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Sources of Variation in Avoidable Hospital Use and Cost across Low-Income Communities in New Jersey

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Executive Summary

There is a great deal of geographic variation in healthcare utilization and cost across the United States as well as within the state of New Jersey. Recently, the Rutgers Center for State Health Policy documented substantial variation in avoidable hospital utilization and costs among 13 regions of NJ that are potential candidates for the formation of accountable care organizations (ACOs) in Medicaid. These findings have generated debate among policymakers and stakeholders about the causes of these variations and the extent to which they may be controllable or influenced by local healthcare providers. This debate is directly relevant to the implementation of Medicaid ACOs and other healthcare reforms where providers are directly paid or otherwise judged on the outcomes of their patient populations. Clearly, providers can be held accountable for factors that are within their control (e.g., overinvestment in hospital capacity). In contrast, providers cannot be held directly accountable for broader socioeconomic problems such as widespread unemployment or illiteracy.

To the extent that these factors are major drivers of population health outcomes and outside the control of providers, policymakers may consider adjusting for these factors when measuring provider performance. It is important to note, however, that providers often do have opportunities to help improve socioeconomic factors leading to avoidable healthcare costs. For example, providers can work closely with social service agencies to assure that patients receive help with housing, disability benefits, or other support that might be needed. Moreover, New Jersey's Medicaid ACO model provides financial incentives for providers to engage in these kinds of collaborations.

In this study, we built a database to achieve three related objectives. First, we estimated statistical models to determine the effects of socioeconomic and hospital market variables on ambulatory care sensitive (ACS) hospital admissions, inpatient costs, and emergency department (ED) treat-and-release visits across small areas (i.e., zip codes) of NJ. Second, we developed a socioeconomic risk adjustment methodology to refine the identification of avoidable hospitalization "hot spots", defined as zip codes with unusually high rates of ACS hospital utilization or costs. Under this second objective, we did not include hospital market variables, since these are generally controllable within local healthcare systems, while

socioeconomic variables are more likely to be beyond the direct influence of healthcare providers. Third, we examined how the socioeconomic risk adjustment methodology affected the performance of the 13 potential Medicaid ACO regions by ACS hospital utilization and costs.

Our analysis shows that per capita income is the most important driver of avoidable hospital utilization and costs. For example, a 1% increase in local area per capita income is associated with a 0.85% decrease in avoidable hospitalizations after adjusting for local population size and other key socioeconomic and hospital market variables. After adjusting for income, other socioeconomic indicators (e.g., uninsured rates, race/ethnicity, immigrant population) make generally small or statistically insignificant individual contributions to ACS admission rates across zip codes. Among the hospital market variables examined (including overall bed supply, market concentration, and teaching intensity), the most important is the occupancy rate among local area hospitals. Specifically, a 1% increase in the occupancy rate is associated with a 0.32% decrease in ACS admissions holding all the other socioeconomic and hospital market variables fixed. We found further that the hospital occupancy rate has no association with ACS inpatient costs and a negative association with ACS ED visits.

After socioeconomic risk adjustment, many of NJ's apparent hot spots exhibit rates of avoidable hospital utilization and cost that are well in line with expected performance given their socioeconomic and demographic composition. In contrast, other areas retain their hot spot designations and some new hot spot areas appear after the more detailed socioeconomic adjustment is made.

Most strikingly among the 13 potential Medicaid ACO regions, the Camden region, which is notable for extremely high rates of avoidable hospital utilization and cost, performs well in proportion to what is expected given the city's high level of socioeconomic disadvantage. In contrast, the performance gaps in Jersey City and Asbury Park change very little after socioeconomic risk adjustment.

Our findings show that area income is by far the greatest driver of geographic variation in ACS admissions, inpatient costs, and ED visits. In addition, despite the importance of income, there is potential for modest reduction of ACS admission rates by removing excess capacity from local hospital markets.

Our analysis also introduced a methodology to refine hot spot targeting of avoidable hospital use and cost, which allows for flexibility in defining the goals and expectations that are set for any particular community-based intervention strategy. For example, if zip codes are identified as having disproportionately high ACS admission rates after adjustment for socioeconomic factors, then interventions that focus on the structure of primary care delivery systems should be emphasized. Alternatively, among zip codes that move from very high to moderate rates of ACS admissions after socioeconomic risk adjustment, interventions that focus more directly on the problems associated with poverty and other socioeconomic disadvantages, such as initiatives to expand safe and stable housing or address substance abuse, would likely produce greater benefit than changes in traditional healthcare delivery per se.

Sources of Variation in Avoidable Hospital Use and Cost across Low-Income Communities in New Jersey

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Introduction

Geographic variation in health and healthcare utilization across the United States is well documented (Dartmouth Institute for Health Policy and Clinical Practice 2014; Rosenthal 2012). There is controversy, however, about the main drivers of this variation and the corresponding consequences for health policy. At issue is whether geographic variation is primarily the result of inefficiencies in healthcare finance, delivery, or availability versus underlying differences in the health, cultural, or socioeconomic status of the people who live in different areas (Bach 2010; Cooper 2011; Cooper et al. 2012; Neuberg 2009). If the primary driver is health system inefficiency, then the appropriate policy responses would emphasize changes in healthcare financing and organization. In contrast, if the primary drivers involve connections between health and socioeconomic conditions, then the appropriate policy responses would focus more broadly on improving the social and economic conditions that affect population health rather than a more narrow focus on the delivery of medical care.

Geographic variations recently have been documented within New Jersey. Specifically, avoidable hospital utilization and costs have been shown to vary widely across 13 regions of the state that are potential candidates for the formation of accountable care organizations (ACOs) in Medicaid (Chakravarty et al. 2013). These findings have generated debate among policymakers and stakeholders about the causes of these variations and the extent to which they may be controllable or influenced by local healthcare providers. This debate is directly relevant to the implementation of Medicaid ACOs and other healthcare reforms where providers are directly paid or otherwise judged on the outcomes of their patient populations. Clearly, providers can be held accountable for factors that are within their control (e.g., overinvestment in hospital capacity). In contrast, providers cannot be held directly accountable for broader socioeconomic problems such as widespread unemployment or illiteracy.

To the extent that these factors are major drivers of population health outcomes and outside the control of providers, policymakers may consider adjusting for these factors when measuring provider performance. It is important to note, however, that providers often do have opportunities to help improve socioeconomic factors leading to avoidable healthcare costs. For example, providers can work closely with social service agencies to assure that patients receive help with housing, disability benefits, or other support that might be needed. Moreover, New Jersey's Medicaid ACO model provides financial incentives for providers to engage in these kinds of collaborations.

In this study, we built a database to achieve three related objectives. First, we estimated statistical models to determine the effects of socioeconomic and hospital market variables on avoidable hospital utilization and costs across small areas (i.e., zip codes) of NJ. Second, we developed a socioeconomic risk adjustment methodology to refine the identification of avoidable hospitalization "hot spots", defined as zip codes with unusually high rates of avoidable hospital utilization or costs. Under this second objective, we did not include hospital market variables, since these are generally controllable within local healthcare systems, while socioeconomic variables are more likely to be beyond the direct influence of healthcare providers. Third, we examined how the socioeconomic risk adjustment methodology affected the performance of the 13 potential Medicaid ACO regions by avoidable hospital utilization and costs.

Methodology

Data and Measures

Information about avoidable hospital use was obtained from the New Jersey Discharge Data Collection system (NJDDCS), which contains the universe of uniform billing (UB) records for all inpatient and emergency department encounters in the state's hospitals. Our primary outcome measure was the number of inpatient admissions for ambulatory care sensitive (ACS) conditions, which are typically preventable when patients have access to timely and effective primary care (Billings et al. 1993). We also examined two secondary measures, which capture similar concepts but are not as well validated in scientific literature as ACS admissions. The first secondary measure was the amount of cost associated with ACS inpatient admissions. To calculate this measure, we used hospital charges available from the NJDDCS and converted them to costs using cost-to-charge ratios calculated by the federal Agency for Healthcare Research and Quality through the Healthcare Cost and Utilization Project. All dollar amounts were adjusted to year 2011 purchasing power using the Consumer Price Index. The next secondary measure was the number of ACS treat-and-release ED visits, which were identified using the NYU ED Use Profiling Algorithm (Billings, Parikh, and Mijanovich 2000). To provide stable estimates of avoidable hospital use at the zip code level, we combined data for the years 2008-2010. We excluded children from all analyses, since pediatric ACS conditions are very different from those commonly experienced by adults.

We used data from the 2007-2011 American Community Survey to obtain denominator information in calculations of population-based rates of avoidable hospital use and for direct age-sex adjustment of these rates (Newman 2001). The American Community Survey is conducted by the U.S Census Bureau to provide a range of statistics about people and housing at the neighborhood level. The 2011 five-year data file averages data collected over 2007 through 2011 to provide stable estimates of population characteristics at the zip code level.

The American Community Survey was also used to measure socioeconomic and demographic variables for each zip code. Specifically, we measured variables that indicate socioeconomic disadvantage or disability and were hypothesized to affect local variation in ACS admissions. These variables included per capita income and the percentages of residents who are uninsured, speak English poorly or not at all (as a proxy for recent immigration), receive Supplemental Security Income (SSI) cash benefits, are non-Hispanic black, and are Hispanic. We also measured the percentage of male adults who are employed (i.e., those who are not unemployed or out of the labor force due to disability or inability to find work).

Information about hospital market structure was obtained from the NJDDCS, the B-2 Hospital Utilization Report, and the American Hospital Association (AHA) Annual Survey of Hospitals. The B-2 Hospital Utilization Report is maintained for regulatory purposes by the NJ DOH and includes hospital-level information about hospital capacity and utilization. Using this source, we measured total staffed beds and inpatient occupancy rates. Consistent with our approach for measuring utilization outcomes, we averaged these variables over 2008-2010. We hypothesized that patients in areas with an abundant bed supply and/or low occupancy rates are more likely than patients in other areas to be admitted as inpatients. This hypothesis was based on two reinforcing factors: 1) financial pressure on hospitals to fill empty beds and 2) more stringent admitting criteria that must be used when available beds are scarce. Using the NJDDCS, we calculated the Hirschman-Herfindahl Index (HHI), which is a measure of hospital market concentration, for each zip code. Possible HHI values range from 0 to 1. A value of 0 indicates a highly competitive market where many hospitals divide market shares evenly and a value of 1 indicates a market served by a single monopoly hospital. Using the AHA Survey and the information on total staffed beds from the B-2 report, we calculated the ratio of intern and residents per bed (IRB), which serves as an index for intensity of hospital teaching activity.

Although it is straightforward to calculate ACS hospital use and costs, socioeconomic variables, and the HHI at the zip code level, the assignment of other hospital variables to zip codes requires additional steps. Following DeLia et al. (2009), we created a “hospital choice set” for each zip code. The hospital choice set is the smallest set of hospitals that accounts for at least 90% of all hospital use among residents of the relevant zip code. In other words, the hospital choice set reflects the hospitals that most zip code residents use most of the time. We linked hospital level information to each zip code by taking a weighted average of each variable where the weights were defined as the share of discharges in each zip code attributable to each hospital in the choice set.

Although other health system factors such as physician supply and availability of community health centers are also relevant to avoidable hospitalizations, information about these factors was not available for our study (particularly in a way that could be linked to zip codes). The implications of this for our study findings are discussed in the final section of the report.

Analysis

We tabulated descriptive statistics measuring central tendency and variation in all of the study's outcome and predictor variables. We also displayed age-sex adjusted ACS utilization and costs on maps of NJ. We then used econometric methods to model each outcome measure as a function of socioeconomic and hospital market variables. For a variety of statistical reasons detailed in a technical manuscript that is currently under peer review (DeLia and Lloyd 2014), the dependent variable in each model was an age-sex adjusted total amount (i.e., ACS utilization or cost) with total population included in each model as an independent variable.

Next, we examined how adjustment for socioeconomic variables, which are not within the direct control of local healthcare systems, affected the identification of avoidable hospital utilization and cost hot spots. As mentioned above, we did not adjust for hospital market variables in this part of the analysis, since these are within the direct control of local healthcare systems. As part of our socioeconomic risk adjustment methodology, we compared raw rates of age-sex adjusted admissions with corresponding rates that were adjusted for all of the additional socioeconomic variables described above in addition to direct age-sex adjustment of the dependent variable. This comparison was done using the observed-to-expected ratio methodology commonly used for clinical risk adjustment of patient treatment outcomes (Iezzoni 2013). For any given zip code z, the socioeconomic risk adjusted ACS admission rate is given by the following formula:

(Observed volume in z/Expected volume in z)•(Average statewide age-sex adjusted rate)

To calculate the expected number of ACS admissions, we used econometric models similar to those described above (but without hospital market variables). The same methodology was used to calculate socioeconomic risk adjusted ACS inpatient costs and ED visits. We then compared hot spot maps using the newly risk adjusted rates to the hot spot maps based on adjustments for age and sex only. Finally, we tabulated the three outcome measures for each of the 13 ACO regions with and without the newly developed adjustment methodology.

Our risk adjustment methodology is similar to indirect risk standardization used in epidemiology, which raises some important caveats about how to interpret our findings (Newman 2001). Specifically, zip codes cannot be compared to each other using the observed-to-expected value methodology if there is "covariate imbalance" between zip codes, which in this context would mean zip codes that are very dissimilar in terms of per capita income, racial/ethnic composition, and other variables used in the risk adjustment model (Shahian and

Normand 2008). Thus, the identification of hot spots using this methodology indicates clearly whether zip codes have better or worse than expected performance with respect to their given socioeconomic and demographic profiles. But in general, this methodology cannot be used to rank the performance of any given zip code to all other NJ zip codes, since there are major differences in socioeconomic and demographic profiles across the state's zip codes.

Findings

Table 1 shows the central tendency and variation of all the study variables. Clearly, there is wide variation across NJ zip codes in terms of total volume and per capita rates of ACS utilization and costs. The table also shows the diversity of NJ zip codes by socioeconomic factors and hospital market structure.

Table 1: Descriptive Statistics

			Percentile				
	Mean	**SD**	**10th**	**25th**	**50th**	**75th**	**90th**
Rates of avoidable hospital use, 2008-2010							
ACS admissions per 1,000	16.7	8.4	8.7	11.5	14.8	20.1	25.4
Total ACS admissions	221.3	252.4	28.2	54.4	122.9	293.0	577.1
ACS inpatient costs per 1,000 ($)	167,598	90,500	81,518	109,765	148,404	198,731	266,945
Total ACS inpatient costs ($)	2,253,059	2,644,638	273,134	526,363	1,204,611	2,928,601	5,857,518
ACS ED visits per 1,000	131.0	87.2	59.4	72.5	106.6	157.9	228.5
Total ACS ED visits	1,761.4	2,227.9	194.9	394.1	866.6	2,134.9	4,804.0
Socioeconomic & demographic variables, 2007-2011							
Population	12,306	10,810	2,065	4,286	8,676	17,319	29,543
Per capita income ($)	38,966	14,995	23,227	29,548	35,996	46,452	58,882
Uninsured residents (%)	10.7	7.1	3.8	5.9	9.0	13.0	20.1
Residents who speak English poorly or not at all (%)	9.0	9.3	1.6	2.7	5.8	12.0	20.4
Residents receiving Supplemental Security Income cash benefits (%)	4.9	4.6	1.3	2.2	3.6	5.8	9.5
Male residents who are employed (%)	67.4	8.0	58.0	64.1	68.9	72.1	75.5
Black residents (%)	9.2	15.6	0.3	1.3	3.4	8.9	26.9
Hispanic residents (%)	12.6	14.2	2.4	4.3	7.3	15.1	29.4

[a]HHI is the Hirschman-Herfindahl Index as defined in the text.
SD: standard deviation

Continued on next page

Table 1: Descriptive Statistics (continued)

	Mean	SD	Percentile				
			10th	25th	50th	75th	90th
Hospital variables							
Staffed beds	323.5	104.5	188.6	237.6	318.9	407.7	467.1
Occupancy rate (%)	70.5	8.2	60.4	65.7	71.5	75.4	79.9
Hospital market concentration (HHI)[a]	0.5	0.2	0.3	0.3	0.4	0.6	0.7
Interns & residents per bed	11.1	9.4	1.8	3.8	8.5	15.3	25.6

[a]HHI is the Hirschman-Herfindahl Index as defined in the text.
SD: standard deviation

Table 2 shows the effects of the socioeconomic and hospital market variables on the three outcome measures. To facilitate comparisons across the independent variables, these effects were measured as "elasticities", which convey relationships in terms of percentage changes. For example, if a variable generates an elasticity of 2.0, then a 1% increase in that variable is associated with a 2% increase in the dependent variable holding all other variables fixed.

Not surprisingly, Table 2 shows that a 1% increase in population is associated with an approximately 1% increase in each of the three outcome measures holding the remaining independent variables fixed. More importantly, with the exception of population, per capita income has by far the largest effect on all three outcome measures. For example, a 1% increase in per capita income is associated with a 0.85% decrease in avoidable hospitalizations holding population and other independent variables fixed. The association with per capita income is similar for the two secondary outcome measures.

There is also a small yet statistically significant association between the percentage of residents who are black and each of the three outcome measures. The male employment rate has a significantly negative association with ACS ED visits and a significantly positive association with ACS inpatient costs. The remaining socioeconomic variables have small and statistically insignificant effects on the outcome measures.

Among the hospital market variables, the only one that significantly predicts ACS admissions is the occupancy rate. Specifically, a 1% increase in the occupancy rate is associated with a 0.32% decrease in ACS admissions holding all the other independent variables fixed. This effect is consistent with our hypothesis that hospitals with little or no excess capacity would be less likely to admit borderline cases with ACS conditions.

Table 2: Effects of Hospital Market and Socioeconomic Variables on Ambulatory Care Sensitive (ACS) Hospital Use and Costs

	ACS Admissions[a]	ACS Costs[a]	ACS ED Visits[a] (without admission)
Socioeconomic & demographic variables			
Population	0.99*	0.99*	0.99*
Per capita income ($)	-0.85*	-0.91*	-1.03*
Uninsured residents (%)	-0.02	-0.02	0.00
Residents who speak English poorly or not at all (%)	-0.03	-0.03	-0.07*
Residents receiving Supplemental Security Income cash benefits (%)	0.01	0.01	0.00
Male residents who are employed (%)	0.12	0.40*	-0.41*
Black residents (%)	0.03*	0.03*	0.03*
Hispanic residents (%)	0.04	0.03	0.02
Hospital market variables			
Staffed beds	-0.06	-0.10	0.05
Occupancy rate (%)	-0.32*	0.13	-0.28*
Hospital market concentration (HHI)[b]	0.04	0.00	0.20*
Interns & residents per bed	-0.01	0.01	-0.01

[a]The dependent variable in each model is an age-sex adjusted total volume of hospital utilization or costs.
[b]HHI is the Hirschman-Herfindahl Index as defined in the text.
*Statistically different from 0 at the 5% level of statistical significance.

Table 2, however, also shows that the occupancy rate is not related to costs that are associated with ACS admissions. This finding is also consistent with our hypothesis, since the borderline cases, who are less likely to be admitted when the local hospitals are full, are also the lower-cost cases relative to patients with ACS conditions who need to be admitted regardless of current occupancy levels. In other words, reduction in the use of inpatient care among borderline cases with ACS conditions may not produce any detectable reductions in the total costs of inpatient care for these conditions.

The effects of hospital market variables on ACS treat-and-release ED visits are somewhat unexpected. First, a higher occupancy rate is associated with a smaller amount of ACS ED visits. This finding is not consistent with the hypothesis that higher occupancy would lead to borderline cases being treated and released in the ED instead of being admitted as inpatients. It is important to note, however, that although the NYU ED Use Profiling Algorithm does identify conditions that might be treated on an inpatient or outpatient basis (e.g., acute flare-up of asthma), the algorithm includes many other conditions such as those that are non-emergent or primary care treatable where substitution between inpatient and outpatient care is not plausible. Therefore, the relationship found in Table 2 may instead reflect the effect of an unmeasured variable that is correlated with both occupancy rates and ED visits, a possibility that we discuss further below.

Second, there is a positive and statistically significant association between hospital market concentration (HHI) and the volume of ACS ED visits. This finding is unexpected in light of prior research, which found that avoidable ED use tends to be higher in places where patients have access to a larger number of local EDs (Lowe et al. 2009).

Figure 1: ACS Admission Rates per 1,000 Residents Using Different Adjustment Methods

Age-Sex Adjustment Only   Full Socioeconomic Adjustment

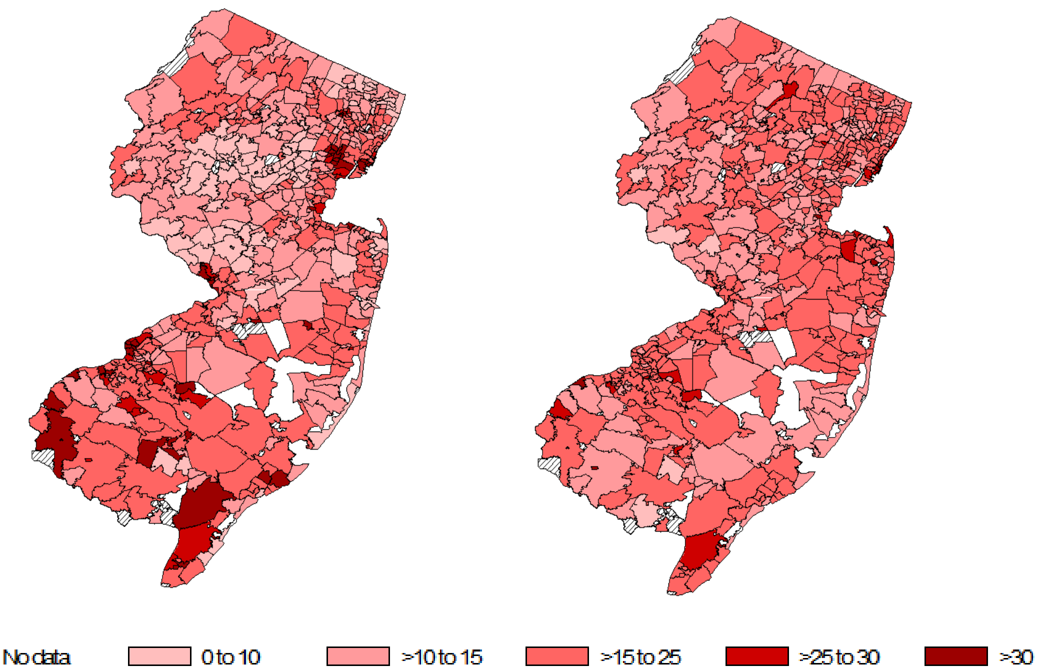
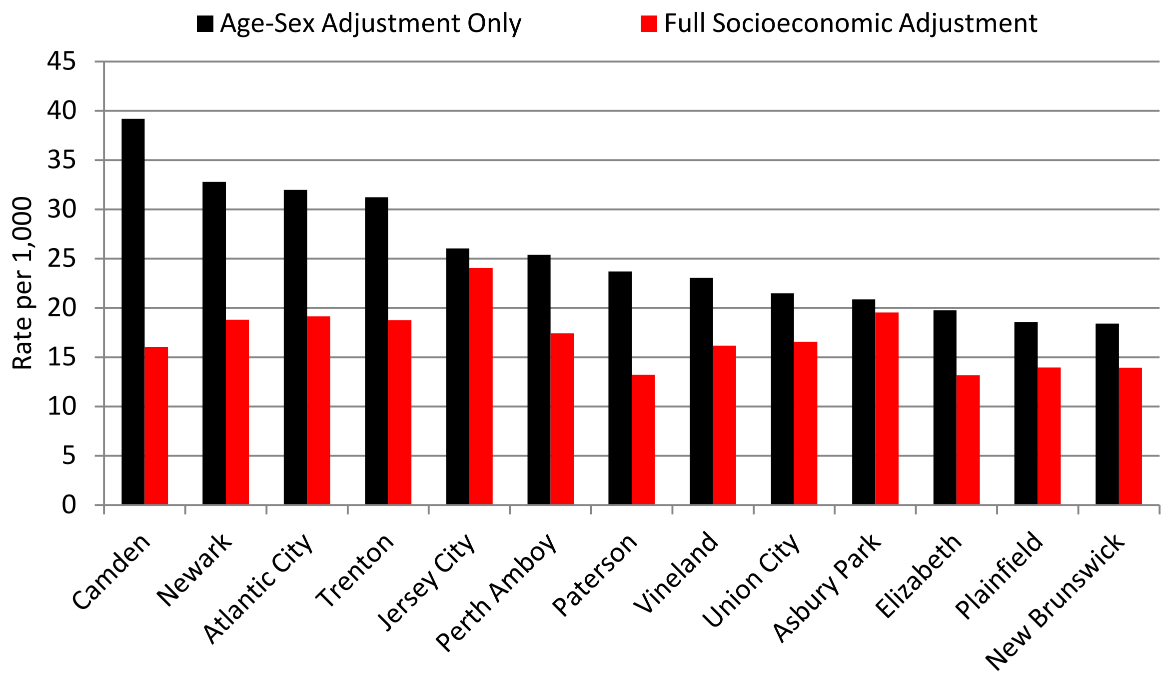


Figure 1 shows how the refined socioeconomic adjustment affects the ACS admission hot spots. Because we are most interested in identifying zip codes with unusually high rates of avoidable hospital utilization and costs, the shading categories in each of the maps correspond to values (after rounding) that define zip codes ranking in one of the following five categories: 1) bottom 20%, 2) above the bottom 20% but within the bottom 50%, 3) above the bottom 50% but within the bottom 90%, 4) above the bottom 90% but within the bottom 95%, and 5) above 95% (i.e., top 5% of all zip codes). After accounting for the added socioeconomic variables, many of the hot spots (in dark red in the left panel) become closer to the statewide average. In other words, the high level of socioeconomic disadvantage in these areas is the driving factor behind their high ACS admission rates. In contrast, other areas retain their hot spot designations and some new hot spot areas appear after the more detailed socioeconomic adjustment is made.

Figure 2 provides a more detailed look at how the refined socioeconomic adjustment affects the performance of the 13 potential Medicaid ACO regions by ACS admission rates. Most strikingly, the Camden region, which is notable for extremely high rates of avoidable hospital utilization and cost, performs well in proportion to what is expected given the city's high level of socioeconomic disadvantage. Although all of the regions experience some reduction in ACS admission rates with the socioeconomic risk adjustment, these reductions are not uniform. In the regions with the smallest of these reductions (e.g., Jersey City, Asbury Park), there appears to be substantial room to reduce ACS admission rates by focusing on the reorganization of healthcare delivery rather than socioeconomic interventions.

Figure 2: ACS Admission Rates among 13 Potential Medicaid ACO Regions Using Different Adjustment Methods



Figures 3 through 6 provide similar information for the two secondary outcome measures. Across all three outcome measures, Camden's performance moves close to the statewide average after the more refined socioeconomic risk adjustment. The performance of the remaining regions depends on the outcome measure and the adjustment methodology employed.

Figure 3: ACS Admission Costs per 1,000 Residents Using Different Adjustment Methods

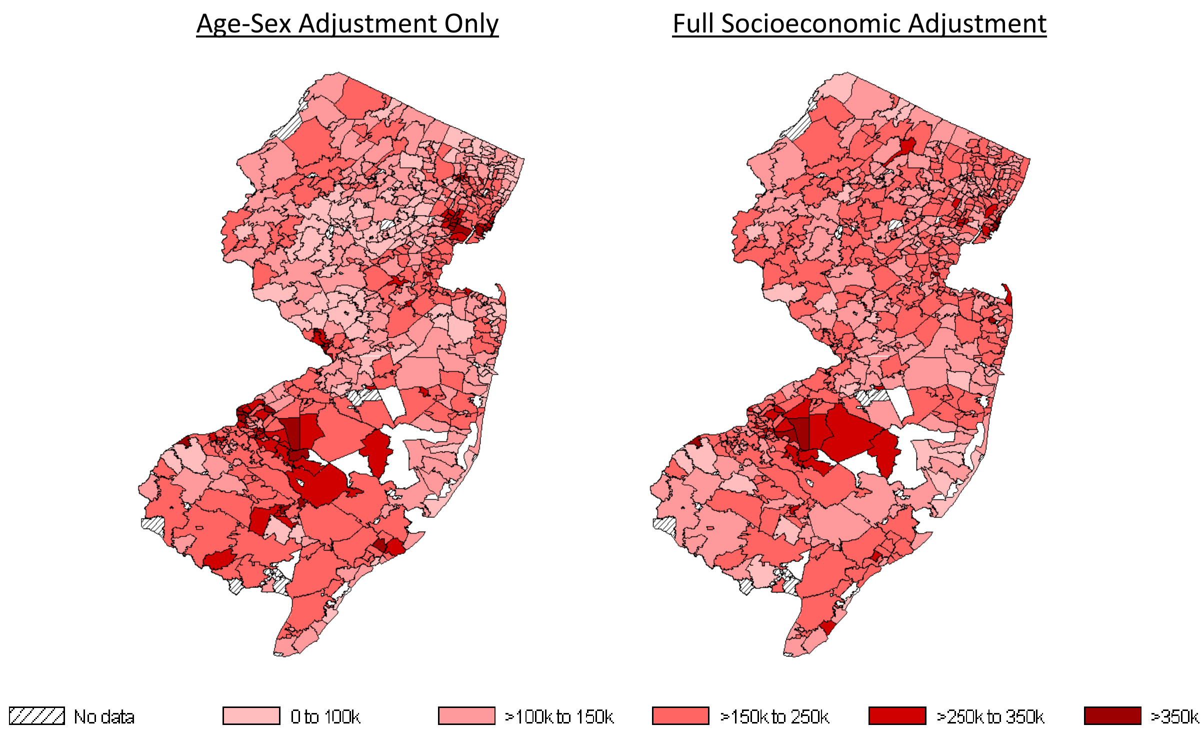


Figure 4: ACS Admission Costs among 13 Potential Medicaid ACO Regions Using Different Adjustment Methods

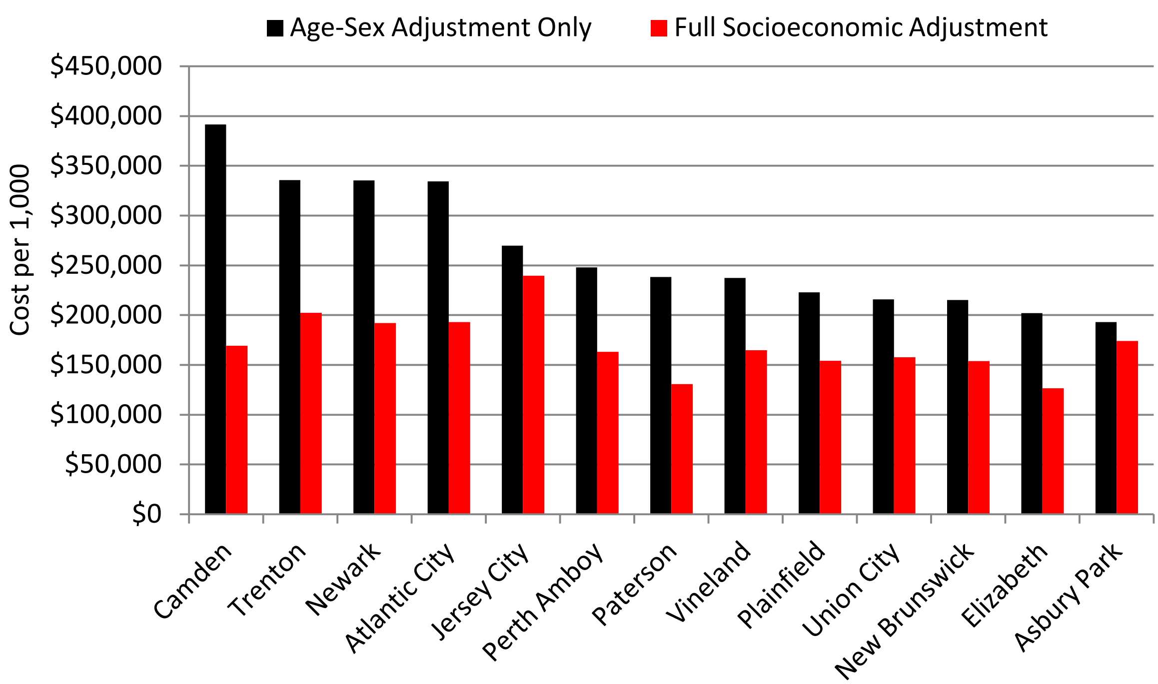


Figure 5: ACS ED Visit Rates per 1,000 Residents Using Different Adjustment Methods

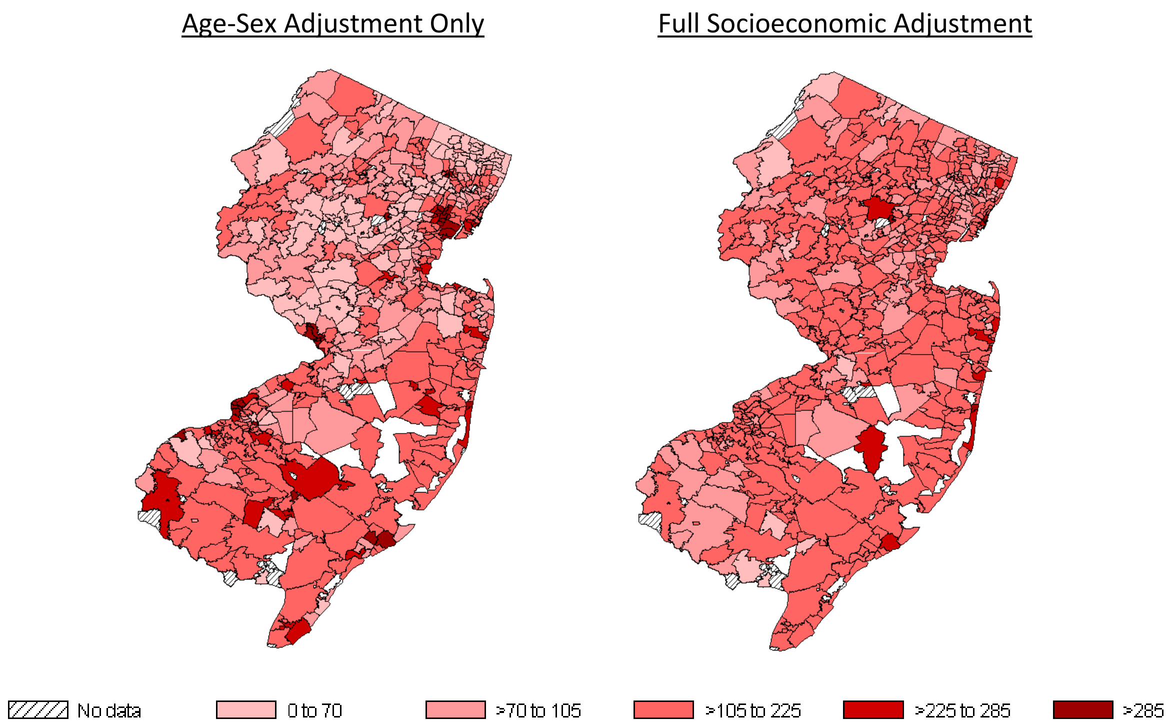
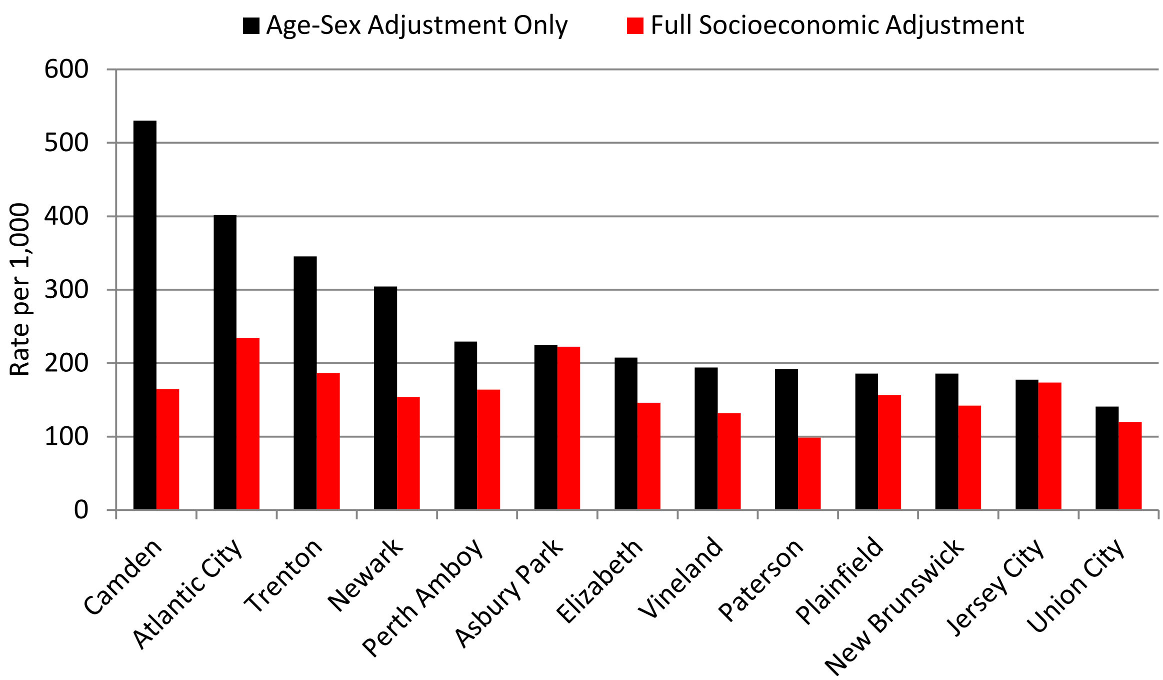


Figure 6: ACS ED Visit Rates among 13 Potential Medicaid ACO Regions Using Different Adjustment Methods



Discussion

In this report, we examined the extent to which geographic variation in avoidable hospital utilization and costs is driven by hospital market and socioeconomic variables. We found that area income is by far the greatest driver of geographic variation in ACS admissions, inpatient costs, and ED visits. After adjusting for income, other socioeconomic indicators each made generally small or statistically insignificant contributions to ACS admission rates across zip codes. We also examined characteristics of hospital markets including bed supply, occupancy rates, concentration, and teaching intensity. Among these, only the occupancy rate had a large and statistically significant effect.

Our findings suggest that despite the importance of income, there is room for modest reduction of ACS admission rates by removing excess capacity from local hospital markets. Hospitals with excess capacity have a clear financial incentive to fill empty beds, especially when they are reimbursed on a fee-for-service basis. For example, when hospitals have excess capacity (i.e., low occupancy rates), they may be more likely to admit marginal cases that would not be admitted if available beds were scarce. Healthcare reforms such as ACOs, shared savings, and population-based payment reward providers for limiting preventable hospitalizations and do not provide incentives to maintain excess capacity. Thus, initiatives such as these may lead to reductions in ACS admissions and excess capacity simultaneously.

Although these reductions would be beneficial in many local hospital markets, some caution is needed to ensure that they do not lead to adverse outcomes. Specifically, pressure to avoid hospital admissions could lead to patients with ACS conditions being treated and released from the hospital emergency department before they are well enough to go home. Also, rapid reductions in hospital capacity might exacerbate existing problems with hospital overcrowding (IOM 2007).

We also introduced a new methodology to refine the identification of avoidable hospital utilization and cost hot spots. Specifically, we used statistical models to calculate socioeconomic risk adjusted rates of ACS admissions, inpatient costs, and ED visits. Our findings show that this refined adjustment substantially changes the zip codes that would be identified as hot spots.

Of course, this does not mean that local areas with high rates of avoidable hospital use or costs before socioeconomic adjustment should no longer be considered hot spots. Instead, our analysis provides different views on the kinds of interventions that would be most useful for addressing the problems that lead to avoidable hospitalizations. For example, if zip codes are identified as having disproportionately high ACS admission rates after adjustment for socioeconomic factors, then interventions that focus on the structure of primary care delivery systems should be emphasized. Alternatively, among zip codes that move from very high to moderate rates of ACS admissions after socioeconomic adjustment, interventions that focus more directly on the problems associated with poverty and other socioeconomic disadvantages, such as initiatives to expand safe and stable housing or address substance abuse, would likely produce greater benefit than changes in traditional healthcare delivery per se.

Our approach to socioeconomic adjustment followed the risk-adjustment literature in attempting to “control away” factors that are not considered under the direct influence of healthcare providers. In many ways, however, the concept of provider influence might be regarded as one of degree and focus rather than a binary yes or no proposition. For example, problems such as homelessness or poor housing conditions do not fall within the boundaries of medical care as traditionally defined. Nevertheless, if these problems are major drivers of avoidable healthcare utilization and spending, then healthcare providers might find it useful to partner with social service professionals to address these issues. As ACOs and other provider coalitions continue to form, many will likely expand and alter the nature of patient services they offer depending on the needs of their patient populations. Thus, the variables that should be included in a socioeconomic adjustment for measuring preventable hospitalization hot spots will depend on the nature of planned interventions and what any particular coalition or regulatory body believes should be “controlled away” as something beyond providers ability to influence.

There is some debate about which variables should be included in socioeconomic adjustment (see, for example, Cook, McGuire, and Zaslavsky 2012). Our adjustment method controls for a broad range of socioeconomic risk factors, including the percentage of the population that is black or Hispanic. While clearly the racial distribution within a community is not is amenable to intervention, including these variables in statistical models may “adjust away” the effects of institutionalized discrimination that could and should be addressed. In the analysis above, we opted to measure socioeconomic status comprehensively, including the racial/ethnic composition of zip codes, in order to help isolate the possible impacts of health system factors. Furthermore, our models above show very small or non-significant associations of race/ethnicity with avoidable use and cost, and therefore, these variables do not substantially influence the identification of avoidable hospital utilization and cost hot spots. Nevertheless, future users of our methodology should be aware that controlling for race and ethnicity would “adjust away” potential problems associated with discrimination that users may wish to address. In future applications of this methodology, it may be informative to conduct adjustments with and without race/ethnicity variables to assess the sensitivity of the adjusted values to these variables.

We examined in greater detail how the newly introduced socioeconomic risk adjustment method affects the performance of the 13 potential Medicaid ACO regions according to ACS admissions, inpatient costs, and ED visits. We found that zip codes in Camden, which are widely considered avoidable hospitalization hot spots, perform well in proportion to what is expected given the city's high level of socioeconomic disadvantage. This finding suggests that the most promising strategies for reducing avoidable hospital use in Camden will need to focus more on addressing issues related to socioeconomic disadvantage rather than improvements in traditional healthcare delivery. In contrast, the performances of Jersey City and Asbury Park change very little after socioeconomic risk adjustment. This finding suggests that rates of avoidable hospital use and cost in these ACO regions are not driven primarily by socioeconomic disadvantage but are instead likely the result of poor performance in the organization of healthcare services.

Our analyses must be viewed in light of some limitations. First, we were not able to adjust for the zip code level prevalence of the specific conditions that lead to ACS admissions (e.g., asthma, heart failure). Prevalence of conditions could fall under the heading of factors that should be controlled away in judging local area performance. Alternatively, providers and public health officials taking a longer term view could be held accountable to some extent for the prevention of many conditions. In these cases, it would not be appropriate to control away these factors.

Second, although our focus was on hospital market factors affecting preventable hospitalizations, there are many other delivery system variables that could be at least as important, especially those related to the supply and availability of primary care providers to local residents. Moreover, these variables, which are often correlated with area income, may account for the strong income effects that we detected in our modeling. Nevertheless, it was not possible for us to obtain primary care supply data in a way that could be assigned to zip codes. Still, as shown in our hot spot analyses, many zip codes have high rates of avoidable hospital use and costs even after accounting for income and other socioeconomic variables. This suggests that reduction in these rates must address issues directly related to healthcare delivery ranging from excess hospital capacity to insufficient primary care capacity.

Overall our analysis shows the primary importance of socioeconomic factors, particularly area income, in determining rates of avoidable hospital utilization and cost, while simultaneously outlining some areas where healthcare delivery might be better organized and delivered. Our analysis also introduced a methodology to refine hot spot targeting of avoidable hospital use and cost, which allows for flexibility in defining the goals and expectations that are set for any particular community-based intervention strategy.

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