicaid mothers fell from 0.0086 to 0.0078, so the decline in segregation explains about 92 percent of the decline for this group. The results for high school drop-outs (column 3) and Hispanics (column 4) suggest that desegregation had no impact on neonatal mortality

[25] Note that the effect of a unit change in segregation on neonatal mortality is given by β(1/(1-HSI)). Therefore the effect of a change of –0.09 is given by β(1/(1-HSI))(-0.09)

for these groups. This could be a result of their lower initial rates of neonatal mortality, suggesting the decreasing marginal product of neonatal care.

Because women carrying twins are readily predicted to be at higher risk of poor outcomes, we anticipate that desegregation should have a greater impact on birth outcomes for twins than singleton births, therefore we re-estimate the model using the sample of 15,199 twins born over this period. Consistent with our predictions, the results presented (Table IV.B) suggest that desegregation has a much larger impact on neonatal mortality among twin births than singleton births for all mothers (column 1) and for Black mothers (column 2). However we still find no effects for high school drop-outs (column 3) and positive effects for Hispanic mothers (column 4).[26]

In Table V, we investigate these findings further by stratifying by initial level of segregation (all subsequent estimations include both single births and twins, with an indicator for twin birth). We separate counties into those with high levels of segregation (greater than the mean in 1990) and counties with low initial levels of segregation. This exercise reveals that for Blacks all of the effects on neonatal mortality are being driven by reductions in segregation in counties that were originally very segregated. The effect is about 2/3 larger in these counties than for the average. On the other hand the coefficient is insignificant for counties with low levels of segregation in 1990. And we still find that changes in segregation had no impact for Hispanics or high school drop-outs.

We also look at the impact of changes in segregation on a number of other outcomes that could be potentially affected by access to better hospitals, namely low and

[26] This is consistent with previous work by Phibbs et al. (1993) that showed that hospital quality tended to be more important for high-risk women.

very low birth weight, premature birth and the adequacy of prenatal care.[27] These results are presented in Table VI. Birth weight is an important marker for health, and is an outcome that is influenced by events during pregnancy. Premature births are likewise affected by events during pregnancy (premature labor can be brought on by smoking or drug-use) but a premature birth can be delayed temporarily with proper medical intervention in the form of prescription medications or, in some cases, surgical procedures for a longer delay.

For Blacks, we find that desegregation significantly lowered the percentage of very low birth weight babies and premature births, but had no effect on the percentage of low birth weight babies or the use of prenatal care.[28] To determine how much of the decline in VLBW is due to reductions in premature delivery, we regress VLBW on desegregation while controlling for pre-term births (column 5 Table VI.) We find that the positive impact of desegregation on VLBW is working largely through a reduction in pre-term births as evidenced by the reduction of the coefficient for desegregation from -.0091 to -.0045. Our estimates suggest the declines in segregation in this period lowered the incidence of premature births among Blacks by 1.8 percentage points or 11 percent relative to the mean in 1990. According to these results, 95 percent of the decline in premature births among low income Blacks observed between 1990 and 1995 can be attributed to declines in segregation.[29] Finally note that although not presented here, there

[27] We do not have any other measures of behaviors during pregnancy.
[28] We present results for the percent of mothers with inadequate prenatal care, but the results are identical if we use the number of prenatal care visits, the month when prenatal care began or the Kotelchuk Index. Irrespective of the measure we use, we do not find that changes in segregation led to improvements in the use of prenatal care.
[29] Gould (2000) finds that residential segregation is correlated with low birth weight among Blacks; our results suggest that this is partially due to lack of access to higher quality care which can delay premature labor – one of the main causes of low birth weight and very low birth weight.

were no effects for Hispanics or high school drop-outs for any of the outcomes we examine.

Not all decreases in neonatal mortality among Blacks are due to declines in premature births: if we control for premature births (Panel C of Table VIII) we still find a large effect of desegregation on neonatal mortality in high segregation areas. These results suggest that it is the access to quality care for the delivery that is responsible for most of the improvements in neonatal mortality that we observe. These results are consistent with findings by Almond, Chay and Greenstone (2004) that access to medical care explains historical racial differences in the infant mortality rate and other findings that high quality neonatal medical care in particular is an important determinant of birth outcomes (Cutler and Meara, 1999; Phibbs et al, 1996).

VI. Specification checks

In this section we investigate the possibility that the hospital desegregation witnessed over this period is due to factors other than the incentives created by DSH, such as changes in the composition of Medicaid (or more generally changes in demographics), changes in residential segregation or changes in the hospital market. We also test the robustness of our results and include a discussion of other possible mechanisms behind the improvements in outcomes for Blacks and the differences in their mobility rates.

A. Medicaid expansions

Table I showed that the characteristics of Medicaid pregnant women changed over the period 1990-1995 which is most likely due to expansions in Medicaid eligibility at the beginning of the period. It is possible that women who became eligible for

Medicaid were more likely to both use private hospitals and to have lower neonatal mortality risk. The two most significant expansions consisted of an increase in the financial eligibility for Medicaid from 100 to 185 percent of the Federal Poverty Line in 1989 and an expansion of Medicaid eligibility to undocumented pregnant women in 1990.[30] The former would have the effect of increasing the average health of mothers on Medicaid while the latter would likely have the opposite effect. In addition, the financial eligibility expansion also raises the possibility of crowd-out, in which case the composition of privately insured mothers would also change over this period. This would cast doubt on our ability to use the privately insured as a control in this context (though the bias introduced by this change in the control group would understate our results.) However, the impact of the expansions in financial eligibility is likely small because according to the state, in 1995, only 8.2 percent of all Medicaid deliveries were to women qualifying under the expansions.[31] In addition, we dropped all Medicaid deliveries to mothers with a college degree, further mitigating the impact of the eligibility expansions.

To better understand the changing composition of Medicaid births and how this might affect our results, we present trends in the number of Medicaid deliveries to native and foreign born mothers over this period. As Figure 4 illustrates, total Medicaid births increased substantially over the 1990s as the expansions took effect. However, it appears that almost all this growth was in foreign-born mothers. The number of Medicaid births to native-born mothers remained relatively constant over this period. Furthermore Figure 3C shows that the trends for the segregation index are not very different if we exclude all

[30] The changes in Medicaid eligibility that took place in California between 1989 and 1995 are documented in Appendix C.
[31] Medical Care Statistics, "MediCal Funded Deliveries, 1994-2000." State of California, Department of Health.

foreign-born mothers (both Medicaid and privately insured). And since foreign-born undocumented mothers are on average less healthy than the average Medicaid mother, this change in composition would bias our results downwards (rather than upwards).

Nonetheless, we re-estimate our main results by restricting our sample only to native-born mothers,[32] and recalculate the changes in segregation only for this group. The results (panel A of Table VIII) are quantitatively similar to those we present in Tables IV and V.[33] We also calculated segregation indexes only for Black Medicaid mothers and used it instead of the overall segregation index. Our results, reported in panel B of table VII, are unchanged.[34]

B. Residential segregation

Another possibility is that changes in where Medicaid mothers reside may drive the change in where they deliver. To investigate this possibility we present trends in residential segregation of Medicaid mothers (Figure 3a). Residential segregation at the county level is calculated just like hospital segregation but based on share within zip codes rather than hospitals. While hospital segregation begins to fall in 90-91 coincident with the launching of DSH, residential segregation is actually increasing slightly over this period suggesting that any changes in where Medicaid mothers resided over this period did not drive the change in hospital desegregation that we witness.

C. The hospital market and incentives created under DSH

[32] We do not know whether foreign-born mother are undocumented, so we exclude all foreign-born mothers from the analyses.
[33] The effects of segregation appear to be somewhat larger for counties with initially low levels of segregation, but they remain statistically insignificant.
[34] Using group specific indexes does not alter our previous conclusions for less than high school and Hispanics—Results available upon request.

Finally we investigate the factors that may explain changes in segregation directly. We regress changes in segregation on other county level changes: changes in demographics, changes in residential segregation, changes in the hospital market (hospital openings and closings) and variables related to hospital incentives created under DSH in 1990. If desegregation is caused by DSH, we expect only the hospital incentives in 1990 to predict changes in segregation.

Following Duggan (2000a), we include the following as measures of incentives: the number of hospitals in the county (counties with more hospitals are more competitive), percent of private hospitals (private hospitals responded more strongly to incentives created under DSH), percent of hospitals with low income number between 15 and 25, percent of hospitals with low income number above 25 (these two variables capture the fact that hospitals close to 25 had a large incentive to increase the number of Medicaid patients, but hospitals above the threshold also had incentives since the reimbursements were increasing in the number of Medicaid patients), and the interaction between incorporation and low income number. The dependent variable is the change in segregation from 1990 to 1995, thus positive coefficients correspond to decreases in segregation.

As expected the only variables that are significant are the variables related to incentives (Table VIII). The percent of hospitals with low-income numbers between 15 and 25 or with low-income numbers above 25 that are private reduce segregation (both coefficients are significant at the 10% level). The percent of public hospitals increases segregation, although the coefficient is only significant for those with low-income numbers between 15 and 25. These “incentive variables” are jointly significant at the

10% level. Not only all the other coefficients are insignificant, they are not jointly significant (both test statistics are reported at the bottom of table VIII). Thus, differences across counties in desegregation can be explained by initial market conditions as predicted by Duggan (2000a) but not by changes in hospitals markets or Medicaid characteristics. We note however that these results must be taken with caution since we only have 30 observations, and therefore our low power may prevent us from finding significant effects.

D. Robustness checks

Another concern arises from the fact that our empirical strategy relies on changes overtime within a small number of counties.[35] In order to verify the robustness of the results and insure that they are not driven by one or two counties, we re-estimate the main specifications, dropping one county at a time. The resulting distribution of the estimated betas suggests that the results are very stable (see Table IX). There does not appear to be any one county that drives our results for Black mothers.

E. Why did Blacks move less?

We found that segregation fell more slowly for Blacks than for other Medicaid moms. We have so far interpreted this to mean that Blacks responded less to the increase in choice afforded by DSH. Another possibility is that the hospitals that sought to attract new Medicaid patients as a result of DSH were located disproportionately close to Hispanics and other low income groups and farther away from Blacks. Chandra and Skinner (2003) suggest that one reason Blacks use lower quality hospitals is their geographic proximity to such hospitals. We find no evidence for this hypothesis in the

[35] There are 58 counties in California and we restrict our sample to 30 of them. 28 counties are dropped because they are mostly rural (and thus sparsely populations) and/or have very few hospitals.

California data. Black Medicaid mothers in California have access to significantly more hospitals within 5 miles, both public and private, than other Medicaid mothers. They also had roughly similar geographic access to hospitals facing the strongest incentives to attract Medicaid patients (private hospitals with low income numbers between 15-25 and 25+). Our results for the effect of segregation on neonatal mortality are not affected if we control for the number of hospitals with low income numbers within 5 miles of the zip code center (see Panel D of Table VII).

It does not appear that lower Black mobility is due to smaller benefits (at least in terms of health gains, since, in fact, we find larger benefits). So we conclude that Blacks must face larger costs (of some sort) associated with changing hospitals (although this is not something that we can test directly with our data).

F. Alternative Mechanisms

We have argued that the positive impact of desegregation on outcomes reflects the fact that Medicaid mothers chose to deliver in different (presumably better) hospitals when their access to such hospitals increased. However, other factors may be responsible for the declines in neonatal mortality. First, quality within hospitals may have improved with the infusion of DSH funds, although Duggan (2000a) finds that hospitals did not use DSH funds to invest in the quality of care but rather they "used most of their cash windfalls to increase their holdings of financial assets".

Alternatively, quality could have improved due to the increase in competition among hospitals that sought to attract Medicaid patients. Both these explanations suggest that private mothers would have been positively affected as well. If this were the case, it

would lead us to underestimate the effect of desegregation on birth outcomes among Medicaid mothers.

Alternatively, we could be overestimating the impact of DSH if Medicaid mothers displaced privately insured mothers into worse hospitals, or resulted in crowded hospitals with lower quality care. We know of no evidence that hospitals were at full capacity over this period. In 1995 in California, among the 405 general acute care hospitals, there were only 3 hospitals operating at or above 87% occupancy and 9 hospitals at or above 80%. On average occupancy rates for that year were below 50%.[36] Additionally, our evidence suggests that privately insured mothers did not go to different hospitals after the implementation of DSH.

VII. Interpretation and Implications

We have found that implementation of DSH, which effectively increased Medicaid payment rates for hospitals that qualified, resulted in substantial desegregation of poor publicly insured mothers from separate, often public, hospitals. Interestingly, within Medicaid, most subgroups defined by race, ethnicity or education, took advantage of the increase in access at roughly similar rates with the exception of one group – Black mothers. Ironically, it is Black mothers who benefited the most from the increase in provider access in terms of reduced neonatal mortality. Over this period, neonatal mortality for Black mothers on Medicaid declined from 8.4 to 7.8 neonatal deaths per 1000, or 6 fewer deaths per 10,000 births, reducing the gap between non-Black

[36] Statistics come from the annual hospital financial data maintained by OSHPD.

(domestic) and Black deaths by 3.3 percent. Our estimates suggest that had segregation fallen from .72 to .36 (the interval representing the interdecile range in 1990) for Blacks, the Black-white gap would have fallen by14 percent.

Several conclusions can be drawn from these findings. First, differential access to health care is still an important determinant of health for Blacks and has not been eliminated through expansions in public health insurance, nor can it be explained by persistent residential segregation. Yet simply expanding the number and quality of hospitals available to Blacks is not sufficient to induce them to utilize higher quality care, as evidenced by our finding that Blacks (who stood to gain the most) moved the least.

Second, the fact that so many women with Medicaid switched providers after the introduction of DSH suggests that their choice of provider had previously been constrained because Medicaid payments were below market price. Raising payments increases the amount of competition among hospitals for poor patients and enhances their access to high quality hospital care. In addition, our finding that neonatal mortality declined and that the decline was in most part not due to increases in birth weight implies that quality of care at the hospital of delivery is an important determinant of birth outcomes.

The fact that we find significant improvements in birth outcomes only among those with the highest initial levels of mortality suggests that the marginal productivity of neonatal medical technology is declining. As a result we should expect further increases in access to care to result in smaller improvements in neonatal mortality. Also, it suggests that hospital quality may matter only for extreme cases, thus it may not be surprising to find small or no effects of hospital quality on health for the average patient.

And finally, the finding that among Medicaid mothers, those who stood to gain the most because of higher initial rates of neonatal mortality moved less than others with relatively little to gain has important implications for both the proper functioning of the market for health care as well as how to value high quality care. The fact that Black mothers moved at lower rates could be a sign of inefficiency in the hospital market - either a lack of information or possible discrimination. It is also possible that Black mothers have higher costs of switching hospitals relative to other mothers. It is not possible with our data to investigate these issues but our results certainly suggest that more research in this area is needed.

As to why other Medicaid mothers moved, even though they appeared to have received no benefit - we can think of two distinct reasons. One is that these mothers moved because private hospitals offered amenities that these mothers value but that are not related to the quality of care provided. Alternatively these mothers value ex-ante the availability of high quality care. In other words, it is possible that quality serves as a form on insurance: it is very unlikely that any one-mother may need a neonatal intensive care unit, but the value of its availability in the event of a complication is extremely high. Again, we do not have the ability to distinguish between these hypotheses. But in either case the finding that mothers took advantage of the increase in access by choosing alternative hospitals implies that their choices were previously constrained and that DSH improved their welfare. This suggests that an evaluation of the social benefits of programs such as DSH should include improvements in welfare that are not captured by changes in objective measures of health such as infant mortality.

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Figure 1a. Share of Medicaid Patients at Each Type of Hospital

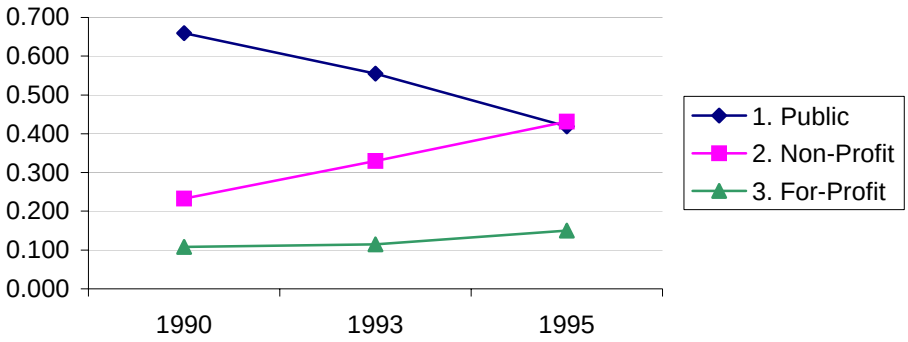

Figure 1b. Share of Indigent Patients at Each Type of Hospital

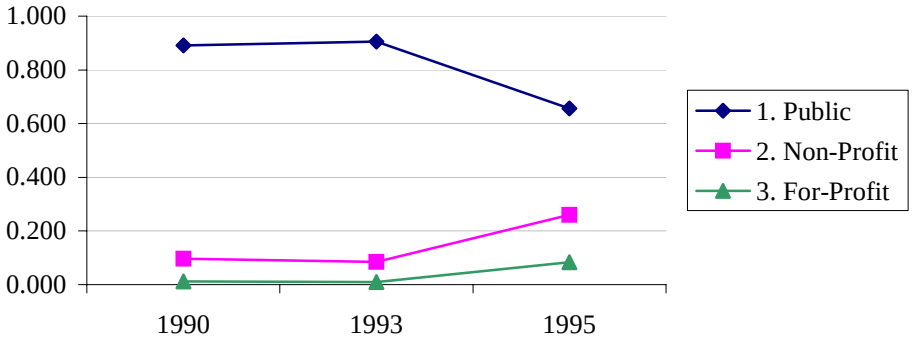

Figure 1c. Share of Private Patients at Each Type of Hospital

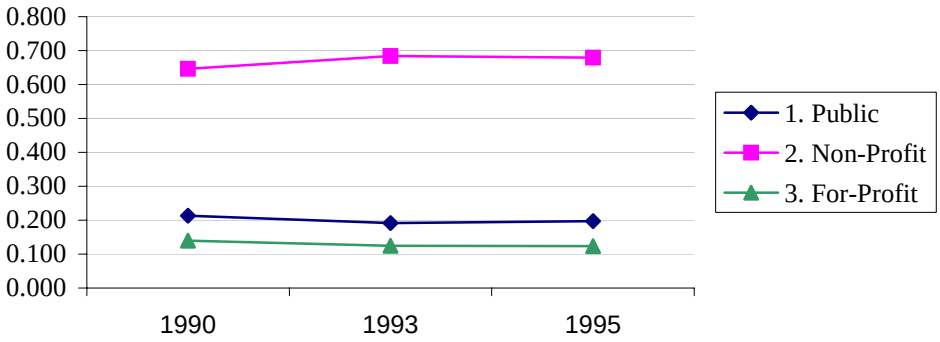

Figure 2a. Share of Medicaid Deliveries at Each Type of Hospital

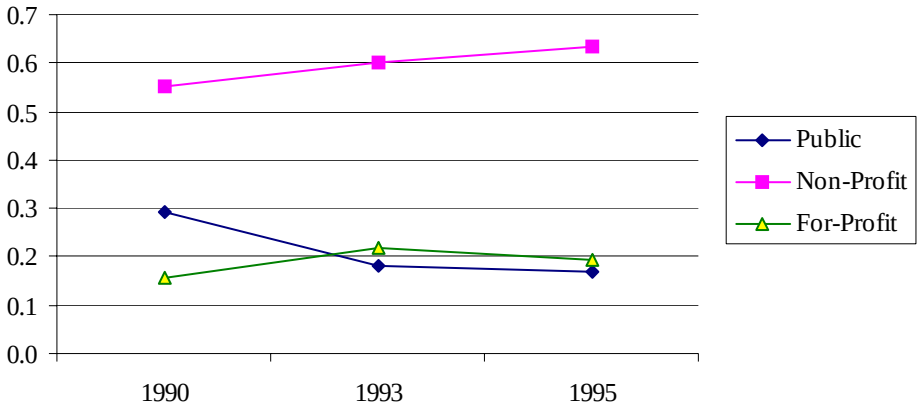

Figure 2b. Share of Private Deliveries at Each Type of Hospital

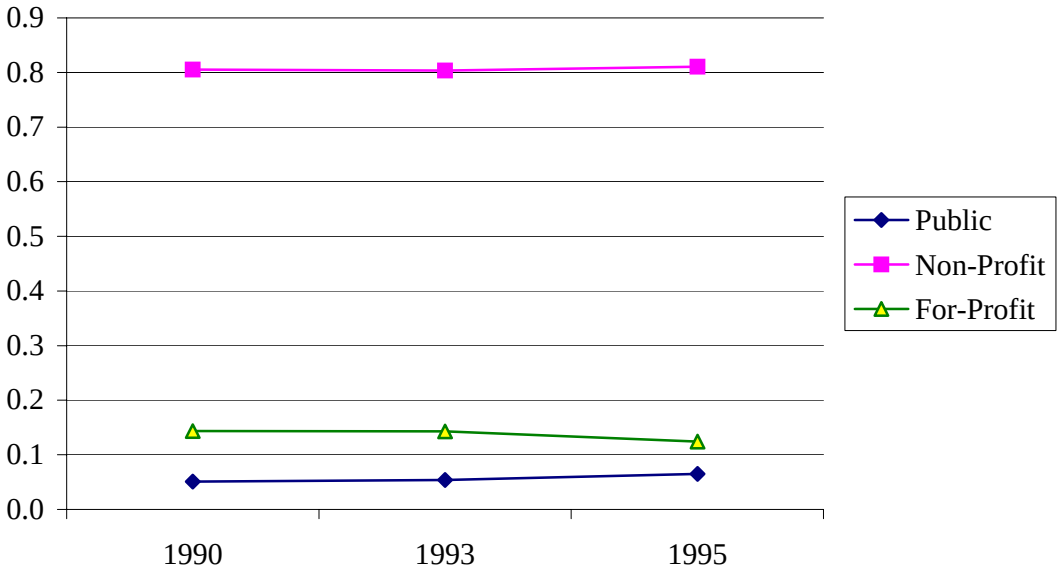

Figure 3a: County Segregation in California, 1989-1995

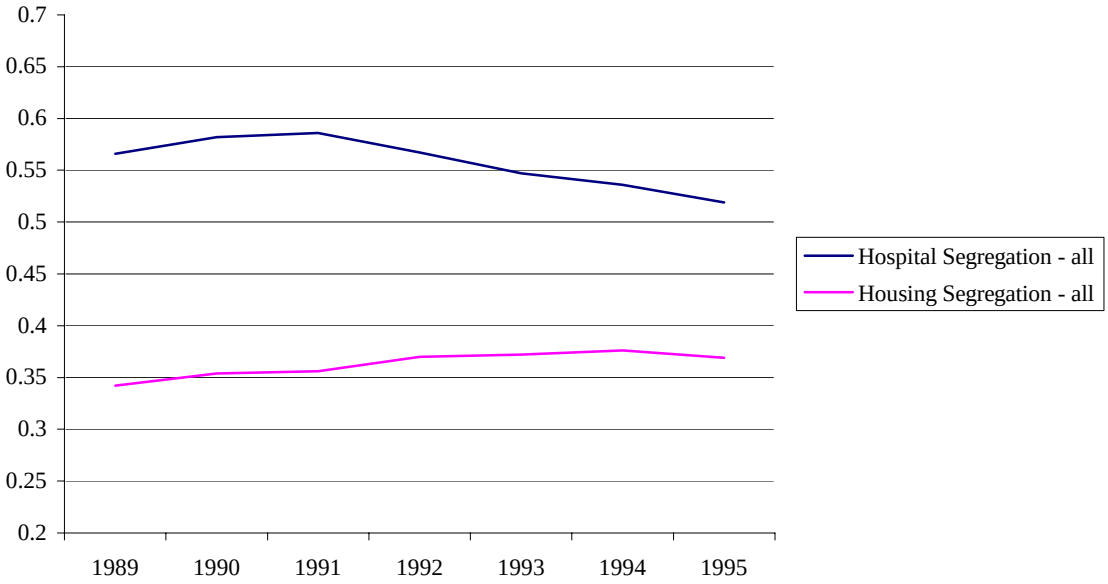

Figure 3b: Segregation index for sub groups of the Medicaid population

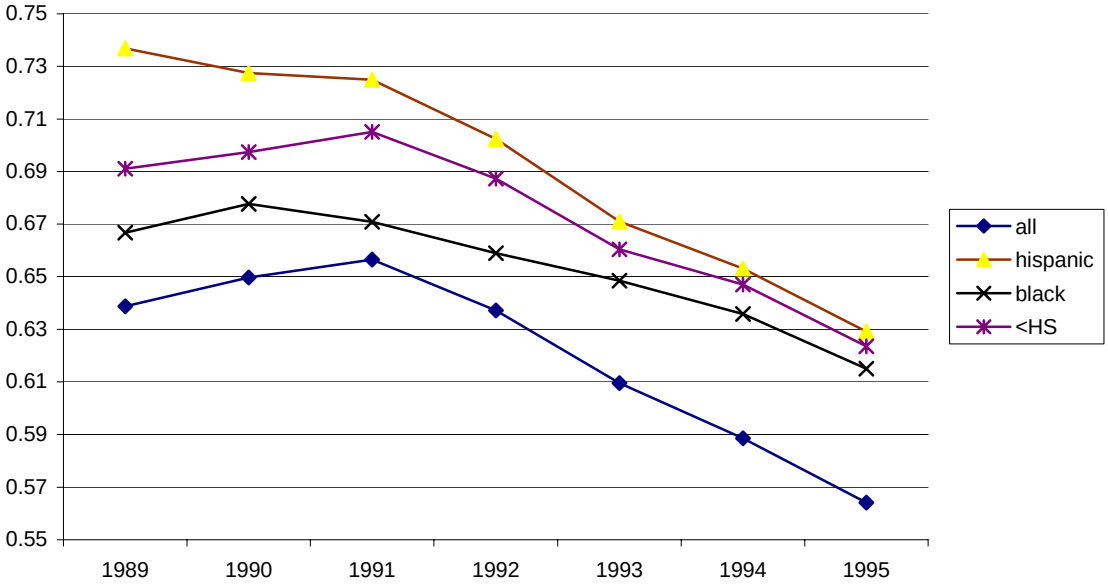

Figure 3c: Trends in segregation, all mothers and native born only

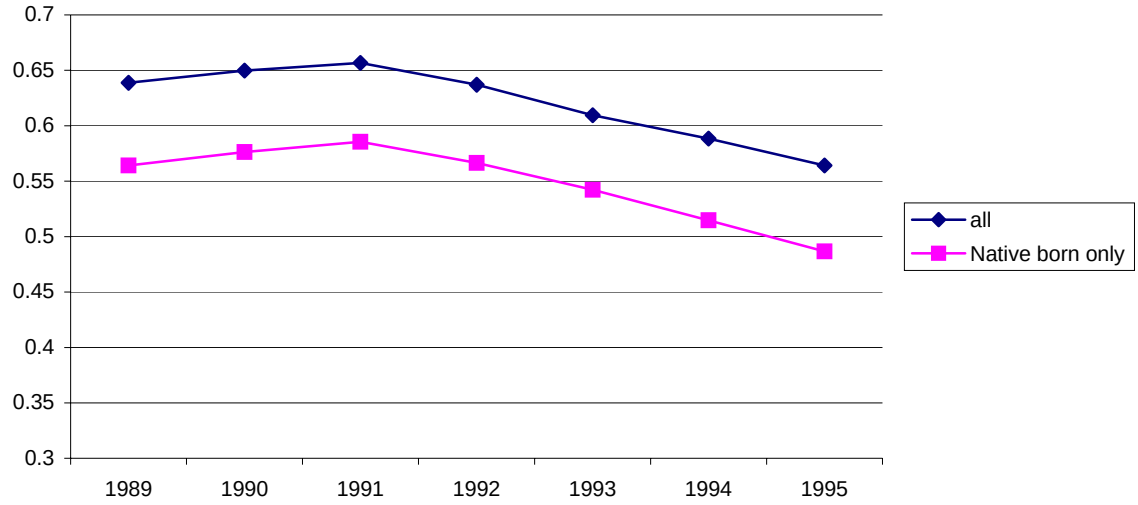

Figure 4: Number of Medicaid births by foreign status, 1989-1995

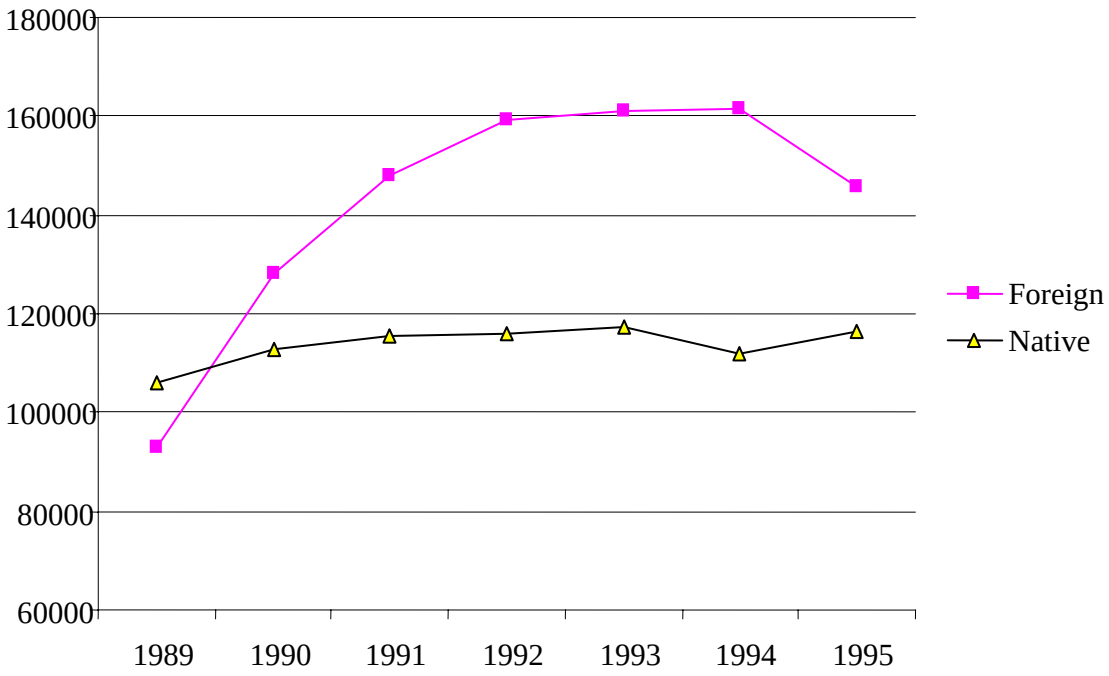

Table I.a
Summary statistics

	All		Medicaid		Private	
Year	1990	1995	1990	1995	1990	1995
Hospital Segregation	0.6541	0.5611	0.6492	0.5600	0.6573	0.5624
	(0.1561)	(0.1330)	(0.1645)	(0.1376)	(0.1501)	(0.1288)
Neonatal Mortality	0.0041	0.0035	0.0048	0.0040	0.0036	0.0031
	(0.0638)	(0.0594)	(0.0688)	(0.0632)	(0.0602)	(0.0557)
Low Birth Weight	0.0594	0.0619	0.0712	0.0679	0.0515	0.0567
	(0.2363)	(0.2410)	(0.2571)	(0.2515)	(0.2211)	(0.2312)
Medicaid	0.3955	0.4651				
	(0.4896)	(0.5000)				
Foreign-born	0.4229	0.4674	0.5980	0.6219	0.3068	0.3308
	(0.4940)	(0.4989)	(0.4903)	(0.4849)	(0.4612)	(0.4704)
Black	0.0816	0.0726	0.1104	0.0892	0.0625	0.0579
	(0.2738)	(0.2595)	(0.3134)	(0.2851)	(0.2420)	(0.2336)
Hispanic	0.4074	0.4623	0.6245	0.6687	0.2633	0.2796
	(0.4914)	(0.4986)	(0.4843)	(0.4707)	(0.4405)	(0.4488)
HS dropout	0.3183	0.3188	0.5915	0.5575	0.1361	0.1062
	(0.4658)	(0.4660)	(0.4915)	(0.4967)	(0.3428)	(0.3081)
Single	0.2903	0.2923	0.5306	0.4622	0.1308	0.1420
	(0.4539)	(0.4548)	(0.4991)	(0.4986)	(0.3372)	(0.3490)

Notes: standard deviation in parenthesis

Table I.b
Summary statistics among Medicaid mothers,
by demographic characteristics, 1990 and 1995

	1990	1995
Neonatal Mortality		
Black	0.0085	0.0079
Non-Black	0.0043	0.0036
Hispanic	0.0043	0.0034
HS dropout	0.0047	0.0035
Very Low Birth Weight (VLBW)		
Black	0.0381	0.0361
Non-Black	0.011	0.012
Hispanic	0.011	0.012
HS dropout	0.012	0.012
Low Birth Weight (LBW)		
Black	0.163	0.154
Non-Black	0.060	0.059
Hispanic	0.056	0.056
HS dropout	0.062	0.061
Inadequate prenatal care		
Black	0.346	0.245
Non-Black	0.387	0.237
Hispanic	0.409	0.233
HS dropout	0.425	0.254
Premature birth		
Black	0.159	0.140
Non-Black	0.079	.076
Hispanic	0.077	0.074
HS dropout	0.085	0.080

Table II
Non-Parametric Trends in Hospital Segregation

Dependent variable:	Hospital segregation index
1989	-0.0118
	[0.0057]
1990	-0.0044
	[0.0056]
1992	-0.0155
	[0.0055]
1993	-0.045
	[0.0055]
1994	-0.0685
	[0.0055]
1995	-0.0962
	[0.0055]
Black	0.0936
	[0.0040]
Hispanic	0.0677
	[0.0036]
HS dropout	0.0569
	[0.0031]
Constant	0.5511
	[0.0044]
Observations	1552
R-squared	0.91
Constant	0.5511
P-values	
Test of trend break 1990	0.752
Test of trend break 1991	0.038
Test of trend break 1992	0.134
Test of trend break 1993	0.521
Test of trend break 1994	0.662
Test of linear trend post 1991	0.379

Table III
Differences in Linear Trend post-1991 by Race and Education

Dependent variable:	HSI	HSI	HSI	HSI
Year*post 1991	-0.03244	-0.03589	-0.0359	-0.0364
	[0.00332]	[0.00560]	[0.0059]	[0.0057]
Year*post 1991*Black		0.01689	0.0172	0.0177
		[0.00829]	[0.0087]	[0.0084]
Year*post 1991* HS dropout		-0.0029	-0.0027	-0.0028
		[0.00687]	[0.0072]	[0.0069]
Year*post 1991*Hispanic		0.00263	0.0032	0.0031
		[0.00788]	[0.0083]	[0.0080]
Year	0.00589	0.00384	0.004	0.0041
	[0.00283]	[0.00477]	[0.0050]	[0.0048]
Year*Black		-0.00529	-0.0053	-0.0058
		[0.00697]	[0.0073]	[0.0070]
Year* HS dropout		0.00737	0.0073	0.0072
		[0.00585]	[0.0061]	[0.0059]
Year*Hispanic		0.00085	0.0007	0.0008
		[0.00678]	[0.0071]	[0.0068]
Post 1991	2.9612	3.28456	3.301	3.3212
	[0.30215]	[0.50998]	[0.5363]	[0.5143]
Post 1991*Black		-1.5481	-1.5605	-1.6313
		[0.75434]	[0.7932]	[0.7607]
Post 1991* HS dropout		0.26148	0.2468	0.2485
		[0.62524]	[0.6576]	[0.6306]
Post 1991*Hispanic		-0.25653	-0.2878	-0.303
		[0.71715]	[0.7543]	[0.7234]
Black	0.09361	0.56251	0.5628	0.6102
	[0.00399]	[0.62731]	[0.6596]	[0.6326]
Hispanic	0.06772	-0.00354	0.0092	0.002
	[0.00362]	[0.61096]	[0.6427]	[0.6163]
HS dropout	0.05692	-0.61549	-0.6111	-0.6002
	[0.00310]	[0.52644]	[0.5537]	[0.5310]
# Hospitals LIN 15-25 within 5 miles*year91*year			-0.0005	
			[0.0001]	
# Hospitals LIN 25+ within 5 miles*year91*year			0	
			[0.0001]	
# Private hospitals within 5 miles*year91*year				-0.0001
				[0.0000]
# Public hospitals within 5 miles*year91*year				0.001
				[0.0001]
Observations	1552	1552	1358	1358
R-squared	0.91	0.91	0.91	0.92

Notes: standard errors (in brackets) are clustered at the county level.

Table IV.A
Impact of Hospital Segregation on Neonatal Mortality—Singleton Births

	(1) All	(2) Black	(3) <HS	(4) Hispanic
Medicaid* ln(1-HSI)*Black		-0.0032		
		[0.0016]		
HSI*Black		0.0015		
		[0.0014]		
Medicaid*Black		0.0115		
		[0.0058]		
Medicaid* ln(1-HSI)* HS dropout			-0.0007	
			[0.0011]	
HSI* HS dropout			-0.0001	
			[0.0009]	
Medicaid* HS dropout			0.0013	
			[0.0038]	
Medicaid*ln(1-HSI)*Hispanic				0.0006
				[0.0008]
HSI*Hispanic				-0.0009
				[0.0004]
Medicaid*Hispanic				-0.0002
				[0.0009]
Medicaid*ln(1-his)	0.0001	0.0003	0.0004	0.0000
	[0.0004]	[0.0004]	[0.0005]	[0.0005]
Ln(1-HSI)	-0.0004	-0.0005	-0.0004	-0.0002
	[0.0006]	[0.0006]	[0.0006]	[0.0003]
HS drop out	0.0005	0.0005	0.0014	0.0005
	[0.0002]	[0.0002]	[0.0032]	[0.0003]
Age 20-29	0.0006	0.0006	0.0006	0.0006
	[0.0002]	[0.0002]	[0.0002]	[0.0001]
Age 30-34	0.0009	0.0009	0.0009	0.0009
	[0.0002]	[0.0002]	[0.0002]	[0.0003]
Black	0.0042	-0.0014	0.0041	0.004
	[0.0003]	[0.0049]	[0.0003]	[0.0005]
Asian	-0.0002	-0.0002	-0.0002	-0.0003
	[0.0004]	[0.0004]	[0.0004]	[0.0002]
Hispanic	0.0004	0.0004	0.0003	-0.0002
	[0.0002]	[0.0002]	[0.0002]	[0.0005]
Other race	0.0007	0.0007	0.0007	0.0006
	[0.0004]	[0.0004]	[0.0004]	[0.0003]
Single	0.0000	0.0000	0.0000	0.0000
	[0.0002]	[0.0002]	[0.0002]	[0.0002]
Foreign Born	-0.0008	-0.0008	-0.0008	-0.0008
	[0.0002]	[0.0002]	[0.0002]	[0.0002]
Commercial HMO penetration	-0.0047	-0.0048	-0.0046	-0.0045
	[0.0021]	[0.0021]	[0.0021]	[0.0018]
Observations	9068	9068	9068	9068
R-squared	0.04	0.04	0.04	0.04

Notes: standard errors (in brackets) are clustered at the county level. Regressions are weighted by number of observations in each cell and they include county fixed effects.

Table IV.B
Impact of Hospital Desegregation on Neonatal Mortality--Twins

	All	Black	<HS	Hispanic
Medicaid* ln(1-HSI)*Black		-0.0734		
		[0.0271]		
Ln(1-HSI)*Black		0.0327		
		[0.0174]		
Medicaid*Black		-0.0752		
		[0.0293]		
Medicaid* ln(1-HSI)* HS dropout			-0.018	
			[0.0176]	
Ln(1-HSI)* HS dropout			0.0082	
			[0.0140]	
Medicaid*Hispanic			-0.0207	
			[0.0217]	
Medicaid* ln(1-HSI)*Hispanic				0.0086
				[0.0157]
Ln(1-HSI)*Hispanic				-0.0032
				[0.0124]
Hispanic*Medicaid				0.0014
				[0.0181]
Medicaid* ln(1-HSI)	-0.0073	0.0005	-0.0023	-0.011
	[0.0041]	[0.0040]	[0.0037]	[0.0061]
Ln(1-HSI)	-0.0029	-0.0039	-0.0032	-0.0019
	[0.0170]	[0.0181]	[0.0167]	[0.0156]
Medicaid	-0.0107	-0.0031	-0.0051	-0.0111
	[0.0054]	[0.0055]	[0.0049]	[0.0081]
Black	0.0201	0.0536	0.02	0.0188
	[0.0044]	[0.0212]	[0.0045]	[0.0044]
HS dropout	-0.0002	-0.0003	0.01	0
	[0.0044]	[0.0042]	[0.0182]	[0.0044]
Hispanic	0.0021	0.0023	0.002	0.0016
	[0.0049]	[0.0052]	[0.0048]	[0.0148]
Observations	2006	2006	2006	2006
R-squared	0.04	0.04	0.04	0.04

Notes: standard errors (in brackets) are clustered at the county level. Regressions are weighted by number of observations in each cell and they include county fixed effects.

Table V
The effect of hospital segregation on neonatal mortality, by initial level of segregation

	High	Low	High	Low	High	Low
Medicaid* ln(1-HSI)*Black	-0.0055	-0.0006				
	[0.0023]	[0.0082]				
Ln(1-HSI)*Black	0.0039	0.0017				
	[0.0029]	[0.0050]				
Medicaid*Black	-0.006	0.0002				
	[0.0026]	[0.0036]				
Medicaid*ln(1-HSI)* HS dropout			-0.0003	0.0029		
			[0.0009]	[0.0043]		
Ln(1-HIS)* HS dropout			-0.0001	-0.008		
			[0.0004]	[0.0035]		
Medicaid* HS dropout			-0.0014	-0.0005		
			[0.0010]	[0.0022]		
Medicaid*ln(1-HSI)*Hispanic					0.0001	0.0059
					[0.0010]	[0.0037]
Ln(1-HIS)*Hispanic					-0.0003	-0.0043
					[0.0007]	[0.0019]
Hispanic*Medicaid					-0.0006	0.0021
					[0.0011]	[0.0017]
Ln(1-HSI)	-0.0005	-0.001	-0.0004	-0.0004	-0.0003	-0.0001
	[0.0007]	[0.0012]	[0.0006]	[0.0010]	[0.0006]	[0.0012]
Medicaid*ln(1-HIS)	0.0005	-0.0011	0.0003	0.0011	0.0002	-0.0026
	[0.0005]	[0.0022]	[0.0006]	[0.0013]	[0.0006]	[0.0012]
Medicaid	0.0012	0.0004	0.0014	0.0019	0.0013	-0.0001
	[0.0006]	[0.0012]	[0.0008]	[0.0008]	[0.0009]	[0.0009]
Black	0.0087	0.0031	0.0044	0.0025	0.0043	0.0024
	[0.0038]	[0.0025]	[0.0006]	[0.0008]	[0.0007]	[0.0008]
HS dropout	0.0004	0.0007	0.001	-0.0019	0.0004	0.0007
	[0.0003]	[0.0007]	[0.0007]	[0.0022]	[0.0003]	[0.0007]
Hispanic	0.0009	-0.0005	0.0008	-0.0005	0.0007	-0.0022
	[0.0002]	[0.0003]	[0.0002]	[0.0004]	[0.0009]	[0.0010]
Twin	0.0203	0.0138	0.0203	0.0138	0.0203	0.0138
	[0.0021]	[0.0036]	[0.0021]	[0.0036]	[0.0021]	[0.0036]
Observations	5829	5442	5829	5442	5829	5442
R-squared	0.08	0.03	0.08	0.03	0.08	0.03

Notes: standard errors (in brackets) are clustered at the county level. Regressions are weighted by number of observations in each cell and they include county fixed effects Regressions include all other controls in table IV (age, HMO penetration, other races, foreign born dummies)

Table VI
The effect of segregation on other outcomes

	Low Birth Weight	Very Low Birth Weight	Pre-Term	Inadequate Prenatal Care	Very Low Birth Weight
Medicaid*ln(1-HSI)*Black	-0.012	-0.0096	-0.0286	-0.0092	-0.0045
	[0.010]	[0.0027]	[0.0109]	[0.0176]	[0.0028]
Medicaid*ln(1-HSI)	-0.002	0.001	0.0006	-0.0331	0.001
	[0.001]	[0.0005]	[0.0024]	[0.0285]	[0.0005]
Ln(1-HSI)*Black	-0.004	0.003	0.0087	-0.0072	0.0015
	[0.007]	[0.0029]	[0.0062]	[0.0122]	[0.0023]
Ln(1-HSI)	0.002	0.0012	0.0067	0.0185	0.000
	[0.002]	[0.0011]	[0.0024]	[0.0316]	[0.0011]
Medicaid*Black	0.029	-0.0024	0.000	-0.0206	-0.0025
	[0.012]	[0.0032]	[0.0120]	[0.0215]	[0.0029]
Medicaid	0.01	0.0044	0.0152	0.1312	0.0017
	[0.002]	[0.0007]	[0.0028]	[0.0367]	[0.0007]
Black	0.043	0.0212	0.0522	0.0411	0.0119
	[0.006]	[0.0031]	[0.0067]	[0.0176]	[0.0026]
HS dropout	0.004	0.001	0.0119	0.0711	-0.0012
	[0.001]	[0.0003]	[0.0012]	[0.0043]	[0.0003]
Hispanic	0.003	0.0023	0.010	0.0236	0.0005
	[0.001]	[0.0003]	[0.0012]	[0.0057]	[0.0003]
Twin	0.429	0.0755	0.2784	-0.0004	0.0249
	[0.008]	[0.0033]	[0.0093]	[0.0035]	[0.0031]
Premature births					0.1804
					[0.0129]
Observations	11267	11267	11142	11271	11138
R-squared	0.69	0.22	0.48	0.73	0.33

Notes: standard errors (in brackets) are clustered at the county level. Regressions are weighted by number of observations in each cell and they include county fixed effects Regressions include all other controls in table IV (age, HMO penetration, other races, foreign born dummies)

Table VII
Specification checks--Black Medicaid mothers

	(1) All	(2) High HSI	(3) Low HSI
Panel A: Native only			
Medicaid*ln(1-HSI)*Black	-0.0028	-0.0055	0.004
	[0.0017]	[0.0018]	[0.0082]
Observations	6131	3095	3036
R-squared	0.07	0.09	0.05
Panel B: Black segregation index			
Medicaid*ln(1-HSI)*Black	-0.0026	-0.0049	0.0023
	[0.0016]	[0.0017]	[0.0061]
Observations	11220	5829	5391
R-squared	0.07	0.08	0.03
Panel C: Controlling for premature births			
Medicaid*ln(1-HSI)*Black	-0.0021	-0.0048	-0.0001
	[0.0021]	[0.0023]	[0.0085]
Observations	11142	5770	5372
R-squared	0.09	0.11	0.05
Panel D: Controlling for proximity to hospitals			
Medicaid*ln(1-HSI)*Black	-0.0031	-0.0045	-0.0004
	[0.0019]	[0.0023]	[0.0033]
Observations	11142	5770	5372
R-squared	0.07	0.48	0.09

Notes: standard errors (in brackets) are clustered at the county level. Regressions are weighted by number of observations in each cell and they include county fixed effects Regressions include all other controls in table IV (age, HMO penetration, other races, foreign born dummies)

Table VIII
What county characteristics explain decreases in segregation?

Dependent variable: Segregation change (1990-1995) Mean 0.088, s.d. (0.80)	Coef.	mean	std dev
1990 incentive variables			
Low Income Number (LIN) between 15 and 25	-0.915	0.128	0.088
	[0.395]		
LIN above 25	-0.200	0.202	0.126
	[0.320]		
Private hospital	-0.007	0.833	0.173
	[0.108]		
Private * LIN(15-25)	0.790	0.111	0.089
	[0.377]		
Private * LIN(25+)	0.973	0.135	0.085
	[0.486]		
Total number of hospitals	-0.001	34.116	28.462
	[0.002]		
Changes in population and market characteristics			
Change in % less than high school	0.196	-0.005	0.024
	[1.102]		
Change in % 20-29	-2.156	0.044	0.020
	[2.599]		
Change in % age 30-35	-0.973	-0.014	0.010
	[3.679]		
Change in % single	-0.214	-0.006	0.023
	[0.962]		
Change in % Black	-4.419	0.007	0.009
	[4.257]		
Change in % Hispanic	-0.525	-0.060	0.030
	[1.474]		
Change in % Asian	-1.076	-0.011	0.014
	[2.676]		
Change in % other race	3.881	-0.007	0.008
	[2.672]		
Change in % foreign born	0.070	-0.050	0.022
	[2.287]		
Change in housing segregation index	-0.941	-0.012	0.024
	[0.671]		
Change in the number of hospitals	-0.082	-0.058	0.083
	[0.204]		
F-statistics (p-value)			
Joint significance of the 1990 incentive variables	2.68		
	(0.07)		
Joint significance of the changes in population and market	1.19		
	(0.38)		

Table IX
Distribution of Estimated Coefficients, dropping one county at a time

	All	High Segregation	Low Segregation
Mean	-0.00309	-0.0055	-0.00098
Median	-0.00311	-0.0055	-0.00063
Minimum	-0.00411	-0.007	-0.02155
Maximum	-0.00176	-0.0043	0.00241
Standard Error	0.000065	0.00007	0.00057
95 % CI	[-.00322,-.00296]	[-.00561,-.00532]	[-.00213,-.00017]

Appendix A
Background on the Disproportionate Share program

History

Hospitals that served Medicaid patients often lost money: Medicaid reimbursement rates were not sufficient to cover the cost of treating Medicaid patients. Additionally, hospitals that did not serve many private patients did not have enough profits from these patients to cross-subsidize the cost of low-income patients. The Disproportionate Share program (DSH) was first introduced in the 1980 and 1981 Omnibus Reconciliation Acts (OBRA) to attempt to alleviate this problem. However it wasn't until 1986, when caps on reimbursements were freed, that states could fully exploit DSH. Each state instituted its own DSH program.

How DSH works

- DSH payments made by the states are eligible for federal reimbursements at a rate of 50 to 80%
- Hospitals qualify for DSH if:
  1- # Medicaid inpatient days > state mean + s.d.
  2- Low income number (revenues from low income patients, i.e. Medicaid and indigent)> 25% total revenues
- Reimbursement for hospitals that qualify:
  1- If qualify in year t, then in year t+1 get a per diem amount
  2- Reimbursement is a increasing non-linear function of a hospitals' low income number
  3- Low income number is calculated using a formula that weights Medicaid patients more than indigent patients
- Restrictions:
  - In 1992 reimbursements were capped at 12% of total Medicaid spending, with exceptions for high spending states such as California.
  - There are other restrictions at the hospitals level, like hospitals cannot make a profit using DSH funds
- Hospitals have greater incentives to attract Medicaid rather than indigent patients
  - Because the low income formula weights them more heavily than indigent patients
  - Because Medicaid patients are also reimbursed at a certain rate through regular Medicaid
  - They may be healthier
- Indirect effects
  - No effects on other Medicaid programs
  - HMO: DSH and managed care are in conflict. Managed care lowers costs mostly through decreasing inpatients care (making it into outpatient care or lowering utilization rates). However the DSH formal is based in inpatient days.

Appendix B
Hospital Segregation Index by county and year, for 30 urban counties

County	1989	1990	1991	1992	1993	1994	1995
Alameda	0.671	0.677	0.667	0.637	0.647	0.623	0.630
Butte	0.209	0.156	0.270	0.201	0.139	0.084	0.031
Contra Costa	0.781	0.809	0.824	0.833	0.844	0.810	0.749
Fresno	0.432	0.535	0.547	0.602	0.615	0.630	0.649
Kern	0.976	0.977	0.984	0.971	0.952	0.914	0.908
Los Angeles	0.723	0.722	0.723	0.693	0.657	0.644	0.621
Marin	0.025	0.116	0.038	0.080	0.107	0.078	0.083
Merced	0.052	0.002	0.035	0.004	0.012	0.055	0.026
Monterey	0.331	0.404	0.478	0.421	0.401	0.349	0.325
Napa	0.073	0.199	0.193	0.197	0.308	0.277	0.265
Orange	0.700	0.690	0.669	0.634	0.623	0.615	0.621
Placer	0.012	0.029	0.005	0.001	0.007	0.012	0.027
Riverside	0.718	0.820	0.758	0.672	0.557	0.511	0.471
Sacramento	0.446	0.455	0.467	0.467	0.465	0.413	0.371
San Bernardino	0.636	0.662	0.741	0.744	0.686	0.567	0.461
San Diego	0.338	0.359	0.418	0.443	0.439	0.431	0.395
San Francisco	0.645	0.669	0.659	0.684	0.692	0.674	0.661
San Joaquin	0.367	0.373	0.361	0.365	0.360	0.336	0.344
San Mateo	0.514	0.532	0.490	0.511	0.483	0.474	0.395
Santa Barbara	0.447	0.338	0.339	0.304	0.269	0.322	0.327
Santa Clara	0.732	0.755	0.749	0.703	0.645	0.624	0.605
Santa Cruz	0.346	0.364	0.411	0.433	0.432	0.470	0.418
Shasta	0.069	0.042	0.040	0.000	0.000	0.001	0.129
Solano	0.614	0.649	0.721	0.720	0.703	0.707	0.636
Sonoma	0.256	0.543	0.615	0.662	0.668	0.640	0.617
Stanislaus	0.401	0.280	0.297	0.331	0.348	0.367	0.384
Sutter	0.006	0.002	0.006	0.000	0.000	0.000	0.000
Tulare	0.216	0.267	0.319	0.216	0.210	0.192	0.027
Ventura	0.760	0.795	0.789	0.791	0.736	0.651	0.547

Appendix C
Changes in Medicaid Eligibility Laws Between 1989 and 1995

Year	Change in Medicaid Law
1989	Income eligibility increased from 110% to 185% of the federal poverty line. Eligibility workers are out stationed to high-volume clinics. Increased reimbursement to obstetric providers.
1990	Coverage extended to undocumented foreign-born women
1992	Asset test eliminated for women with incomes between 185% and 200% of the federal poverty line.
1993	Presumptive eligibility implemented, allowing immediate temporary coverage for women who believe they are eligible. Shortened application form introduced.
1994	Asset test eliminated for all women with incomes below 200% of the federal poverty line.