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DOES PUBLIC INSURANCE IMPROVE THE EFFICIENCY OF MEDICAL CARE? MEDICAID EXPANSIONS AND CHILD HOSPITALIZATIONS

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ABSTRACT

One of the benefits commonly claimed for expanded public health insurance is improved efficiency of medical care delivery, but this claim has little rigorous empirical support. We provide such support by assessing the impact of the Medicaid expansions over the 1983-1996 period on the incidence of avoidable hospitalizations. We find that expanded public insurance eligibility leads to a significant decline in avoidable hospitalization: over this period Medicaid eligibility expansions were associated with a 22% decline in avoidable hospitalization. But we also find that there is a countervailing and larger impact in terms of increased access to hospital care for newly eligible children, so that there is an overall 10% rise in child hospitalizations due to the expansions. The expansions have mixed implications for treatment intensity, but appear to be associated with a significant shift in the types of hospitals at which children are treated, with fewer children treated in public hospitals and more in for-profit facilities.

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The dramatic rise and high level of uninsurance rates in the U.S., despite an economic boom that has had only one interruption in 15 years, is striking. In 1987, 14.8% of non-elderly Americans were without health insurance. Over the next decade, the non-elderly population without insurance coverage grew by nearly 25% to 18.3%, so that in 1997 there were over 43 million uninsured Americans. Particularly troubling is the significant increase in the uninsurance rates of children in the U.S.; despite dramatic expansions of public health insurance through the Medicaid program since the mid-1980s, the share of children without health insurance has grown by over 10% since 1987, to 15% of children (Fronstin, 1998).

This rise in the uninsured concerns policy-makers for two reasons. The first is that insurance coverage is generally assumed to lead to better health. The second is that insurance coverage is generally assumed to lead to more efficient use of medical care. The presumption is that uninsured individuals will not only use more care when they become insured, but that care will be used more appropriately, for example by using physicians rather than emergency rooms for primary care.

There is a substantial literature assessing the first of these contentions, with both simple comparisons of individuals across insurance states and more sophisticated analyses of exogenous shifts in insurance coverage; see Gruber (1997) for an extensive review. But there is much less evidence on the second contention.

The purpose of our paper is to address this deficiency. We do so by exploring the impacts of the Medicaid expansions of the late 1980s and early 1990s, the largest change in public insurance policy over the past 30 years, on the nature of hospitalizations of children in the U.S. We consider the impact of Medicaid on both the total number of child hospitalizations, and the types of hospitalizations. We explore in particular whether the types of hospitalizations that have been denoted by medical experts as "avoidable" rise or fall as Medicaid is expanded. If Medicaid is increasing access to "more efficient" primary care, then we should observe a decline in these avoidable hospitalizations as Medicaid expands. In theory, since Medicaid is both increasing access for unavoidable hospitalizations, but promoting efficiency that reduces avoidable hospitalizations, the net impact of expansions of the program on hospital use are ambiguous.

We focus our analysis on the hospitalization of children, the demographic group which has been the primary target group of public insurance policy over the past 15 years.[1] While much public policy attention has focused on children, the economics literature on hospitalization has largely ignored them; most work by economists on hospitalization has focused instead on adults and, in particular, the elderly. But children's hospitalizations represent 7% of the total, and 11% of hospital spending is devoted to children. Moreover, there has been a sharp decrease in the incidence of child hospitalization over the past 15 years, with rates falling by almost 50% since 1980, much more than for adults. This trend may be related to the high fraction of children's hospitalizations that is believed to be avoidable - 25 percent as compared to 10 percent for adults. As a result, children are a particularly interesting group to study in this context.

There are two key features of our empirical strategy. The first is the Medicaid expansions, which occurred over the period since 1984 at a very different pace across the states, and across different groups of children within states. This policy heterogeneity provides the exogenous

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[1]There have also been substantial expansions in the coverage of the expenses of pregnancy; see Gruber (1997) for a review. But here the issues of efficiency are different, since virtually every pregnancy results in a hospitalization; rather, the question is whether mothers who gain insurance coverage see physicians earlier in their pregnancies, and if pregnancy outcomes improve as a result. For evidence that this is the case, see Currie and Gruber (1996a).

variation in insurance status necessary to carry out our analysis. The second is our use of the National Hospital Discharge Survey (NHDS), the only nationally representative survey of hospital discharges. These data have large samples of child discharges for each year, as well as detailed information on admission diagnoses that allows us to assess the "avoidability" of hospitalizations. By matching our information on Medicaid eligibility to these data, we are able to assess the impact of insurance status on the number and type of hospitalizations.

We find that extending Medicaid coverage to low-income children has substantially reduced the incidence of avoidable hospitalization, while increasing the rate of hospitalization overall. Between 1983 and 1996, Medicaid expansions led to 22 percent fewer avoidable pediatric hospitalizations, but 10 percent more hospitalizations overall. In addition, the expansions are associated with shorter hospital stays, but a higher number of procedures performed during those stays. They also appear to have significantly increased children's access to for-profit hospitals.

Our paper proceeds as follows. Part I provides background on child hospitalizations, avoidable hospitalizations, and the Medicaid expansions. Part II discusses our data and empirical strategy. Part III presents our results on total and avoidable hospitalizations. Part IV then extends our analysis to consider what Medicaid has done to the nature of child hospitalization more generally, focusing on sources of insurance coverage, intensity of treatment, and the types of hospitals to which children are admitted. Part V concludes.

Part I: Background

Pediatric Hospitalizations

Accounting for 7.2% of all hospital admissions in 1996, pediatric hospitalizations are frequently overlooked in the health economics literature. Yet these hospitalizations were responsible for $20 billion in charges in 1987, the latest year for which data are available, representing 10.7% of hospital charges and nearly half of total expenditures on child health care services.[2] Moreover, recent public health insurance reforms have focused on extending coverage to impoverished children, highlighting the need to understand children's health and health care utilization patterns.

Figure 1 presents time trends in hospitalization rates in the U.S. for the under 15, 15 to 64, and 65 plus populations, estimated using the annual National Hospital Discharge Survey (NHDS). The disparity in hospitalization rates across age groups is large, with the over 65 population hospitalized 9 times as frequently as children (346 per 1,000 elderly vs. 38 per 1,000 children). A marked decline in hospitalization rates during the 1980-1996 period is evident for both the 15-64 and the under 15 groups; the trend in the over 65 category fluctuates during this period, but due to the changing age composition of this group, this trend cannot be meaningfully compared to the trends in the younger groups. Overall, the hospitalization rate declined by 31%, with the relative decline for children (47%) the largest among the three groups.

Table 1 compares the leading causes of pediatric and adult hospitalizations, tabulated using the first-listed diagnosis code in the 1996 NHDS. The table highlights the obvious age-

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[2] Tabulations from the National Medical Expenditure Survey, 1987, as reported in Hahn (1992). Estimates refer to children aged 0 to 17.

related patterns in hospital needs, with diseases of the respiratory system (asthma, pneumonia, and acute infections) topping the list for children, childbirth ranking first for adults 15-64, and diseases of the circulatory system (largely heart disease) accounting for the plurality of hospitalizations among the elderly. Infectious and parasitic diseases, along with the category of endocrine, nutritional, metabolic, and immunity disorders, account for the major afflictions specific to children.

Despite this wealth of statistical information on children's hospitalizations, there is little work by health policy analysts on the causal determinants of child hospitalization; the work that exists is largely descriptive in nature. McConnochie et. al (1997a) review the medical literature on pediatric hospitalizations, and draw two conclusions that are important for our purposes. First, there is a substantial amount of "inappropriateness" or "avoidability" in child hospitalization; we discuss this further below. Second, there is high geographic variation in hospitalization rates of children that is not easily explained by morbidity differences. In their own studies of hospitalization rates for infants of different socioeconomic backgrounds, the authors find that nearly 80 percent of the higher rates for disadvantaged infants is due to "discretionary" as opposed to "mandatory" conditions, suggesting that disease prevalence is not the only determinant of hospitalization. A study of infant hospitalizations for asthma by Homer et al. (1996) controls for morbidity burdens using measures of oxygen saturation in admitted patients, and finds that morbidity does not explain all of the differences in hospitalization rates between Boston and Rochester, New York. Goodman et al. (1994) investigate the effects of demand inducement and health system characteristics on pediatric discharges, concluding that discharges are positively associated with bed supply, and negatively associated with distance from the hospital and residence near an academic medical center.

Finally, several studies have noted that hospitalization rates are higher for the uninsured and Medicaid populations, though these studies do not present separate estimates for children (e.g. Weissman et al., 1992; Billings and Teicholz, 1990). Only two studies of which we are aware, however, utilize a framework that addresses causality between insurance status and the probability of hospitalization for children. The RAND Health Insurance experiment (Manning et al., 1987) uses randomly assigned variation in copayment rates to show that there are insignificant increases in the probability of admission for children covered fully for inpatient expenses versus those covered by cost-sharing plans. On the other hand, Currie and Gruber (1996), using the Medicaid expansions studied here, find that becoming eligible for Medicaid nearly doubles the probability of hospitalization. The discrepancy between these findings may arise from the fact that the RAND experiment capped out-of-pocket exposure at a reasonably low level, so that in many cases those children covered by cost sharing plans were effectively fully insured for hospitalization.

Avoidable Hospitalizations

Defined as hospitalizations that "might not have occurred had [patients] received effective, timely, and continuous outpatient (ambulatory) medical care for certain chronic disease conditions," avoidable hospitalizations (AVHs) are commonly used as a measure of access to health care. As such, the list of AVH diagnoses is carefully selected so as to represent conditions more likely to result from inadequate access to ambulatory care, rather than from differences in disease prevalence or provider practices. The list is therefore distinct from so-called "discretionary" admissions, those for which subjective physician judgment is an integral part of the decision to admit.[3] For example, admissions for immunizable conditions are non-discretionary and avoidable, whereas admissions for acute fever are discretionary but unavoidable. Of course, as noted by Weissman, Gatsonis, and Epstein in their oft-cited 1992 JAMA article on AVH rates by insurance status, "being avoidable is a matter of degree." Nevertheless, the AVH rate is designed to capture the effectiveness of the health care system in providing timely care.

A list of pediatric AVH diagnoses is presented in Table 2. Of the 39.4 million pediatric hospitalizations that occurred between 1983 and 1996, 26 percent were classified as avoidable using this definition. The top 6 avoidable conditions are for asthma (24% of AVHs), pneumonia (23%), gastroenteritis (14%), ear, nose, and throat (ENT) infections (13%), dehydration (8%), and kidney/urinary tract infections (5%). Previous estimates of the share of hospitalizations that are avoidable range from 7 to 12 percent for the nonelderly population as a whole and 18 to 28 percent for children.[4] We use the criteria defined in Gadomski et al. (1997), who base their definition on a 1993 Institute of Medicine report on access to health care. The authors revise the general definition provided in the report, excluding adult conditions and dental diagnoses and adjusting the criteria to reflect pediatric illnesses. There are two other definitions used in the literature, but one is not specific to children (Weissman et al, 1992), and the second (Casanova and Starfield, 1995) is a slightly more expansive version of the Gadomski et al. list, classifying 29 percent of the NHDS hospitalizations as avoidable. Given the minimal differences between the two pediatric definitions available, we choose the more conservative measure.

[3] McConnochie et al. (1997b).

[4] Weissman et al. (1992); Pappas et al. (1990); Casanova and Starfield (1995); McConnochie et al. (1997a). Note the estimates that include adults exclude psychiatric and obstetrical admissions.

Time series trends in avoidable hospitalizations are presented in Figure 2, which shows both AVH rates per 1,000 population under age 16, and the share of hospitalizations for this age group which are categorized as avoidable. Between 1983 and 1996, there was a steep decline in the AVH rate of nearly 35 percent. However, this decline is slower than the overall decline in hospitalization of children documented above, so the share of hospitalizations that are avoidable is rising.

Previous research on AVHs has concentrated on two areas: (1) calculating age and gender-standardized AVH rates for different populations and types of insurance coverage; (2) establishing a causal link between inadequate ambulatory care and subsequent AVHs. A good example of the research in the first area is Weissman, Gatsonis, and Epstein, who studied the relative risk of admission, by insurance status, for 12 AVH conditions in the under 65 population residing in Maryland and Massachusetts in 1987. After adjusting for age, sex, and baseline hospital utilization for unavoidable conditions, the relative AVH admission rates for the uninsured as compared to the privately insured were 1.71 in Massachusetts and 1.49 in Maryland. For Medicaid recipients, the relative AVH admission rates were 1.84 and 1.65 in Massachusetts and Maryland, respectively.[5]

This work, though useful for descriptive purposes, fails to control adequately for omitted variables influencing both insurance status and AVH incidence, and therefore cannot provide evidence on a potential causal link between the two. For example, those who are uninsured may be in worse underlying health, leading to more avoidable hospitalizations independent of their

[5]Two other studies that examine the relationship between insurance status and AVH rates are Billings and Teicholz (1990) and Pappas et al. (1997).

insurance status. By exploiting exogenous changes in insurance coverage across different age groups and states over time, our approach enables us to surmount these types of biases.

The only previous work of which we are aware that attempts to assess the impact of exogenous insurance shifts on the efficiency of hospitalization is Kaestner, Joyce, and Racine (1999). They use data from 11 states to examine whether children who live in low income areas are less likely to be admitted for avoidable categories of illnesses when Medicaid expands in those areas. Their results are mixed, with decreases in non-asthma avoidable hospitalizations but increases in asthma hospitalizations for younger children, and no impact on older children. One limitation of their approach is that the denominator for their analysis is either total hospitalizations or total births at those hospitals, both of which are likely to be rising as Medicaid expands (since the expansions for pregnancy are correlated with the expansions for children); this could lead to a relative fall in avoidable hospitalizations even as absolute avoidable hospitalizations are rising. The question of relevance for thinking about efficiency is not whether avoidable hospitalizations rose more quickly or slowly than total hospitalizations; it is whether avoidable hospitalizations rise or fall at all as Medicaid expands. This is the question that we address.

The remainder of the work in this first area consists of a number of medical papers documenting significantly higher AVH rates among low-income populations and blacks (e.g. Begley et al., 1994; Billings et al., 1993). The authors acknowledge that they cannot fully control for disease prevalence among the different populations, and therefore the evidence they find, while supportive of the hypothesis that AVHs are an outcome associated with poor access to ambulatory care, is not conclusive.

The second strand of literature provides evidence for the presumption that avoidable hospitalizations are indeed avoidable; that is, that increased consumption of outpatient services does, in fact, deliver fewer AVHs. One approach has been to link aggregate measures of access to medical care with corresponding data on AVH rates. Using hospital discharge data from 26 health service areas (HSAs) in Pennsylvania in 1989, Parchman and Culler (1994) find that higher per-capita rates of family and general practice physicians are negatively associated with AVH rates, after controlling for the effects of mean per-capita income. Another approach has been to show that avoidable hospitalizations are associated with inadequate pre-hospital care. Solberg et al. (1990) find that 45% of avoidable hospitalizations studied failed explicit quality criteria and 10% were judged by physicians to have received poor-quality care. A third approach is taken by Homer et al. (1996) and Holfan and Newacheck (1993), who show that places and income groups with lower rates of preventative care for childhood asthma have higher rates of hospitalization, though this association could also be explained by a host of other intermediating factors between location and poverty status and hospitalization. Finally, Gadomski et al. (1998) evaluated the Maryland Access to Care (MAC) Medicaid managed care program, which emphasized improved access to primary care. They find that the program increased the odds of ambulatory care, and that among those children who did use ambulatory care, the program was associated with decreased probabilities of both hospitalization in general and avoidable hospitalization in particular.

Each of these approaches has limitations, but the weight of the evidence supports the contention of a link between inadequate primary care and avoidable hospitalization. We therefore follow the medical literature in employing the AVH rate as a measure of the efficiency of patient care.

Medicaid Expansions

Historically, Medicaid eligibility for children has been tied to participation in the Aid for Families with Dependent Children program (AFDC). This linkage with AFDC restricted access to the program in three ways. First, despite the existence of the AFDC-Unemployed Parents program (AFDC-UP) which provides benefits to households in which the primary earner is unemployed, AFDC benefits were generally available only to single-parent households. Second, income cutoffs for cash welfare vary across states, and can be very low. For example, in 1984, the cutoff for a family of 4 in South Carolina was only 29 percent of the poverty line. Third, the stigma of applying for cash welfare programs may have prevented eligible families from receiving Medicaid benefits.

In some states, children could also qualify for Medicaid under state Medically Needy or Ribicoff programs. The Medically Needy program relaxed the income criteria for eligibility by covering people who would have been eligible for AFDC if their incomes were lower, but who had large medical expenditures that brought their "net income" below program thresholds. The Ribicoff option allowed states to cover children in two-parent families who met the AFDC income criteria.

Beginning with the Deficit Reduction Act of 1984 (DEFRA '84), the linkage between AFDC coverage and eligibility for Medicaid has gradually been weakened. DEFRA '84 eliminated the family structure requirements for Medicaid eligibility of young children by requiring states to cover children born after September 1, 1983 who lived in families that were income-eligible for AFDC. DEFRA was followed by a series of measures that raised the income cutoffs for Medicaid eligibility, first at state option, and then by federal mandate. These options are described in Appendix 1. The important point to note is that states took up these options at different rates, so that there was a great deal of variation across states in both the income thresholds and the age limits governing Medicaid eligibility.

Over the 1983 to 1996 sample period we use, we estimate that the fraction of children under 16 who were eligible for Medicaid rose by 16 percentage points. But this national trend masks considerable heterogeneity across the states: there was actually a decline in eligibility of 2% in Alaska during this period, and a rise of 37% in West Virginia. In addition, there is also heterogeneity within states in the rate at which children of different ages were covered. For example, coverage of infants under 1 rose by over 45% in Texas, while coverage of children ages 11 to 15 rose by less than 5%. It is this variation across states, within states over time, and even across different age groups in the same state at a given point in time, that we use to identify our models.

Part II: Data and Empirical Strategy

Data

Our study period begins in 1983, nearly a year before the first federally-mandated expansions took effect, and continues through 1996, the latest year for which all the data are available. The source of our hospitalization data is the National Hospital Discharge Survey (NHDS), the only continuous nationwide survey of inpatient utilization of non-federal, short-stay hospitals. The NHDS samples approximately 250,000 discharges annually, collecting data on diagnosis and procedure codes, discharge status, length of stay, and selected hospital and demographic characteristics. Weights provided with the survey data enable estimation of statistics for the universe of annual hospitalizations in the United States.

Because our primary independent variable of interest, Medicaid eligibility, varies only by state, birth date, and calendar quarter, we group the individual hospital data into cells. The sample size does not permit grouping at such a fine level of detail, so we define cells for 4 age categories for each state and year. The age categories are children under 1 year old, 1-5 year-olds, 6-10 year-olds, and 11-15 year-olds. Note that the under 1 category does not include the initial hospitalization of newborns admitted upon birth. This age group nevertheless warrants its own category, both because it accounts for 27.6% of total hospitalizations to children under 15 during the study period, and because many federal and state initiatives have expanded Medicaid eligibility specifically for infants under 1 year old.

Of the resulting 2,856 cells (4 age categories * 14 years * 51 "states" (50 states plus Washington, DC), we drop 348 because the corresponding state-years are not surveyed at all, 180 because they are poorly surveyed for several consecutive years, and 20 because they are undersampled in advance of being excluded entirely from the sample. These rules affect 16 states in total: 3 are dropped entirely from the sample, 11 are dropped in the late 1980s when the survey data suddenly becomes patchy or disappears, and 2 are missing data for 2 consecutive years in the middle of the study period but are otherwise included in the sample. Regressions of a dummy for inclusion in the data set on our independent variables revealed no systematic relationship between the probability of inclusion and our variables of interest. Each of the remaining 2,308 cells is then matched to the appropriate age/state/year population estimate from the Census Bureau. We calculate hospitalization rates by dividing the weighted number of hospitalizations in each cell by population.

The major advantage of the NHDS is that it provides a large, nationally representative sample of hospital discharges, with information on diagnosis at hospitalization that can be used to identify avoidable hospitalizations. The major disadvantage is that the NHDS is not designed to yield state-specific estimates of either total or child hospitalizations. Discharges from hospitals with 1,000 or more beds are sampled with certainty, while discharges from smaller institutions are selected using a stratified, three-stage design, with selection of primary sampling units (PSUs), hospitals within the selected PSUs, and discharges within the hospitals constituting the first, second, and third stages, respectively.

This sampling design leads to two problems for the empirical analysis, which relies on state level estimates of hospitalization rates. First, this sampling approach can and does leave a number of states entirely (or almost entirely) out of the survey. Discharges in the states that are included in the survey are overweighted in order to produce national estimates; thus, a number of state cells have large numbers of weighted hospitalizations relative to the underlying state population. Since we only include states that have survey data, this results in a high rate of hospitalizations in our dataset, relative to the true national average. Second, since the PSUs can cross state boundaries, a sample which is representative of a PSU need not represent the individual states that comprise it.

Neither of these factors would present a significant problem for the analysis if the sampling rules remained fixed from year to year. By including state fixed effects, we can capture the extent to which states' estimated hospitalization rates deviate from representative levels. We can also reduce the influence of outliers by censoring the hospitalization rates.[6] But there is reason to believe that the sampling rules within states change over time, particularly in 1987 when there is a redesign of the NHDS. This could be particularly problematic for our analysis if there is a shift in the composition of hospitals across states within a PSU.

As a result, we also include in our model a set of state*year interactions. These interactions allow for changes within states over time in the sampling frame of hospitals, and also control for other state time trends which may be correlated with Medicaid eligibility policy. Our model is still identified when these are included, since the expansions occurred at a differential pace for different age groups.

The final issue related to the sampling design concerns the question of what weights to use for our regression analysis. The accuracy of the NHDS estimate for a given cell depends not on the sample size of that cell per se, but on the sampling probability of a discharge within that cell. Thus, even if a larger number of discharges for 1-5 year-olds are sampled in California than in Rhode Island, the accuracy of the hospital statistics for 1-5 year-olds in Rhode Island will be much greater if the sample represents a larger fraction of the universe of discharges. Restrictions on the use of our NHDS dataset, discussed briefly below, prevented our calculating these sampling probabilities for each cell. We were, however, able to develop approximate sampling probabilities for each state and year using the ratio of total NHDS survey discharges in that state and year to total discharges in that state and year as reported by the American Hospital Association.

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[6]We censor the individual cell hospitalization rate at 0.5. Our results are not very sensitive to the censoring point used.

Descriptive statistics for our cell data, calculated using these weights, are presented in Table 3. The first panel shows several key variables as a fraction of the population. The hospitalization rate in our sample is 10.3%, which is significantly higher than the aggregate rate shown in Figure 1; as noted above, this arises through the fact that we are only using sampled cells in the NHDS, which are overweighted to represent the nation. Nevertheless, the time trend in our data is very similar to the national trend, suggesting little systematic bias to our estimates as a result. The AVH rate is 2.5 percentage points, or 24% of the total hospitalization rate. The incidence of the leading causes of avoidable hospitalization are shown as well. The second panel describes the distribution of characteristics of hospitalizations. About 56% of hospitalizations are financed by private insurance, and about one-quarter by Medicaid. Over four-fifths of hospitalizations in the sample occur in non-profit hospitals.

Due to the sensitive nature of the information gathered in the NHDS, geographic identifiers are not released in the public use files. We were able to create the NHDS data cells and match Medicaid policy variables to those cells through an agreement with the Research Data Center at the National Center for Health Statistics. Once the dataset was complete, we were allowed restricted remote access to the data.

Empirical Strategy

Our key variable of interest is the percentage of children in each age group, state, and year eligible for Medicaid. We estimate this variable using a detailed simulation model originally developed for Currie and Gruber (1996a,b), and updated through 1996 for this project. This model uses information on family structure, age, income, state and year to impute eligibility for

Medicaid using state-specific rules for AFDC and expansion eligibility. These earlier papers describe this model in more detail.

We begin by extracting data for 0 to 16 year-olds from the March Current Population Survey (CPS) data for each year, which has sufficient information on income, family structure, and location to determine eligibility for Medicaid. We then compute eligibility for each child in the CPS data, aggregate into the age groups used for our NHDS sample (0, 1-5, 6-10, 11-15), and match the eligibility measures onto the NHDS sample by age group, state, and year.

After matching these eligibility measures to our NHDS data, we can estimate models of the following form:

(1) $$HOSP_{ajt} = \alpha + \beta_1 ELIG_{ajt} + \beta_2 \eta_a + \beta_3 \delta_j + \beta_4 \tau_t + \beta_5 \delta_j{*}\tau_t + \varepsilon_{ajt}$$

where a indexes age groups, j indexes states, and t indexes years; HOSP is the hospitalization rate (or one of our other dependent variables), ELIG is the fraction of children eligible for Medicaid in each age group/state/year cell, and η_a, δ_j, and τ_t are full sets of dummy variables for age group, state, and year, respectively.

This model relates the rate of hospitalization in a cell to the probability that a child in that cell is eligible for Medicaid. We control for age group, state, and year fixed effects to capture any underlying correlation between Medicaid eligibility and hospitalization across these groups. In addition, as discussed above, we include a full set of state*year interactions to control both for any changes in the NHDS sampling frame that change how a state is represented in our data, and for other state-specific trends that might be correlated with Medicaid eligibility policy.

Even in this rich framework, however, two concerns remain with our ELIG measure. The first is measurement error: given the small sample sizes by age group and state in the CPS, there is likely to be substantial noise in our measure relative to true population Medicaid eligibility. The second is omitted variables bias: the actual eligibility of these children will be correlated with omitted factors that also determine their hospitalization rates. For example, a recession that hits a given state/age group particularly hard may lead to both rising Medicaid eligibility and rising hospitalization.

We therefore instrument for actual eligibility using what Currie and Gruber call "simulated eligibility". To construct this instrument, we begin by drawing a nationally representative random sample of 250 children of each age from each year's CPS. Then, we take this *same sample* through our simulation programs to calculate the fraction of children of each age who would be eligible for Medicaid if they lived in each state. That is, we ask how many zero year olds would have been eligible had they lived in California, how many would have been eligible had they lived in Texas, etc. We then once again aggregate these data into the NHDS age groupings, and match them onto the NHDS data by age group, state and year. These simulated eligibility estimates become instruments for actual eligibility, and we estimate our models below by two-stage least squares.

This nationally representative population measure provides a convenient index of the generosity of state Medicaid rules that utilizes only variation in the eligibility rules across states, years, and age groups of children. It is independent of factors specific to state/age groups that might affect both Medicaid eligibility and hospitalization rates. This instrumental variables strategy also surmounts measurement error problems in our actual eligibility measure, so long as the error does not derive from miscoding of state rules. As shown in Table 3, about one-quarter of the children for whom hospital data is available are estimated to be eligible for Medicaid over this sample period.

Part III : Basic Results

Total Hospitalizations

The first column of Table 4 presents our results for total hospitalizations. As noted above, our dependent variable is the rate of hospitalizations per child, and our independent variable of interest is the percentage of children in that age group/state/year cell eligible for Medicaid. We show only the coefficient of interest from models that also include a full set of age group, state, and year dummies, as well as state*year interactions.

Our first important finding is that increases in Medicaid eligibility are associated with increases in hospitalizations. We estimate that for each percentage point of children made eligible for Medicaid, hospitalizations rise by 0.066 percentage points. That is, we estimate that if all children were made eligible, hospitalizations would rise by 6.6 percentage points, or by 64% of their baseline value. Since the expansions over our time period increased eligibility by 16 percentage points, we estimate that they increased child hospitalization by 1.06 percentage point, or 10.3 percent.

This finding confirms Currie and Gruber's (1996b) finding that children are more likely to be hospitalized if they are Medicaid-eligible. Our estimate is somewhat smaller than theirs; they found that making a child eligible for Medicaid doubled the odds of hospitalization. But their analysis examines the odds of a child experiencing at least one hospitalization, whereas our examines total hospitalizations per capita. If Medicaid serves to increase first hospitalizations of children, but to reduce additional hospitalizations, the two results are readily reconciled.

This finding also reveals that, if the Medicaid expansions did increase the efficiency of care, this effect was not large enough to produce a decline in total hospitalizations. That is, either efficiency did not rise, or any efficiency gains were offset by increased access of children for unavoidable inpatient care. We return to this point below.

Avoidable Hospitalizations

The next column of Table 4 shows our findings for avoidable hospitalizations per capita. In fact, we find a very significant negative effect of Medicaid eligibility on avoidable hospitalizations. Our estimates suggest that for each percentage point increase in eligibility, avoidable hospitalizations fall by 0.034 percentage points. That is, an out-of-sample extrapolation suggests that if all children were Medicaid-eligible, there would be no avoidable hospitalization. More relevantly, we find that the expansions over the 1983-1996 period reduced avoidable hospitalizations by 0.54 percentage points, or 22%.

This striking finding suggests substantial efficiency gains to providing public insurance coverage to children. We cannot prove through this evidence that the route to more efficient hospital care was improved use of ambulatory care. But, given the nature of these types of admissions, and given that Currie and Gruber (1996b) find significant improvements in access to primary care associated with the Medicaid expansions, this result certainly implies that improved ambulatory care is the cause of increased efficiency of hospitalizations.

To gain a clearer picture of how Medicaid impacts avoidable hospitalizations, in Table 5 we consider separately the impact of Medicaid eligibility on each of the six most frequent categories of avoidable hospitalizations: asthma; pneumonia; gastroenteritis; ear, nose, and throat

(ENT) infections; kidney/urinary tract infections; and dehydration.

Our results here are quite interesting. For four of the six top conditions, the impact of Medicaid is negative, and it is significant for pneumonia, gastroenteritis, and ENT infections. For kidney/urinary tract infections, the coefficient is positive, but not significant. But for dehydration, the coefficient is positive and significant. This is striking since the type of ambulatory care that is likely to be most effective in preventing dehydration is not preventive care, but rather emergent ambulatory care. This suggests that for the conditions for which preventive care is most key, there is very strong support for a causal role of Medicaid in reducing avoidable hospitalization.

Reconciling the Hospitalization Results

Our finding that the Medicaid expansions simultaneously decreased the avoidable hospitalization rate by approximately 0.54 percentage points and increased the total hospitalization rate by 1.06 percentage points implies that "unavoidable" hospitalizations rose by 1.6 percentage points, or 16% of our baseline hospitalization rate. That is, the access gains of expanded Medicaid eligibility were quite large. This finding begs the question: what kind of hospitalizations were so responsive to the increase in insurance coverage?

In fact, as noted earlier, there is a substantial literature on child hospitalization which suggests that a large share of hospitalizations are for "discretionary" diagnoses that may respond to insurance coverage. "Discretionary" admissions involve a substantial amount of physician discretion, and can often be handled on an outpatient basis. They are also characterized by a lack of clinical consensus regarding the appropriate course of treatment, and large locational variation in admit rates. A study of hospital records in four states in the early 1980s finds that 14 to 22 percent of all admissions for all age groups occurred in the "most discretionary" DRG codes, defined using measures of local variation in admit rates (Roos et al. 1988). A more recent study (McConnochie et al.1997b) of geographic variation in rates of infant hospitalization in Rochester, New York reveals that 59 percent of hospitalizations were discretionary, as compared to 18 percent that were mandatory (defined as a diagnosis "for an acute condition that is life-threatening or has the potential to produce long-term disability without (or even with) immediate hospitalization").

It is difficult to assess directly the impact of the Medicaid expansions on discretionary hospitalizations, since the sole compilation of diagnoses that we can find is designed for infants only. However, as a specification check that our results are sensible, we can assess whether our finding of an increase in total hospitalizations is reflected in a category of mandatory hospitalization that seems unlikely to respond to Medicaid eligibility: the hospitalization rate for severe fractures, burns, and trauma. That is, if our finding of rising total hospitalizations reflects not rising discretionary admissions, but rather some spurious omitted variable, then we should see rises in mandatory admissions as well. But if the mechanism is the one that we suggest, then such mandatory admissions should not be rising with eligibility increases.

In fact, we find no significant relationship between the hospitalization rate in this category and Medicaid eligibility. The coefficient of Medicaid eligibility in a regression using the hospitalization rate for severe fractures, burns, and trauma as the dependent variable is -0.0002 (.0011). This falsification exercise provides support for our hypothesis that the Medicaid expansions led to a greater number of unavoidable, discretionary admissions.

Implications

Assessing the implications of these findings is difficult. In principle, the efficiency gains from reduced avoidable hospitalizations may be quite large. Among children enrolled in Medicaid in 1996, average hospital expenditures per year per user of hospital services was $3,627 (U.S. Department of Health and Human Services, 1998). The typical user of hospital services has 1.5 inpatient stays per year (Hahn, 1992), so that the cost per stay was approximately $2,418. While data is not specifically available on the cost of an avoidable hospitalization, lengths of stay for avoidable hospitalizations are on average about 2/3 those for unavoidable hospitalizations, so that we can roughly impute their cost as $1600. This is roughly <u>forty times</u> the mean cost of an ambulatory visit per user of ambulatory services, once again corrected for the frequency of service use. Thus, so long as the ambulatory care that reduced the incidence of avoidable hospitalizations consisted of fewer than 40 episodes, there were cost savings from these increases in how care was delivered.

Of course, not only those children who are at risk for avoidable hospitalization will increase their usage of primary care, so that even if for a given child there were fewer than 40 additional primary care visits associated with an avoided hospital stay, over all children the Medicaid expansions may have been associated with more than 40 additional visits per avoided hospitalization. However, the available evidence suggests that there were fewer than 40 increased visits per hospitalization avoided. Currie and Gruber (1996b) find that making a child eligible for Medicaid lowers the odds of going a year without a physician visit by 10 percent. We find here that if all children were eligible for Medicaid the rate of avoidable hospitalization per capita would fall by 3.4%. This suggests that there are only on the order of three increased visits per hospitalization avoided. Of course, the 10% figure is a lower bound, since Medicaid would increase not just the odds of seeing a physician, but the frequency with which a physician is seen. Moreover, it may be that the physician contacts that allow children to avoid hospitalization are more expensive than average. But even if the rate of physician contacts rose substantially, and even if they were somewhat more costly than average, it seems unlikely that this calculation would approach the point where the increased ambulatory care was not cost-effective.

At the same time, however, Medicaid is associated with an even larger rise in unavoidable, discretionary hospitalizations. As a result, the expansions are raising total costs. Evaluating the costs and benefits of these increased hospitalizations is very difficult, and relies critically on the value of any health improvements to children from increased access to the hospital. Currie and Gruber (1996b) document that the Medicaid expansions overall were associated with a significant decline in child mortality, but there is no way to decompose from their estimates the share of these health improvements that are due to hospital access.

In summary, it seems likely that the reduction in avoidable hospitalization that we document was due to efficiency gains from increased primary care. Whether the increase in total hospitalizations due to the Medicaid expansions was cost-effective, in terms of cost per unit of health improvement, is unclear.

Part IV: Impact of Medicaid on the Nature of Child Hospitalization

Our analysis thus far has focused on the use of hospital data to provide a marker for trends in the efficiency with which medical care is delivered. But there are a separate set of interesting issues associated with how expansions in public insurance impact the general nature of child hospitalization. How does public insurance eligibility expansion affect the insurance coverage of those who are hospitalized? How does it impact the intensity with which children are treated in the hospital? How does it impact where children are treated?

Insurance Coverage of Hospitalized Children

Expansions of Medicaid eligibility can have both direct and indirect effects on the insurance coverage of hospitalized children. The direct effect is to increase the number of hospitalizations that are paid for by Medicaid. The magnitude of this direct effect will be the product of two factors: the marginal takeup rate of Medicaid by the newly eligible; and the rate at which those newly eligible are hospitalized. There is considerable evidence on the first of these factors which suggests fairly low marginal takeup rates, on the order of 25% (Currie and Gruber, 1996b; Cutler and Gruber, 1996). There is little evidence on the second. Moreover, these two factors interact, as much of the takeup decision for hospital treatment is made not by the individual but by the hospital; in the wake of Medicaid expansions, hospitals have set up extensive facilities for enrolling eligible uninsured patients in Medicaid (US GAO, 1994).

The indirect effect of the Medicaid expansions may be to lower the coverage of hospitalizations of children by private insurance. This could occur through the "crowdout" mechanism introduced by Cutler and Gruber (1996). Since privately insured individuals must pay, on average, roughly two-thirds of the cost of their medical care, some of them may switch to the free public insurance provided by Medicaid when they become eligible. Cutler and Gruber estimate quite large crowdout, with one of every two persons enrolling in Medicaid formerly having private insurance; this reduction in private insurance amounts to about 20% of the privately insured who were made eligible by the expansions. Subsequent work has produced a wide range of estimates, with a number of studies confirming large crowdout effects (e.g. Shore-Sheppard, forthcoming; Currie, 1996) and a number disputing that the effects are sizeable (e.g. Dubay and Kenney, 1997; Blumberg, forthcoming). Once again, the magnitude of this effect would be the product of the extent of crowdout, and the extent to which crowded out children are hospitalized. The latter might be expected to be well below the average rate of hospitalization of privately insured children, as parents may be willing to substitute lower quality Medicaid coverage for higher quality private coverage only when their children are unlikely to need medical care.

The impacts of the expansions on the insurance coverage of those hospitalized are shown in Table 6. The dependent variable here is total hospitalizations covered by different payers, relative to population. We find that the expansions were associated with more hospitalizations paid for by Medicaid; each percentage point of eligibility is associated with a 0.057 percentage point increase in Medicaid-financed hospitalizations. This figure is much lower than the marginal takeup rates discussed earlier, but this is not surprising since it is also multiplied by hospitalization rates. Indeed, since the average hospitalization rate in our sample is 10.3 percent, if those taking up were hospitalized at the average rate we would have expected a coefficient of only 0.026. The fact that the coefficient is more than twice this figure suggests that those taking up are hospitalized at much higher than average rates.

In the second column, we show that hospitalizations financed by private insurance actually appear to <u>increase</u> as Medicaid expands, contradicting the crowdout hypothesis, but that the coefficient is insignificant and small. It is unclear why higher Medicaid eligibility would be associated with a rise in privately financed hospitalizations. But, given the small size and insignificance of this coefficient, the general conclusion appears to be that there is little evidence of crowdout operating here. This could be consistent with small crowdout on average; alternatively, there could be substantial crowdout on average, but low crowdout among those privately insured families whose children are likely to be hospitalized (since those families are the ones least likely to move to the public system).

The third column shows the impact on uninsured hospitalizations, which fall significantly. Thus, the expansions of Medicaid appear to be associated with a substantial shift in hospitalizations that are not insured to hospitalizations that are financed by the Medicaid program. The smaller magnitude of the coefficient in the uninsured regression relative to the Medicaid regression reflects the fact that inpatient utilization increases with Medicaid coverage. Not only are those hospitalizations that were formerly uninsured now being financed by Medicaid, but the newly eligible are going to the hospital more often.

Intensity of Treatment

An issue that has received considerable study in the health literature is whether insurance status differentials are associated with differences in the intensity of treatment of patients in the hospital. A large literature, reviewed in Weissman and Epstein (1990) and in Currie and Gruber (1999), has compared the treatment of groups with different types of insurance coverage and reached somewhat mixed conclusions: those with private insurance coverage are treated much more intensively than are the uninsured, but those with public insurance coverage do not appear to be consistently treated more intensively. Currie and Gruber (1999) extend this literature by examining the impact of the Medicaid expansions on the intensity of treatment of childbirth. They find no aggregate impact on intensity of treatment, but they do find an important compositional impact. For those mothers who were likely to be uninsured prior to becoming Medicaid-eligible, there was a significant increase in treatment intensity. On the other hand, for those mothers who were likely to be privately insured, and therefore subject potentially to crowdout, treatment intensity decreased. This is a logical result of the fact that Medicaid reimburses providers at much lower levels than does private insurance, so that a move from private to Medicaid coverage would lower incentives for intensive treatment.

We examine the impact of Medicaid on the intensity with which children are treated in the hospital. We follow the literature on the hospitalization of the elderly to consider two dependent variables: length of stay in the hospital, in days; and the number of procedures performed on the child (Cutler, 1991). Since over 50% of our sample has no procedures performed on them during their stay in the hospital, we also consider a dummy variable for having an inpatient procedure.

For this analysis, we are considering average treatment of those in the hospital; thus, we are not comparing hospitalization figures to underlying population rates, but rather considering the impact of the expansions on the nature of how those who are hospitalized are treated. Doing so runs into a critical difficulty of interpretation because the Medicaid expansions are affecting the mix of who is hospitalized. Thus, the expansions will have compositional impacts, in addition to supply-side impacts, on the nature of hospitalizations. The compositional changes have an uncertain effect on our coefficients. On the one hand, avoidable hospitalizations are falling; since these hospitalizations are treated less intensively on average, the Medicaid expansions will be associated with a higher level of intensity of the remaining hospitalizations through compositional effects. On the other hand, however, unavoidable hospitalizations are rising even more than avoidable hospitalizations are falling, and the marginal unavoidable hospitalization for a new Medicaid enrollee may have a lower intensity of treatment. This would lead the expansions to be associated with a lower level of intensity through compositional effects.

The direct supply-side incentives have uncertain effects as well, as there will be more intensive treatment of those moving from an uninsured state to Medicaid, but less intensive treatment of those moving from private insurance to Medicaid. Thus, the prediction for treatment intensity is quite ambiguous. Of course, this discussion does not necessarily mitigate the interest of these types of results. It is still important in a reduced form sense to understand what public insurance coverage does to the nature of hospitalization. But we cannot attach any structural interpretation to our findings in terms of conditional impacts on treatment or other features of the data; public insurance may be affecting intensity for either supply incentive or composition reasons.

Our results are shown in Table 7. Perhaps for the reasons just described, we find very mixed evidence on treatment intensity. We find a significant increase in both the number of procedures and the odds of having any procedure; we estimate that a one percentage point increase in eligibility raises the odds of having a procedure by 0.3 percentage points, or 0.63 percent of baseline. At the same time, however, there is a significant and sizeable decline in length of stay, suggesting that each percentage point increase in Medicaid eligibility lowers the length of stay by 0.011 days, or 0.25 percent of baseline. Thus, the Medicaid expansions appear to be leading to shorter stays for children in the hospital on average, but more intensive treatment per day when hospitalized.

Types of Hospitals

Another interesting aspect of hospitalization that might be affected by the expansions is the type of hospital to which children are admitted. If non-government hospitals have structures in place to reduce their accessibility to the uninsured, then expanding Medicaid may increase access of low-income populations to these types of hospitals. In particular, given the relatively generous levels of Medicaid reimbursement to hospitals in the world of managed care in the private sector, hospitals may be eager to solicit the business of formerly uninsured patients who become insured by Medicaid.

In the next panel of Table 7, we consider the impact of Medicaid expansions on the type of hospitals to which children are admitted; the dependent variables are the share of hospitalizations in different hospital ownership categories. In fact, we find a very strong impact of the expansions on where children are hospitalized: there is an equal and opposite reduction in government hospitalizations and rise in for-profit hospitalizations, of about 0.055 percentage points for each percentage point increase in Medicaid eligibility. At these estimates, a 100% level of Medicaid eligibility would double the share of children admitted to for-profit hospitals, and almost halve the share admitted to government hospitals. There was no impact on admits to non-profit hospitals.

These findings suggest that different types of hospitals do care about insurance coverage in deciding who to admit, particularly for the types of discretionary admissions that are making up a large share of the hospitalizations of children in our sample (as opposed to emergency admissions, where hospitals are legally bound to treat all who arrive at the emergency room). When children are entitled to Medicaid coverage, they are made more attractive to for-profit hospitals, who pull them from the public hospitals in which they were treated as uninsured patients.

Part V: Conclusions

The relentless rise in the number of uninsured in the U.S. ensures that public insurance policy will remain a topic of considerable interest for the near term. Moreover, whenever the advantages of public insurance are discussed, enhanced efficiency of care is always listed as one of the major benefits of insuring more of our nation's citizens, and in particular more children. But there is little evidence to suggest directly that providing public insurance increases the efficiency with which care is delivered, as opposed to simply providing more care.

We provide such evidence. We find that over the 1983-1996 period, expansions in the Medicaid program significantly increased the rate at which children were hospitalized, with the expansions raising hospitalization rates of children by 10%. But we also find that hospitalizations objectively classified as avoidable by medical experts fell sharply, with the expansions inducing a 22% reduction. This suggests that public insurance can improve the efficiency of care, and substantially reduce the share of hospitalizations that are avoidable, while at the same time expanding overall access of low-income populations to hospital care.

We then turned to the implications of the expansions more generally for child hospitalization. We found that the post-expansion world was one with more hospitalizations financed by Medicaid, more intensive treatment per hospital day but fewer days in the hospital, and a shift from public to for-profit hospitalization.

Our findings, taken together with other evidence on the Medicaid expansions, suggest that increased public insurance eligibility for low-income families has led to both improved health and more efficient use of medical care. A central question for policy-makers is whether this is likely to continue to be the case as insurance eligibility is extended further up the income scale. Higher-income individuals who gain insurance coverage through Medicaid may have obtained better ambulatory care before becoming eligible, mitigating any efficiency increases through Medicaid. An important question for future research is to evaluate how the efficiency of care evolves as higher-income children become eligible under the CHIP program recently enacted by Congress.

Bibliography

Begley, Charles E., Slater, Carl H., Engel, Martha J., and Thomas F. Reynolds (1994). "Avoidable Hospitalizations and Socio-Economic Status in Galveston County, Texas," *Journal of Community Health*, 19, 377-387.

Billings, John, and Nina Teicholz (1990). "Uninsured Patients in District of Columbia Hospitals," *Health Affairs*, 9, 158-165.

Billings, John, Zeitel, Lisa, Lukomnik, Joanne, Carey, Timothy S., Black, Arthur E., and Laurie Newman (1993). "Impact of Socioeconomic Status on Hospital Use in New York City," *Health Affairs*, 12, 162-173.

Casanova, Carmen, and Barbara Starfield (1995). "Hospitalizations of Children and Access to Primary Care: A Cross-National Comparison," *International Journal of Health Services*, 25, 283-294.

Currie, Janet. "Do Children of Immigrants Make Differential Use of Public Health Insurance?" Working Paper no. 5388. Cambridge, Mass.: NBER, 1995.

Currie, Janet, and Jonathan Gruber (1996a). "Saving Babies: The Efficacy and Cost of Recent Changes in the Medicaid Eligibility of Pregnant Women," *Journal of Political Economy*, 104, 1263-1296.

Currie, Janet, and Jonathan Gruber (1996b). "Health Insurance Eligibility, Utilization of Medical Care, and Child Health," *Quarterly Journal of Economics*, 111, 431-466.

Currie, Janet and Jonathan Gruber (1997). "The Technology of Birth: Insurance Coverage, Medical Interventions, and Infant Health," NBER Working Paper #5985, April 1997.

Cutler, David (1991). "Empirical Evidence on Hospital Delivery Under Prospective Payment," mimeo, MIT.

Cutler, David, and Jonathan Gruber "Does Public Insurance Crowd Out Private Insurance?," *Quarterly Journal of Economics*, 111, 391-430.

Dubay, Lisa, and Genevieve Kenney. "Did the Medicaid Expansions for Pregnant Women Crowd Out Private Coverage?" Health Affairs 16 (January/February 1997): 185-93.

Fronstin, Paul (1998). "Sources of Health Insurance and Characteristics of the Uninsured: Analysis of the March 1998 Current Population Survey". Washington, D.C.: Employee Benefits Research Institute Issue Brief, December.

Gadomski, Anne, Jenkins, Paul, and Melissa Nichols (1998). "Impact of a Medicaid Primary

Care Provider and Preventive Care on Pediatric Hospitalization," *Pediatrics*, 101.

Goodman, D.C., E.S. Fisher, A. Gittelsohn, C.H. Chang, and C. Fleming (1994). "Why Are Children Hospitalized? The Role of Non-Clinical Factors in Pediatric Hospitalizations," *Pediatrics*, 93, 896-902.

Gruber, Jonathan (1997). "Health Insurance for Poor Women and Children in the U.S.: Lessons from the Past Decade," in *Tax Policy and the Economy 11*, James Poterba, ed.. Cambridge, MA: MIT Press, 169-211.

Hahn, B. (1992). *Annual Expenses and Sources of Payment for Health Care Services*, Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, Center for General Health Services Intramural Research. Washington, DC: U.S. Government Printing Office.

Halfon, N. and P.W. Newacheck (1993). "Childhood Asthma and Poverty: Differential Impacts and Utilization of Health Services," *Pediatrics*, 91, 56-61.

Homer, C.J., Szilagyi, P., Rodewald, L., Bloom, S.R., Greenspan, P., Yazdgerdi, S., Leventhal, J.M., Finkelstein, D., and JM Perrin (1996). "Does Quality of Care Affect Rates of Hospitalization for Childhood Asthma?" *Pediatrics*, 98, 18-23.

McConnochie, Kenneth M., Roghmann, Klaus J., Kitzman, Harriet J., Liptak, Gregory S., and John T. McBride (1997a). "Ensuring High-Quality Alternatives While Ending Pediatric Inpatient Care as We Know It," *Archives of Pediatric and Adolescent Medicine,* 151, 341-349.

McConnochie, Kenneth M., Roghmann, Klaus J., and Gregory S. Liptak (1997b). "Socioeconomic Variation in Discretionary and Mandatory Hospitalization of Infants: An Ecologic Analysis," *Pediatrics*, 99, 774-784.

Manning, Willard G., Newhouse, Joseph P., Duan, Naihua, Keeler, Emmett B. and Arleen Leibowitz (1987). "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment," *American Economic Review*, 77, 251-277.

Pappas, Gregory, Hadden, Wilbur C., Kozak, Lola Jean, and Gail F. Fisher (1997). "Potentially Avoidable Hospitalizations: Inequalities in Rates between US Socioeconomic Groups," *American Journal of Public Health,* 87, 811-816.

Parchman, Michael and Steven Culler (1994). "Primary Care Physicians and Avoidable Hospitalizations," *Journal of Family Practice*, 39, 123-128.

Roos, Noralou P., Wennberg, John E., and Klim McPherson (1988). "Using Diagnosis-Related Groups for Studying Variations in Hospital Admissions," *Health Care*

Financing Review, 9, 53-62.

Solberg, Leif I., Peterson, Kent E., Ellis, Ronald W., Romness, Kenneth, Rohrenbach, Elizabeth, Thell, Terry, Smith, Angela, Routier, Ann, Stillmank, Mary Wermuth, and Soloman Zak (1990). "The Minnesota Project: A Focused Approach to Ambulatory Quality Assessment," *Inquiry*, 27, 359-367.

Soulen, Jeffrey, Anne Duggan, and Catherine DeAngelis (1994). "Identification of Potentially Avoidable Pediatric Hospital Use: Admitting Physician Judgment as a Complement to Utilization Review," *Pediatrics*, 94, 421-424

U.S. Department of Health and Human Services (1998). *Health Care Financing Review Annual Statistical Supplement*, HCFA serial.

U.S. General Accounting Office (1994). *Health Care Reform: Potential Difficulties in Determining Eligibility for Low-Income People*, GAO/HEHS-94-176. Washington, DC: Government Printing Office.

Weissman, Joel S. and Arnold M. Epstein. Falling through the Safety Net (Baltimore: The Johns Hopkins University Press), 1990.

Weissman, Joel S., Gatsonis, Constantine, and Arnold M. Epstein (1992). "Rates of Avoidable Hospitalization by Insurance Status in Massachusetts and Maryland," *Journal of the American Medical Association*, 268, 2388-94

Appendix : The Medicaid Expansions

Deficit Reconciliation Act, 1984: Effective October 1, 1984. Required states to extend Medicaid coverage to children born after September 30, 1983, if those children lived in families that were income-eligible for AFDC.

Omnibus Budget Reconciliation Act, 1986: Effective April 1, 1987. Permitted states to extend Medicaid coverage to children in families with incomes below the federal poverty level. Beginning in fiscal year 1988, states could increase the age cutoff by one year each year, until all children under age five were covered.

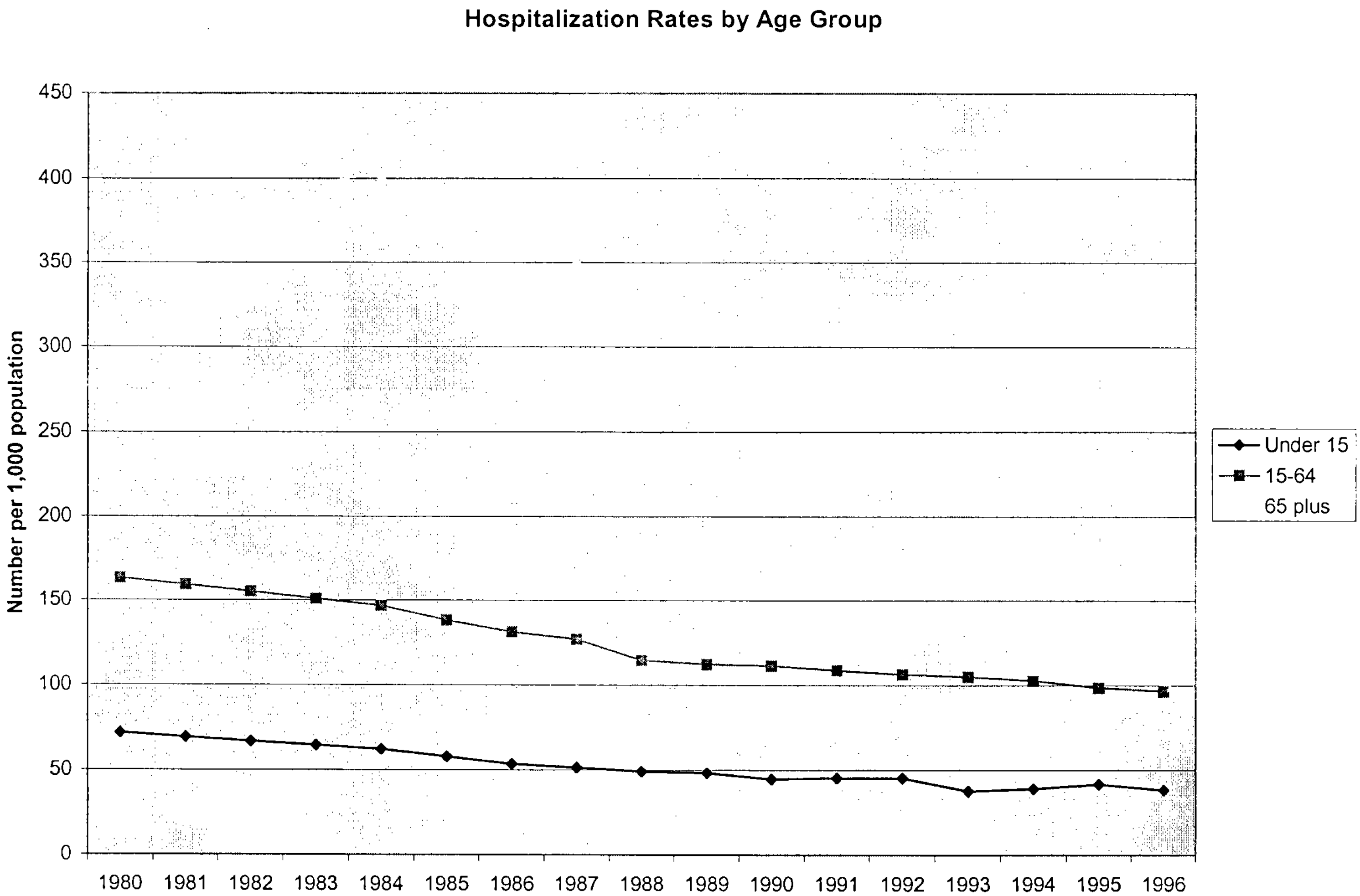
Omnibus Budget Reconciliation Act, 1987: Effective July 1, 1988. Permitted states to cover children under age 2, 3, 4, or 5, who were born after September 30, 1983. Effective October 1, 1988, states could expand coverage to children under age 8 born after September 30, 1983. Allows states to extend Medicaid eligibility to infants up to one year of age in families with incomes up to 185 percent of the federal poverty level. States were required to cover children through age 5 in fiscal year 1989, and through age 6 in fiscal year 1990, if the families met AFDC income standards.

Medicare Catastrophic Coverage Act, 1988: Effective July 1, 1989, states were required to cover infants up to age on in families with incomes less than 75 percent of the federal poverty level. Effective July 1, 1990, the income threshold was raised to 100 percent of poverty.

Family Support Act, 1988: Effective April 1, 1990. States were required to continue Medicaid coverage for 12 months among families who had received AFDC in three of the previous six months, but who had become ineligible because of earnings.

Omnibus Budget Reconciliation Act, 1989: Effective April 1, 1990. Required states to extend Medicaid eligibility to children up to age 6 with family incomes up to 133 percent of the federal poverty line.

Omnibus Budget Reconciliation Act, 1990: Effective July 1, 1991. States were required to cover all children under age 19 who were born after September 30, 1983 and whose family incomes were below 100 percent of the Federal poverty level.



Source: National Center for Health Statistics (various years)

Avoidable Hospitalizations of Children Under 16, 1983-1996

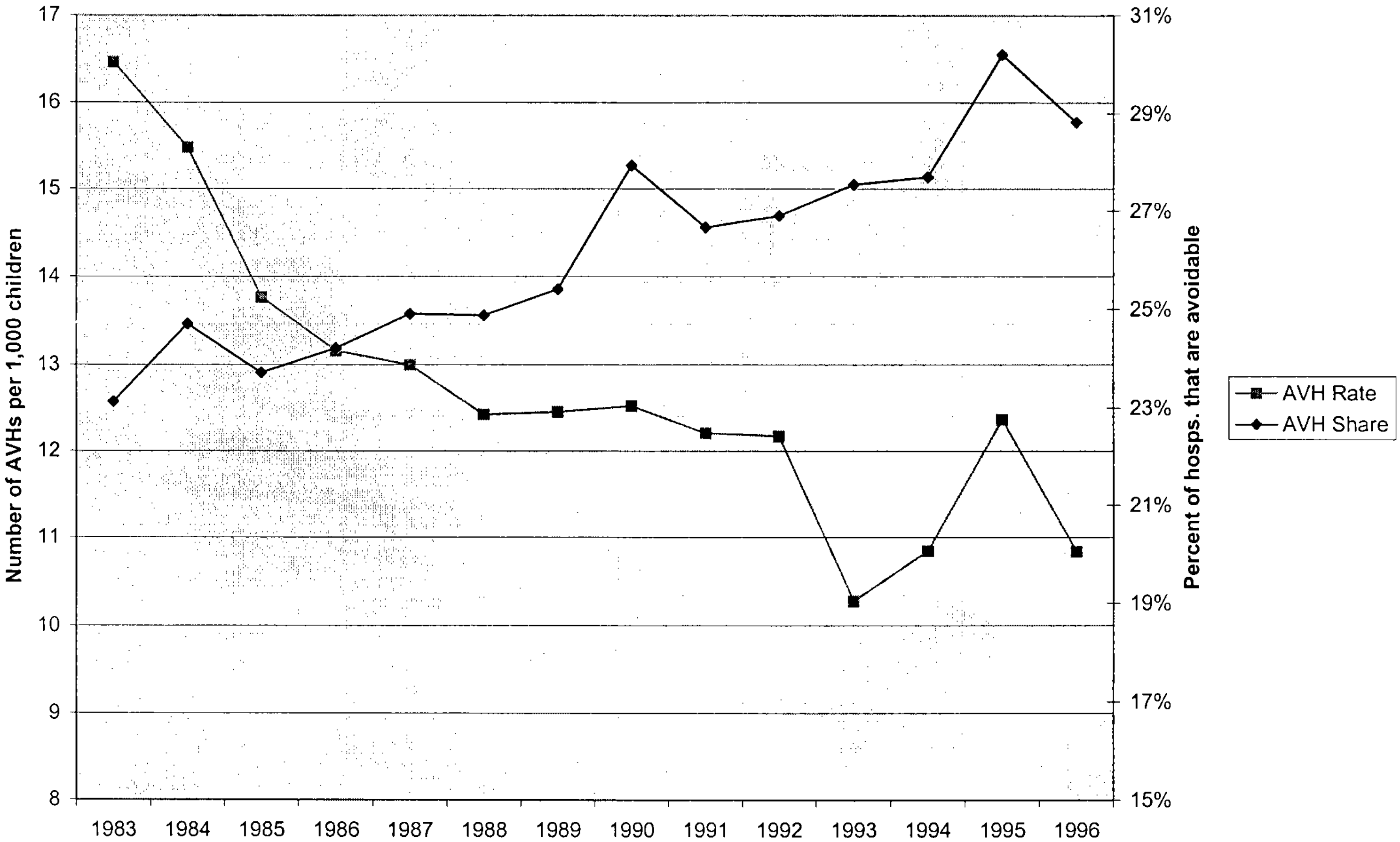


Table 1: Top Hospital Diagnoses and Prevalence by Age Category, 1996

	Number (000s)	% of total
Under 15		
Diseases of the respiratory system	653	30%
Injury and poisoning	223	10%
Diseases of the digestive system	205	9%
Endocrine, nutritional and metabolic diseases, and immunity disorders	155	7%
Infectious and parasitic diseases	153	7%
All diagnoses	**2,207**	100%
15-64		
Deliveries	3,817	23%
Diseases of the circulatory system	2,119	13%
Mental disorders	1,546	9%
Diseases of the digestive system	1,503	9%
Injury and poisoning	1,350	8%
All diagnoses	**16,619**	100%
65 plus		
Diseases of the circulatory system	3,963	34%
Diseases of the respiratory system	1,550	13%
Diseases of the digestive system	1,198	10%
Injury and poisoning	977	8%
Neoplasms	826	7%
All diagnoses	**11,718**	100%
All diagnoses, all ages	**30,544**	

Notes: National Center for Health Statistics (1998).

Table 2: Pediatric Avoidable Hospitalization Conditions		
Condition	ICD-9-CM Code(s)	Qualifiers
Immunization preventable conditions	033, 037, 045, 320.0, 390, 391	Haemophilus meningitis (320.2) for age 1-5 only
Grand Mal status and other epileptic convulsions Convulsions "A" Convulsions "B"	345 780.3 780.3	 Age 0-5 years Age > 5 years
Severe ENT infections	382, 462, 463, 465, 472.1	Exclude otitis media (382) with myringotomy with insertion of tube (procedure 20.01)
Bacterial pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486	Exclude cases with secondary diagnosis of sickle cell (282.6) and patients < 2 months
Asthma	493	
Tuberculosis	011-018	
Cellulitis	681, 682, 683, 686	Exclude cases with a surgical procedure (01-86.99)
Diabetes "A" Diabetes "B" Diabetes "C"	250.1, 250.2, 250.3 250.8, 250.9 250.0	
Hypoglycemia	251.2	
Gastroenteritis	558.9	
Kidney/urinary infection	590, 599.0, 599.9	
Dehydration-volume depletion	276.5	
Iron deficiency anemia	280.1, 280.8, 280.9	Age 0-5 years
Nutritional deficiencies	260, 261, 262, 268.0, 268.1	
Failure to thrive	783.4	Age < 1 year

Source: Gadomski et al. (1998)

Table 3: Descriptive Statistics

	Mean	Standard Deviation
NHDS		
Statistics for Total Population (N = 3,208)		
Hospitalization Rate		
Overall	10.25%	1.08%
Medicaid	3.07%	0.47%
Private insurance	5.41%	0.62%
Uninsured	0.95%	0.28%
Other/unknown	1.45%	0.41%
AVH rate		
Overall	2.48%	0.32%
Asthma	0.44%	0.06%
Pneumonia	0.52%	0.09%
Gastroenteritis	0.41%	0.09%
ENT infections	0.42%	0.09%
Kidney/Urinary Tract Infections	0.13%	0.03%
Dehydration	0.25%	0.07%
Statistics for Hospitalizations (N = 3,206)		
AVH share	24.93%	1.33%
Share by Race		
Black	14.59%	1.59%
White	62.13%	2.41%
Other	7.03%	1.36%
Unknown	16.25%	2.20%
Share by Payer		
Medicaid	25.27%	1.37%
Private insurance	56.19%	1.71%
Uninsured	7.40%	0.62%
Other/unknown	11.14%	1.35%
Share by Hospital Ownership		
For profit	4.94%	1.12%
Not for profit	81.27%	2.41%
Government	13.80%	2.01%
Average LOS	4.27	0.16
Fraction with procedures	47.68%	1.80%
Average number of procedures	0.81	0.04
CPS (N = 3,208)		
ELIG	23.37%	1.45%
SIMELIG	24.21%	1.28%

Table 4: Basic Results For Total and Avoidable Hospitalizations (N=2,308)		
	Total Hospitalizations/Pop	Avoidable Hospitalizations/Pop
Medicaid Eligibility	0.066 (0.026)	-0.034 (0.010)
Mean of Dependent Variable	0.103	0.025

Notes: Coefficient is that on Medicaid eligibility from estimating regressions such as (1) in the text, using SIMELIG as an instrument for ELIG. Fixed effects for age group, state, and year, as well as state*year interactions are also included. Standard errors are in parentheses.

Table 5: Specific Avoidable Conditions (N=2,308)		
Condition	Medicaid Eligibility Coefficient	Mean
Pneumonia	-0.0106 (0.0035)	0.0052
Asthma	-0.0016 (0.0026)	0.0044
ENT Infections	-0.0152 (0.0033)	0.0042
Gastroenteritis	-0.0175 (0.0037)	0.0041
Dehydration	0.0127 (0.0028)	0.0025
Kidney/Urinary Tract Infections	0.0013 (0.0014)	0.0013

Notes: Coefficient is that on Medicaid eligibility from estimating regressions such as (1) in the text, using SIMELIG as an instrument for ELIG. Fixed effects for age group, state, and year, as well as state*year interactions are also included.

Table 6: Insurance Coverage (N=2,308)			
	Medicaid Covered	Privately Insured	Uninsured
Medicaid Eligibility	.057 (.015)	.011 (.019)	-.032 (.011)
Mean of Dependent Variable	.031	.054	.009

Notes: Coefficient is that on Medicaid eligibility from estimating regressions such as (1) in the text, using SIMELIG as an instrument for ELIG. Fixed effects for age group, state, and year, as well as state*year interactions are also included.

Table 7: Treatment and Type of Hospital (N=2,306)		
	Medicaid Eligibility Coefficient	Mean of Dependent Variable
	Treatment	
Length of Stay	-1.082 (.640)	4.27
Number of Procedures	.375 (.107)	.811
Any Procedures	.300 (.045)	.476
	Type of Hospital	
For-Profit Hospital	.056 (.025)	.049
Non-Profit Hospital	-.003 (.032)	.813
Public Hospital	-.053 (.028)	.138

Notes: Coefficient is that on Medicaid eligibility from estimating regressions such as (1) in the text, using SIMELIG as an instrument for ELIG. Fixed effects for age group, state, and year, as well as state*year interactions are also included.