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USING HMOs TO SERVE THE MEDICAID POPULATION: WHAT ARE THE EFFECTS ON UTILIZATION AND DOES THE TYPE OF HMO MATTER?

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SUMMARY

States have increasingly used Health Maintenance Organizations (HMOs) to provide medical services to the Medicaid population. However, the effects of these initiatives on total health-care expenses, the mix of utilization, and access to care remain unclear. We examine the effect of changes in Medicaid HMO penetration between 1996 and 2002 on these outcomes using data for the nonelderly Medicaid population in the Community Tracking Study's Household Survey. We develop market-level measures of Medicaid HMO penetration from CMS and InterStudy data, distinguish whether the HMOs specialize in serving the Medicaid population, and use a market fixed-effects model to focus on changes in HMO penetration rates over time. Although limited by imprecise estimates, we find some evidence that utilization and access are related to the market penetration rates of commercial and Medicaid-dominant HMOs, but the pattern of results we observe does not appear to be consistent with welfare improvements.

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1. INTRODUCTION

State Medicaid programs have increasingly contracted with private Health Maintenance Organization (HMO) plans over the last decade. The Centers for Medicare and Medicaid Services (CMS) reports that the proportion of the Medicaid population enrolled in an HMO increased from 14.1% in 1995 to 39.4% in 2004. (Other forms of Medicaid managed care, which are not the focus of our analysis, include primary-care case management and 'carve out' plans for services like mental health.) When contracting with a Medicaid HMO, the state switches from directly reimbursing medical providers on a fee-for-service basis to negotiating a prepaid 'capitated' amount for comprehensive medical services. However, very little consistent or generalizable empirical evidence on the effects of using Medicaid HMOs on total health-care expenses, the mix of services provided, and access to care currently exists. Our article seeks to add to the empirical literature by analyzing the effects of Medicaid HMOs on these outcomes for enrollees in a nationally representative sample of markets.

Many different explanations for why state policymakers have contracted with HMOs for Medicaid coverage have been suggested. One is the belief that the managed care model can provide medical

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services more efficiently than a fee-for-service model; through improved access to primary care, selective contracting with providers, and/or efficiencies in the actual provision of services (by perhaps using lower-cost provider settings), plans may lower costs and potentially improve quality of care. While a state could, in principle, be willing to improve access and quality at higher levels of spending, so long as the value of the former exceeds the latter, we view this as unlikely due to state budget constraints. Another potential explanation for a state's use of HMOs may simply be improved budget predictability. A drawback to using HMOs for most states, however, is their loss of detailed data to monitor utilization and quality of care once enrollees enter the HMO delivery system.

A reduction in total Medicaid spending could be achieved in various ways, given that total spending equals price times quantity plus administrative costs. Reductions in price can result from selective contracting; Cutler *et al*. (2000) found that the bulk of HMO savings among the privately insured were tied to reductions in unit prices. The low Medicaid fees for physicians in states with direct fee-for-service reimbursement suggest that further reductions in Medicaid prices from negotiation may be unlikely, though some opportunities for lowering hospital payments may exist. Changes in quantity can result from either limiting access to low-value technologies, shifting the mix of utilization away from inefficient modes of care (e.g. emergency room), or better management of episodes of illness. Changes in total administrative costs would result from shifting some (but not all) costs incurred by the state to private plans, inclusive of some level of profit. Total administrative costs could actually increase with a shift to HMOs (i.e. the reduction in the state's direct administrative costs could be smaller than the administrative costs incurred by the plans), but these additional costs might be more than offset by decreases in prices and/or quantity if the HMOs achieve efficiencies.

The type of Medicaid HMO used may also be important. Some states contract with commercial HMOs that integrate Medicaid and privately insured populations, while other states use Medicaid-dominant HMOs, which may be either relatively larger national and regional plans or relatively smaller, local provider-sponsored organizations. One advantage of using commercial HMOs would be the ability to set lower rates due to economies of scale achieved by large pre-existing HMOs. Other advantages from integrating enrollees may be a reduction in the stigma associated with public coverage (Ketsche *et al*., 2007) and an increase in the ability to see mainstream medical providers. Alternatively, an advantage of Medicaid-dominant HMOs may be the economies of scope associated with meeting the unique needs of the Medicaid-eligible population. Medicaid-dominant HMOs may be more likely to include the traditional 'safety net' providers that include important social services used by Medicaid populations. However, inefficiencies associated with 'learning by doing' may exist, as these Medicaid-dominant HMOs are generally newer organizations. In our analysis of the effect of Medicaid HMOs on total health-care expenses, the mix of services provided, and access to care, our primary distinction is between the use of commercial HMOs and Medicaid-dominant HMOs. We discuss the types of plans included in this Medicaid-dominant classification in more detail later.

2. RELEVANT LITERATURE

Numerous studies have examined the effect of managed care on utilization and access to care for the Medicaid population. The earliest research, summarized in Hurley *et al*. (1993) and Rowland *et al*. (1995), observed some changes in utilization, such as lower emergency room and specialty care, but no consistent patterns emerged. One group of recent research has examined various effects of implementing Medicaid HMOs within a particular state over time.[1] A smaller group of recent research has used

[1]Levinson and Ullman (1998) examine access to prenatal visits in Wisconsin. Goldman *et al*. (1998) examine changes in expenses in Florida. Long and Coughlin (2001) examine physician utilization in rural Minnesota. Conover *et al*. (2001) examine prenatal care and birth outcomes in Tennessee. Tai-Seale *et al*. (2001) examine prenatal care and the length of delivery stays in California. Howell *et al*. (2004) examine prenatal care in Ohio.

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nationally representative data. Many of these studies have used cross-sectional variation in HMO penetration.[2] A few nationally representative studies have examined changes in Medicaid HMO penetration over time.[3] However, this recent research has also not yielded consistent patterns of results.

Our empirical analysis extends the existing literature in three important ways. First, we use nationally representative data and focus on changes in Medicaid HMO penetration over time at the market level. By using nationally representative data, our results can be more generalizable. By focusing on changes in Medicaid HMO penetration over a relatively long period of time and using fixed effects in our empirical model, we can (unlike most other studies) ensure that our results are not driven by unmeasured time-invariant differences across local areas.

Second, we distinguish between the use of commercial HMOs and Medicaid-dominant HMOs in our analysis. As noted above, economic theory is ambiguous on the relative merits of integration versus specialization, so empirical tests of these effects are important. Only a few studies have made this distinction. Landon *et al*. (2007) used HEDIS data to compare the quality of care indicator between commercial Medicaid HMOs and Medicaid-dominant HMOs, but found no differences. We used the Community Tracking Study's Physician Survey to test for different effects on the odds that physicians saw Medicaid patients and found that the penetration rate of commercial Medicaid HMOs increased the odds of physicians seeing new Medicaid patients but found no effect for Medicaid-dominant HMOs (Adams and Herring, 2008).

Third, while other studies examine the effects on access to care and different types of utilization, we focus on the effect on *total* spending because the use of HMOs may increase some types of utilization and decrease other types, leaving the net effect on spending unknown. Two recent papers by Duggan (2004) and Burns (2009a) examine the effect of HMOs on total annual expenses for the welfare-related and disabled Medicaid populations, respectively. Specifically, Duggan links California claims data for 1993–2000 to HMO payment rates for a cohort of welfare-related enrollees who were mandated to enroll in Medicaid HMOs. Duggan actually finds increased state spending relative to that expected under fee-for-service and no corresponding improvement in infant health outcomes. Burns also does not find significantly lower expenses due to the presence of HMOs and indeed, finds that spending on prescription medications as well as for other medical and dental care was higher for disabled enrollees in counties with HMO coverage of the disabled versus counties still using fee for service delivery.

We note that Duggan compares the trajectory of fee-for-service expenditures to the capitated payments that the state began to pay. That approach cannot distinguish between the influence of changes in price, quantity, and administrative load on total spending. It could be, for example, that HMOs in California were inherently more efficient but the state paid excessive capitation rates. Our analysis (described below in more detail) instead concentrates on aggregate changes in quantity of services. In this sense, we measure the *potential* effect on state program expenditures that may be achieved from contracting with HMOs if capitation rates are determined appropriately. Both approaches provide valuable information.

[2]For instance, Zuckerman *et al*. (2002) use the 1997 National Survey of America's Families (NSAF) to examine the use of mandatory HMO programs on utilization. Garrett and Zuckerman (2005) use pooled data from the 1997 and 1999 NSAF to examine the effect of county-level Medicaid managed care on utilization. Long (2008) use the 2002 NSAF to examine the difference between for-profit and nonprofit HMOs.

[3]Garrett *et al*. (2003) use the 1991–1995 National Health Interview Survey (NHIS) to examine the county-level presence of Medicaid managed care's effect on utilization. Currie and Fahr (2005) use 1989–1994 NHIS data to examine the effect of state-level managed care penetration on children's physician visits by race/ethnicity. Baker and Afendulis (2005) use the 1996–1997 and 1998–1999 Community Tracking Study's Household Survey to examine the effect of state-level HMO penetration and the use of PCCM on utilization and access to care for children. Kaestner *et al*. (2005) use 1990–1996 National Natality Files to examine the county-level presence of Medicaid managed care's effect prenatal care and birth outcomes. Burns (2009a) and Burns (2009b) use the 1996–2004 Medical Expenditure Panel Survey to examine the county-level presence of mandatory Medicaid managed care's effect on the adult disabled population's spending and access to care, respectively.

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3. DATA AND METHODS

3.1. Data

We use the nationally representative Community Tracking Study's Household Survey (CTS-HS) to obtain data for enrollee utilization and access to care for the nonelderly Medicaid population. Four rounds of CTS-HS data are available: 1996–1997, 1998–1999, 2000–2001, and 2003. This survey collects information on demographics, income, insurance coverage, health status, access to care, and utilization for respondents in 60 geographic 'sites' across the United States, chosen in a way so the resulting pooled sample is nationally representative; 51 of the CTS-HS sites are large urban Metropolitan Statistical Areas (MSAs), such as greater Baltimore and Atlanta, while nine of the sites are collections of rural counties (e.g. northern Georgia). Because Medicaid HMOs are rarely used in rural counties, we use data from only the 51 MSAs. Our sample is, therefore, representative of urban US markets. (Hereafter, we use the terms 'MSA' and 'market' interchangeably.)

Because nonrandom selection into Medicaid HMOs may exist when enrollees are given a choice of plans (Currie and Fahr, 2005), a comparison of outcomes between individuals enrolled in Medicaid HMOs to individuals remaining in fee-for-service Medicaid may yield biased results. We therefore construct market-level measures of Medicaid HMO penetration using data from the Centers for Medicare and Medicaid Studies (CMS) and InterStudy. For the reasons outlined below, we construct HMO penetration rates for the MSA rather than the state or county. Because the CTS-HS survey asks questions about utilization during the previous year (i.e. the 1996–1997 round of the survey was fielded during the early part of 1997 and referred mostly to 1996), we use CMS and InterStudy data from the month of June for the years 1996, 1998, 2000, and 2002 (e.g. June 1996 InterStudy and CMS data to correspond to the 1996–1997 CTS-HS).

Because we are interested in distinguishing between commercial and Medicaid-dominant HMOs, it is necessary to construct these separate HMO penetration rates using plan-level data from both CMS and InterStudy; neither source of data is sufficient alone. Plan-level data from CMS lists the total number of enrollees in the plan and the counties served for each Medicaid managed care plan in the United States but do not include enrollment estimates by county. These data also do not include separate CHIP plans or plans for the so-called 'dual eligibles' (i.e. Medicare beneficiaries with Medicaid as a source of supplemental coverage). We exclude plans in the CMS data that only provide limited benefits, such as dental care or mental health.

Because the CMS data do not provide detail about any non-Medicaid enrollees in the plan, we link the CMS data to the plan-level InterStudy data in order to obtain information about other enrollees in each HMO. (We cannot use the InterStudy database alone either, because it does not include Medicaid-only HMOs.) The InterStudy data lists the total number of enrollees for each type of payer: private (including employment-based, FEHBP, and individual market enrollees), Medicare, and Medicaid/CHIP. Dual eligible enrollees are classified as Medicare enrollees in the InterStudy data; while Medicaid and CHIP enrollment is indistinguishable in the InterStudy data, any separate CHIP plans are not included in our sample because they are absent from the original CMS Medicaid HMO listing. As with the CMS data, the plan-level data from InterStudy from the mid-1990s do not provide separate enrollment estimates by county. Moreover, InterStudy's overall Medicaid HMO penetration rates (for both types of Medicaid HMOs combined) during this time period are only available at the MSA level. While we could determine the number of commercial HMOs and the number of Medicaid-dominant HMOs serving each county with the CMS and InterStudy data, we would not be able to accurately determine whether a particular county had relatively more of its Medicaid enrollees in either type of plan because of the aggregated nature of the data.

Using counts of enrollees from these two data sources, then, we classify each Medicaid HMO as a commercial HMO if it has less than 75% Medicaid enrollment or as a Medicaid-dominant HMO if it

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has between 75 and 100% Medicaid enrollment.[4] Our commercial HMO classification therefore includes both for-profit and nonprofit HMOs that serve at most, 75% Medicaid enrollees (and specifically, traditional Medicaid enrollees versus perhaps either dual eligibles or CHIP enrollees). Our Medicaid-dominant HMO classification therefore includes both relatively larger national and regional for-profit and nonprofit private HMOs specializing in contracts with state Medicaid programs and relatively smaller, public county-level provider-based entities serving at least 75% Medicaid enrollees. While there may be important differences across plans within these two broad classifications that our analysis ultimately overlooks, our primary interest in the work presented here is to distinguish between plans that integrate Medicaid enrollees with other insured populations and plans that do not, those that specialize in the Medicaid population.

As noted above, we measure HMO penetration rates for commercial HMOs and Medicaid-dominant HMOs at the MSA level. Because HMO penetration rates generally vary considerably within a state, our analysis should be an improvement over prior analyses using state-level penetration rates. While data availability from CMS and InterStudy from this time period requires the use of MSA-level measures rather than county-level measures, we do not believe this is overly problematic. Medicaid enrollees are indeed often phased into managed care at the county level, most notably for the relatively smaller public county-level provider-based entities, but states often group counties together (e.g. by MSA) for this phase-in process. If they are not grouped together, sizeable variation in Medicaid HMO penetration within MSAs may remain. However, the data indicate that most of the Medicaid HMOs span multiple counties in a state, frequently including all counties comprising an MSA and, indeed, often across more than one MSA in the state. This, coupled with the fact that most enrollees are by definition, concentrated in larger HMOs, implies that the amount of variation within each MSA should not be great. However, we note that our inability to capture any county-level variation within MSAs as an important limitation; our MSA-level measures may be biased toward zero due to an errors-in-variables problem. We also have fewer degrees of freedom in deriving our estimates, especially due to the relatively small number of MSAs included in the CTS-HS data.

We construct two Medicaid HMO penetration rates for each of the 51 MSAs for each of the four years. The commercial penetration rate is the percentage of all Medicaid enrollees within the market that are in a commercial HMO. The Medicaid-dominant penetration rate is the percentage of all Medicaid enrollees within the market in a Medicaid-dominant HMO.[5] In doing so, we account for the fact that the list of counties served by each HMO sometimes span multiple MSAs. For these multiple-MSA HMOs, we allocate the total enrollment of the plan across the separate counties identified by CMS, based on the size of the general population in those counties. This allows us to estimate the number of Medicaid enrollees for each HMO for each MSA.[6]

[4]We use a 75% threshold for Medicaid enrollment to be consistent with the '75/25 Rule' established by the Omnibus Budget Reconciliation Act of 1981 which modified Section 1903 of the Social Security Act to require (in the absence of a waiver) that Medicaid enrollment be less than 75% of any HMO's membership. Although CMS has recently begun using the term 'commercial' for HMOs that 'provide comprehensive services to both Medicaid and commercial and/or Medicare' and the term 'Medicaid only' for HMOs that 'provide comprehensive services to only Medicaid beneficiaries, not to commercial or Medicare enrollees' (CMS, 2004), we believe that a 100% threshold would exclude too many HMOs that actually do specialize in the Medicaid market.

[5]For example, suppose a city has 100 000 residents covered by Medicaid, and that 25 000 of them are enrolled in a commercial HMO (with an additional 150 000 with employment-based coverage), 50 000 of them are enrolled in a Medicaid-dominant HMO (which only has these 50 000 enrollees), and 25 000 of them remain in the fee-for-service system. The commercial Medicaid HMO penetration rate for this city equals 25% (i.e. 25 000 out of 100 000) and the Medicaid-dominant HMO penetration rate equals 50% (i.e. 50 000 out of 100 000).

[6]Suppose that the Medicaid-dominant HMO described in footnote ♯5 spans two cities, with an additional 150 000 Medicaid enrollees in city ♯2; city ♯1 has 50 000 enrolled in its Medicaid-dominant HMO. The CMS plan-level data would provide the total enrollment of this HMO as 200 000 and provide a listing of the counties comprising city ♯1 and city ♯2. If the total population of city ♯1 is one million and the total population of city ♯2 is four million, we would estimate the 200 000 enrolled in this multicity Medicaid-dominant HMO as 40 000 in city ♯1 and 160 000 in city ♯2. Some error is introduced here because we do not have accurate data for how the HMO's enrollment actually spans across these two cities. It is important to note that this interpolation error would be much worse if we were to attempt constructing county-level penetration rates.

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A limitation to the use of geographic penetration rates is that it will combine both the direct effects for those enrolled in an HMO and any indirect 'spillover' effect for those not enrolled in an HMO. This spillover effect could work in either direction. If hospitals or physicians respond to growth in Medicaid HMOs by treating those remaining in fee-for-service Medicaid more intensively (perhaps to make up for lost revenue from the HMOs) or less intensively (perhaps due to learning how to better coordinate care to Medicaid enrollees), then the estimated effect of Medicaid HMO penetration would reflect an 'indirect' effect on those remaining in fee-for-service Medicaid. Our data measures both the direct and any potential spillover, or 'indirect,' effects.

3.2. Empirical methods

We examine the effects of market-level HMO penetration across the urban markets in the CTS-HS by estimating several empirical models of the following generic form using a sample of the nonelderly Medicaid population:

$$\text{OUTCOME}_{it} = f(\alpha + \beta_{\text{HMO}} X_{\text{HMO},it} + \beta_I X_{I,it} + \beta_{\text{GEO}} X_{\text{GEO},it} + \gamma_{\text{GEO}} \text{GEO}_i + \gamma_{\text{YEAR}} \text{YEAR}_t, \varepsilon)$$

where OUTCOME_{it}, a specific outcome measure for Medicaid enrollee i at time t; $X_{\text{HMO},it}$, measures of commercial HMO and Medicaid-dominant HMO penetration; $X_{I,it}$, a set of individual characteristics; $X_{\text{GEO},it}$, a set of geographic characteristics at the MSA and state level; GEO_i, a set of geographic indicator variables for the MSA; YEAR_t, a set of year indicator variables; and ε, an error term.

We estimate models using several different measures of OUTCOME_{it} to examine total expense, the mix of utilization, and access to care; each of which is described in more detail below. We are primarily interested in the sign and magnitude of β_{HMO}, the effect of both commercial and Medicaid-dominant HMO penetration on these various outcomes. We include market-level fixed effects, GEO_i, and year indicators, YEAR_t, to measure market-specific, time-invariant characteristics and general trends over time that may affect our outcome variables of interest. We include a set of market-level and state-level characteristics, $X_{\text{GEO},it}$, to control for any geographic changes over time which may be correlated with changes in Medicaid HMO penetration; because we include market-level fixed effects, we only include measures here that vary over time. We adjust our standard errors for our estimates of β to control for the sample's market-level clustering of observations because the error terms will generally be correlated within markets.

3.3. Sample

We use a sample of nonelderly people covered by Medicaid; we estimate each model first for children and parents combined and then for children and parents separately. We do not include Medicare beneficiaries with Medicaid as supplemental coverage. The CTS-HS data identify whether respondents are covered by either Medicare, private insurance, military insurance, Medicaid, or 'other public' coverage at the point in time of the survey; this 'other public' category presumably includes stand-alone CHIP plans, high risk pools, and the Indian Health Services. Because our measures of Medicaid HMO penetration do not incorporate separate CHIP plans, we do not include anyone reporting 'other public' coverage with income to make them eligible for CHIP.

Ideally, we would exclude SSI recipients from our sample of Medicaid enrollees, but the CTS-HS data do not include this information. After welfare reform, the composition of Medicaid enrollees likely shifted from relatively more families with young children to relatively more SSI/disabled recipients who incur higher expenditures. Because SSI recipients are often not required to enroll in a Medicaid HMO, an increase in the relative number of SSI recipients over time would be associated with a reduction in Medicaid HMO penetration, which in turn could yield a negative bias of HMO penetration on our utilization measures. However, more recently, states have included SSI beneficiaries in their Medicaid HMO enrollment requirements, which in turn could also bias the relationship between HMO

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penetration and utilization. While not a perfect solution to these potential problems, limiting our analysis to parents and children should minimize the number of SSI beneficiaries in our sample, as adults on Medicaid without young children would disproportionately be SSI beneficiaries.

3.4. Dependent variables

We examine two sets of $OUTCOME_{it}$ measures. The first set examines changes in utilization and the second set examines access to care. For the former, we not only focus on a 'synthetic' estimate of total health-care expenses but also examine specific measures of utilization independently. The CTS-HS includes data for the total number of office-based physician visits during the previous year; the total number of nurse practitioner, physician assistant, or midwife visits; whether any mental health services were used; the number of emergency room visits; the number of inpatient stays; the number of inpatient nights; the number of inpatient surgeries; and the number of outpatient surgeries. However, an important limitation to our analysis of utilization is that it does not entirely reflect utilization covered by the Medicaid program. The first reason is that our sample uses a point-in-time estimate of insurance coverage while our utilization measure is for the past year. Given the large amount of turnover in the Medicaid program, people newly enrolled in Medicaid (but unobservable in the data) may have had part of their prior utilization paid out-of-pocket or by a private insurer. The second reason is that, even for those enrolled in Medicaid the entire past year, some providers may have supplied medical care to Medicaid enrollees but not been reimbursed by Medicaid, resulting in that utilization being observed in the CTS-HS data and thus used in our analysis but not actually representing a cost incurred by the state or Medicaid HMO.

The CTS-HS has no direct measure of total health-care expenses, and so we construct an estimate of total health-care expense for Medicaid enrollees in the CTS-HS by incorporating the Medical Expenditure Panel Survey (MEPS) data in a manner similar to that used by Goldman *et al.* (1998) and Polsky and Nicholson (2004). We first identify the comparable sample of nonelderly urban Medicaid enrollees in the 1996–2003 MEPS and estimate an OLS regression for their total actual Medicaid expenses using the full set of independent utilization measures (i.e. number of physician visits, etc.) identified in the CTS-HS as explanatory variables and constraining the model's intercept to be zero; we inflate all dollars in the MEPS to year 2003 using the Medical CPI. Some of the utilization counts are top-coded in the CTS-HS (e.g. office-based physician visits are toped-coded at 30), and so we include a separate indicator for whether the person has a utilization count that was top-coded for measures frequently top-coded.

The coefficients on the utilization measures from the MEPS analysis are then average 'net unit prices' per quantity of service. These coefficients allow us to then 'sum up' estimated actual total expenses for the Medicaid enrollees in our CTS-HS sample by attaching each average price to the amount of each type utilization observed for every person.[7] Because we construct the prices to be averages across all states and years, and thereby hold prices and administrative costs constant, we are able to focus solely on the contribution of variation in quantity on total expenses. Finally, because the CTS-HS data does not include counts of all medical utilization—most notably prescription drug use – these net unit prices

[7]The MEPS appears to understate medical spending relative to the National Health Accounts (Selden *et al.*, 2001). However, this should generally not be problematic for our analysis because we focus on the relative difference in prices for these types of utilization rather than the actual magnitude of the price; that is, we are interested in how changes in the mix of utilization change overall health-care expenses. If the MEPS undercounts Medicaid beneficiaries, utilization (even differentially for, say, hospitalizations and physician visits), or event-level expenses uniformly, this will not affect our ability to estimate relative event-level 'prices' for the utilization measures in the CTS-HS Medicaid population using the MEPS data. However, if the MEPS undercounts event-level expenditures differentially across the types of services, our cost measure derived from the MEPS may produce a biased estimate of the change in costs if utilization is shifted away from one type of service to another. This is a potential limitation to our analysis, and the direction of the bias would depend on which service is disproportionately undercounted.

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we estimate should be viewed as 'aggregate' prices that incorporate unmeasured utilization correlated to the measured utilization; e.g. the price of a physician visits will include the average subsequent prescription drug use that resulted from that physician visit.

We then use this 'synthetic' estimate of health-care expenses as the dependent variable in the generic empirical model identified above; we estimate a generalized gamma model (GMM) with a log link to account for the skewed nature of health expenditures. We do not use a two-part model because so few of the observations in this population have no utilization for the year. Because it is possible that a change in the mix of utilization occurs in a way that no change in overall health expenditures results (i.e. the utilization of some services increases while the utilization of other services decreases), we also examine each utilization measure independently in follow-up analyses. For these, we estimate a negative binomial model for the count of each of these utilization measures independently, except we estimate a simple logit model for the odds of receiving any care from a mental health professional.

Our second set of outcome measures examines access to care. The CTS-HS asks whether respondents had a usual source of care and a follow-up question to identify that usual source of care, if applicable. We estimate a logit model for the odds of reporting a usual source of care other than an emergency room, and we estimate a model for the odds of reporting that the ER is a respondent's usual source of care. The CTS-HS also asks the questions: 'was there any time when you didn't get the medical care you needed?' and 'was there any time during the past 12 months when you put off or postponed getting medical care you thought you needed?' and so we estimate a logit model for a negative response to either of these questions to measure the lack of any difficulties in obtaining care. Finally, the CTS-HS asks respondents about their satisfaction with their primary care physician, and so we estimate a logit model for the odds that one is very satisfied.

We note, though, that a limitation of our approach is that making multiple comparisons increases the possibility that we observe a significant finding for one of these measures simply due to chance; analyzing 12 outcomes implies that an individual p-value threshold of 1% translates to an overall Type I error rate of about 11%.

3.5. Control variables

As noted above, we are interested in the effect of the commercial HMO penetration rate and the Medicaid-dominant penetration rate on the different OUTCOME_{it} measures. We also include an extensive set of person-level control variables, $X_{I,it}$. These include age, age squared, and gender, family structure (e.g. a single parent with children), total family income as percent of the poverty line, race/ethnicity, the highest education level in the family, and five self-reported health status categories.

We include a set of time-varying, geographic control variables, $X_{\text{GEO},it}$ to account for potential state-level or market-level changes over time which are correlated with changes in Medicaid HMO penetration over time. We include a state-level measure of the Medicaid population in primary-care case management (PCCM) obtained from CMS, because the implementation of PCCM may affect utilization and access to care. (This measure is available from CMS at the state level rather than the market level.) We include a state-level Medicaid fee index based on surveys conducted the Urban Institute—measured as the ratio of Medicaid to Medicare physician fee, adjusted by the CMS geographic physician cost index—because greater physician participation induced by changes in fees may affect utilization and access to care (Cohen and Cunningham, 1995; Gruber *et al.*, 1997; Zuckerman *et al.*, 2004). We also include two market-level measures for the supply of health-care providers aggregated from the Area Resource File: the market-level number of physicians per capita and the market-level number of hospital beds per capita. Finally, we include market-level measures of HMO penetration for the privately insured population from InterStudy as a control variable. Any of these market-level changes in provider competition or insurance market dynamics may be associated with utilization, access to care, and Medicaid HMO penetration.

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4. RESULTS

Table I shows the average penetration rates in the urban markets of the CTS-HS during this time period for all HMOs and for both commercial HMOs and Medicaid-dominant HMOs separately; the standard deviations across markets for each year are also shown in brackets. We also show the nationwide estimates for Medicaid HMO penetration from CMS as a reference point. The overall penetration rate across the CTS-HS markets increased from 23.6% in June 1996 to 40.1% in June 2002. (These estimates for the CTS-HS markets are generally consistent with those released by CMS, although the discrepancies between the two may result from the CTS-HS being limited to only 51 select urban MSAs in the United States) The penetration rate by commercial HMOs peaked at 14.1% in 1998 and then declined to 12.2% by 2002 as some commercial plans pulled out; these patterns are also consistent with Felt-Lisk and Yang (1997) and Long and Yemane (2005). The penetration rate of Medicaid-dominant HMOs increased throughout the study period from 15.4% in 1996 to 27.9% in 2002. However, the changes in penetration rates over time are not uniform across the CTS-HS markets (e.g. some markets had increases in commercial penetration over time, and some markets had decreases in Medicaid-dominant penetration over time), providing us with meaningful variation to exploit in our analysis.

Table II shows the results relevant to the construction of our measure of total health-care expenses for Medicaid enrollees in the CTS-HS. The first column of Table II shows the mean values for the utilization outcome measures in the MEPS sample, and the second and third columns of Table II show the regression results to determine the net Medicaid 'unit prices' we used to derive our synthetic measure of health-care expenses. The regression results appear quite reasonable. For instance, an office-based physician visit has a unit price of $167 while an outpatient surgery has a unit price of $4172.

Table I. Medicaid HMO penetration rates: urban markets in the CTS-HS by period

Penetration rate measures	1996	1998	2000	2002
Urban CTS-HS markets				
HMO penetration rate	23.6%	34.6%	32.0%	40.1%
	[22.2%]	[26.3%]	[30.3%]	[30.5%]
Commercial HMO penetration rate	8.2%	14.1%	13.2%	12.2%
	[9.4%]	[12.5%]	[12.8%]	[14.0%]
Medicaid-dominant HMO penetration rate	15.4%	20.4%	18.8%	27.9%
	[19.0%]	[20.0%]	[23.2%]	[26.9%]
Nationwide HMO penetration rate from CMS:	25.6%	39.6%	38.0%	39.8%

Source: Compiled CMS and InterStudy data. Standard deviations for the CTS-HS data are shown in brackets.

Table II. OLS regression results for utilization-based health-care expenses: nonelderly urban Medicaid population

Variable	Mean	Marginal effect	Standard error
Total Medicaid expenditures	1660	n/a	n/a
Office-based physician visits	3.051	167	11***
Office-based physician visits are top-coded	0.007	3315	563***
Medical practitioner visits	0.263	195	47***
Any mental health services	0.072	1206	181***
Emergency room visits	0.266	426	63***
Inpatient stays	0.110	1683	188***
Inpatient nights	0.783	760	48***
Inpatient nights are top-coded	0.010	11 802	650***
Inpatient surgeries	0.031	3670	261***
Outpatient surgeries	0.025	4172	221***

Source: 1996–2003 medical expenditure panel survey ($N = 20\,025$). All dollar amounts are in 2003 dollars. R-squared = 0.352.
Statistical significance: ***$p<0.01$; **$p<0.05$; *$p<0.10$.

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A three-night inpatient stay without a surgery equals \$3963 (= \$1683+3 × \$760), while a four-night inpatient stay with a surgery equals \$8393 (= \$1683+4 × \$760+\$3670).

Tables III and IV show our main regression results. Table III shows the full set of results from the GMM model for total estimated health-care expenses in order to illustrate the effects of our person-level and local-level control variables. The mean values for these two sets of control variables are shown in the left-hand side of Table III, while the marginal effects, their standard errors, and statistical significance are shown on the right-hand side. For many of the variables, the marginal effect shown represents a one-unit change in the independent variable on the dependent variable; this is the case for each of the categorical variables (i.e. 0–1), age, log of income, and both doctors and hospitals per capita. For the Medicaid HMO penetration rates, however, we show the marginal effect of a 10 percentage point change in the penetration rate; i.e. an increase from 12 to 22%. We choose this range since, alternatively, a marginal effect from a one percentage point change would be somewhat trivial and a marginal effect from a full 100 percentage point change would not be representative of the underlying

Table III. Full GMM regression results for total estimated health-care expenses: full sample of children and adults pooled

Variable	Mean	Marginal effect	Standard error
Medicaid HMO penetration rates			
Commercial Medicaid HMO penetration rate	12.0%	57	108
Medicaid-dominant HMO penetration rate	21.1%	−26	57
Person-level control variables			
Age	13.79	−11	4***
Female	0.562	350	178**
Family type: single parent with kids	0.604	n/a	n/a
Family type: married parents with kids	0.314	−166	161
Family type: nonnuclear	0.082	164	223
Log of family income as a percent of the poverty line	4.217	10	65
White	0.347	n/a	n/a
African American	0.299	−631	129***
Asian	0.048	−431	240*
Hispanic	0.305	−662	195***
Family education: no high school	0.318	n/a	n/a
Family education: high school graduate	0.418	313	185*
Family education: some college	0.200	323	275
Family education: college graduate	0.050	603	524
Family education: graduate degree	0.014	674	697
Self-reported health status: excellent	0.326	n/a	n/a
Self-reported health status: very good	0.266	366	191*
Self-reported health status: good	0.229	1010	249***
Self-reported health status: fair	0.117	3386	616***
Self-reported health status: poor	0.031	8206	2258***
Local-level control variables			
State-level percent of Medicaid population in PCCM	15.8%	−102	94
State-level cost-adjusted Medicaid fee index	67.9%	51	116
Market-level number of doctors per 1000 capita	2.976	−104	368
Market-level number of hospital beds per 1000 capita	3.685	67	280
Market-level private HMO penetration rate	41.8%	184	65***
Other variables:			
Year indicator variables	n/a	Yes	n/a
Market-level fixed effects	n/a	Yes	n/a
Constant term	n/a	Yes	n/a

Source: 1996–1997, 1998–1999, 2000–2001, 2003 CTS-HS ($N = 6129$). *Notes*: The marginal effect for the independent variables represented as percentages (specifically, market-level penetration rates, state-level percent in PCCM, and state-level Medicaid fee index) represent the change for a ten percentage point change in the independent variable. All other marginal effects are for a one-unit change in the independent variable, some of which are for categorical variables changing from 0 to 1. The regression model includes both age and age squared, but the marginal effect shown combines the two effects (specifically, negative for the first-order term and negative for the second-order term) at the average age.
Statistical significance: ***$p<0.01$; **$p<0.05$; *$p<0.10$.

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Table IV. Results for a 10 percentage point change in HMO penetration rates on access, utilization, and expenses: full sample of children and adults pooled and separate

		Commercial HMO		Medicaid-dominant HMO:	
Outcome variable	Mean	Marginal effect	Standard error	Marginal effect	Standard error
Full sample ($N = 6129$):					
Total estimated expenses in 2003$	2596	57	108	−26	57
Utilization measures					
Office-based physician visits	4.214	0.053	0.075	−0.018	0.075
Medical practitioner visits	0.463	−0.009	0.029	0.034	0.014**
Any mental health services	0.121	0.005	0.006	0.004	0.004
Emergency room visits	0.630	0.002	0.032	0.042	0.019**
Inpatient stays	0.196	0.006	0.014	−0.016	0.008**
Inpatient nights	0.534	0.034	0.039	−0.023	0.025
Inpatient surgeries	0.035	0.003	0.001**	−0.002	0.001*
Outpatient surgeries	0.089	−0.009	0.003**	−0.005	0.004
Access to care measures					
Usual source of care other than the ER	0.869	0.005	0.009	−0.007	0.007
Using the ER as a usual source of care	0.038	−0.000	0.004	0.005	0.001***
Difficulty in obtaining care	0.151	0.002	0.007	0.001	0.005
Satisfied with one's primary-care physician	0.659	0.001	0.013	0.007	0.012
Children under age 20 ($N = 3882$)					
Total estimated expenses in 2003$	2 190	11	11	12	47
Utilization measures					
Office-based physician visits	3.728	0.051	0.082	0.033	0.078
Medical practitioner visits	0.371	−0.003	0.021	0.028	0.010***
Any mental health services	0.108	−0.002	0.005	0.002	0.004
Emergency room visits	0.557	0.014	0.033	0.047	0.021**
Inpatient stays	0.168	0.004	0.010	−0.010	0.007
Inpatient nights	0.463	0.019	0.026	−0.011	0.017
Inpatient surgeries	0.020	0.000	0.000*	−0.000	0.000
Outpatient surgeries	0.069	−0.005	0.003	−0.002	0.002
Access to care measures					
Usual source of care other than the ER	0.887	0.009	0.009	−0.008	0.009
Using the ER as a usual source of care	0.031	−0.002	0.004	0.004	0.001***
Difficulty in obtaining care	0.084	−0.000	0.006	0.003	0.006
Satisfied with one's primary-care physician	0.686	0.003	0.013	0.010	0.031
Parents ages 20 and above ($N = 2247$)					
Total estimated expenses in 2003$	3 851	−145	−115	−163	128
Utilization measures					
Office-based physician visits	5.718	−0.178	0.172	−0.059	0.145
Medical practitioner visits	0.749	−0.038	0.044	0.032	0.026
Any mental health services	0.159	0.017	0.014	0.007	0.007
Emergency room visits	0.856	−0.056	0.046	0.039	0.036
Inpatient stays	0.283	−0.007	0.015	−0.024	0.008**
Inpatient nights	0.755	0.005	0.051	−0.093	0.037**
Inpatient surgeries	0.081	0.003	0.002	−0.006	0.003**
Outpatient surgeries	0.151	−0.015	0.008**	−0.007	0.007
Access to care measures					
Usual source of care other than the ER	0.813	−0.008	0.012	−0.001	0.007
Using the ER as a usual source of care	0.058	0.002	0.007	0.008	0.005
Difficulty in obtaining care	0.363	0.009	0.026	−0.005	0.013
Satisfied with one's primary-care physician	0.570	0.004	0.023	0.002	0.018

Source: 1996–1997, 1998–1999, 2000–2001, 2003 CTS-HS.
Statistical significance: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$.

data. For instance, we observe that the marginal effect of a 10 percentage point increase in commercial HMO penetration on total health-care expenses is an insignificant $57 (with a standard error or $108), while the marginal effect of a 10 percentage point increase in Medicaid-dominant HMO penetration is an insignificant -$26 (with a standard error of $57). We also use 10 percentage point changes for showing the marginal effects for the percent change in PCCM, Medicaid fees, and private HMO penetration.

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Many of the person-level control variables are significant here (as well as in the other models for access to care and utilization not shown in entirety) confirming, for example, that less healthy individuals have higher health-care expenses in these data. In contrast, the state-level and market-level control variables are generally insignificant. However, because we include market-level fixed effects, these control variables only capture the variation over time, which may often be minimal.

Table IV shows the marginal effects for the commercial HMO penetration rate and the Medicaid-dominant HMO penetration rate for each of the different $OUTCOME_{it}$ measures. (We discuss the CTS-HS data's limitations and the corresponding implications for the generalizability of these results in the next section.) The mean values for these measures are shown in the left-hand side of Table IV, the marginal effects and standard errors for the commercial HMO penetration rate are shown in the middle, and the marginal effects and standard errors for the Medicaid-dominant HMO penetration rate are shown in the right-hand side. (The mean values for the utilization measures in the CTS-HS sample shown in Table IV are slightly higher than those in the MEPS shown in Table II, but the overall patterns are comparable. It is unlikely that the differences between the surveys vary systematically with Medicaid HMO penetration rates.) The top panel shows the results for the full sample of children and parents enrolled in Medicaid, while the middle and bottom panels show the results for children and parents separately. Each row represents the effect for the two key independent variables in a particular dependent variable's regression results: total health-care expenses, a given utilization measure, or a given access to care measure. For instance, the GMM model's (statistically insignificant) point estimate of the marginal effect for total expenses of $57 for the commercial HMO penetration rate and -$26 for the Medicaid-dominant HMO penetration rate from the top two rows of Table III are shown in the top row of the first panel in Table IV.

For the measure of total expense, we observe no statistically significant relationship between the commercial HMO penetration rate and the Medicaid-dominant HMO penetration rate for either the full sample pooled or the children versus parent subsamples. We should note that the insignificant effects we observe are not the same as precisely estimated effects equivalent to zero. However, our subjective interpretation of these insignificant effects is that they would not be large; for instance, an effect of $57 would represent a roughly 2% change in the base of $2596 (plus or minus about 4% from the $108 standard error). The results for the separate utilization measures do suggest that the utilization of some services increases with Medicaid HMO penetration, while the utilization of other services decreases with Medicaid HMO penetration – consistent though with our finding of no significant net change in spending related to HMO penetration.

The commercial HMO penetration rate is significantly associated with the number of surgeries: inpatient surgeries appear to increase (particularly for children) and outpatient surgeries appear to decrease (particularly for parents). For instance, a hypothetical 10 percentage-point increase in the commercial HMO penetration rate from its average of 12% over this time period to a value of 22% would be associated with an increase in the overall number of inpatient surgeries from about 3.5 to about 3.8 per 100 enrollees per year and associated with a decrease in the overall number of outpatient surgeries from about 8.9 to about 8.0 per 100 enrollees per year.

The Medicaid-dominant HMO penetration rate is significantly associated with an increase in the number of medical practitioner (i.e. a nurse practitioner, physician assistant, or midwife) visits (particularly for children), an increase in the number of ER visits (particularly for children), a decrease in the number of inpatient stays (particularly for adults), and a decrease in the number of inpatient surgeries (particularly for adults). For instance, a hypothetical 10 percentage-point increase in the Medicaid-dominant HMO penetration rate from its average of 21% over this time period to a value of 31% would be associated with an increase in the overall number of medical practitioner visits from about 46.3 to about 49.7 per 100 enrollees per year, an increase in the overall number of ER visits from about 63.0 to about 67.2 per 100 enrollees per year, a decrease in the overall number of inpatient stays from about 19.6 to about 18.0 per 100 enrollees per year, and a decrease in the overall number of

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inpatient surgeries from about 3.5 to about 3.3 enrollees per 100 enrollees per year. The insignificant relationship between total expenses and Medicaid-dominant HMO penetration therefore implies that the higher costs from increased visits to medical practitioners and ERs are offset by the lower costs from reduced inpatient stays and surgeries despite the higher per unit costs of these latter services.

Table IV also shows the results for our four measures of access to care. We find no significant effects for the commercial HMO penetration rate, but we observe one significant effect for the Medicaid-dominant HMO penetration rate. The Medicaid-dominant HMO penetration rate is significantly associated with an increase in the likelihood of using the ER as one's usual source of care (particularly for children). This result is consistent with the significant finding for the number of ER visits (particularly for children). For instance, an increase in the Medicaid-dominant HMO penetration rate from 21 to 31% would be associated with an increase in the percent of enrollees using the ER as a usual source of care from about 3.8 to about 4.3%.

We were initially puzzled by our observation that the use of Medicaid-dominant HMOs increased the number of ER visits and the reliance on the ER as a usual source of care, because a frequent observation in this literature is that Medicaid managed care reduces the use of the ER. However, we were able to reproduce this common negative finding by re-running our model and dropping the market-level fixed effects and the state-level and market-level control variables, that is, cross-sectional variation in HMO penetration is also significantly associated with decreases in ER use in these data. Adding the local-level controls changed this significantly negative effect to an insignificant effect, and then adding the market-level fixed effects changed this effect to significantly positive (as ultimately shown in Table IV).

5. DISCUSSION

Our results suggest that neither the increased use of commercial HMOs nor Medicaid-dominant HMOs over this time period resulted in significant decreases in health-care expenses or improvement in access to care for the Medicaid population, relative to what would have occurred under direct fee-for-service reimbursement from states. These results are qualified, though, by various limitations within the CTS-HS data, which we revisit below. Moreover, because we do not observe measures of health outcomes, we cannot rule out the possibility that commercial HMOs or Medicaid-dominant HMOs led to improvements in welfare via improvements in actual health of enrollees served.

Regarding our commercial HMO results, a shift from outpatient to inpatient surgeries would not seem to be welfare improving. Our other research using the Community Tracking Study's Physician Survey indicates that commercial HMOs increased the likelihood that office-based physicians accept new Medicaid patients (Adams and Herring, 2008), but this did not translate into a finding of either increased number of physician visits or improved access to care using the Medicaid enrollee data presented here. Regarding our Medicaid-dominant HMO results, increases in medical practitioner visits may have been welfare-improving for this low-income population, while increases in ER use would seem to be welfare-reducing. Decreases in inpatient care could be welfare-improving if driven by better preventive care and in turn, reductions in avoidable hospitalizations, but would be welfare-reducing if caused by HMOs denying needed care. Our overall assessment is that the findings for utilization and access to care we observe are not consistent with a claim that an increase in the use of either commercial or Medicaid-dominant HMOs clearly improves efficiency in the management of care nor enrollee welfare for this covered population.

As noted throughout the article, however, a number of econometric limitations to our analysis do make this assessment tentative: limitations to the CTS-HS data (e.g. the inclusion of only 51 MSAs in the sample, the top-coding of the utilization data, the lack of SSI enrollee status, length of insurance coverage, and prescription drug utilization), the availability of market-level measures of HMO penetration through InterStudy and CMS instead of county-level measures, and our aggregating of

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different types of plans within our Medicaid-dominant analytic category. To be clear, our estimated insignificant effects, which may result from any of these limitations noted above, are not equivalent to precisely estimated zero effects. An imprecise estimate of no effect (particularly in the presence of measurement error) ultimately calls for more data and/or additional studies.

With these caveats in mind, we believe our results are relevant to state policymakers that have contracted, or plan to contract, with HMOs to provide medical services to their Medicaid enrollees, as we do not observe reductions in spending or improvements in access to care, other than our prior finding on physicians' acceptance of new patients, with either type of Medicaid HMO. Moreover, our measure of total expenses does not incorporate any changes in the administrative costs incurred. If the sum of administrative costs incurred by the state and by individual HMOs under a capitated delivery system are higher than the administrative costs incurred by the states under a FFS delivery system, then contracting with either type of HMO may ultimately increase total public spending even if the direct medical costs are unchanged (as we appear to observe). However, this risk premium may be acceptable to some states if their primary goal is to achieve greater budget predictability by shifting the risk of increased utilization to the HMOs through capitated payments. Another possibility is that commercial HMOs expected to achieve significant reductions in medical spending but they were ultimately not realized. If so, the exits by many commercial plans during the mid-to-late 1990s would have resulted from contractual burdens and capitation rates that did not fully meet the profit rate expectations of the industry.

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