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James Marton
Georgia State University, marton@gsu.edu

Aaron Yelowitz
University of Kentucky, aaron@uky.edu

Jeffery C. Talbert
University of Kentucky, jtalb1@uky.edu

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A tale of two cities? The heterogeneous impact of medicaid managed care

James Marton[a,*], Aaron Yelowitz[b,1], Jeffery C. Talbert[c,2]

[a] Department of Economics and Georgia Health Policy Center, Andrew Young School of Policy Studies, Georgia State University, United States
[b] Department of Economics, University of Kentucky, United States
[c] College of Pharmacy, University of Kentucky, United States

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ABSTRACT

Evaluating Accountable Care Organizations is difficult because there is a great deal of heterogeneity in terms of their reimbursement incentives and other programmatic features. We examine how variation in reimbursement incentives and administration among two Medicaid managed care plans impacts utilization and spending. We use a quasi-experimental approach exploiting the timing and county-specific implementation of Medicaid managed care mandates in two contiguous regions of Kentucky. We find large differences in the relative success of each plan in reducing utilization and spending that are likely driven by important differences in plan design. The plan that capitated primary care physicians and contracted out many administrative responsibilities to an experienced managed care organization achieved significant reductions in outpatient and professional utilization. The plan that opted for a fee-for-service reimbursement scheme with a group withhold and handled administration internally saw a much more modest reduction in outpatient utilization and an increase in professional utilization.

1. Introduction

Although the implementation of the key features of the Affordable Care Act (ACA) is well underway, policymakers continue to struggle with the best health care finance and delivery system to achieve the "Triple Aim" of improved quality of care, improved population health, and reduced cost (Berwick et al., 2008). This is especially true among state Medicaid programs, as many states have recently expanded their Medicaid programs in January 2014, despite concerns about the impact of the expansion on state budgets.[3]

One relatively new approach to this problem is to create what are known as Accountable Care Organizations (ACOs), which can be generally defined as coordinated networks of medical providers that assume the risk for the quality and total cost of care for their patients (Burns and Pauley, 2012). As discussed in Fisher et al. (2012), much like more traditional managed care organizations (MCOs), health maintenance organizations (HMOs), or integrated delivery networks, ACOs may differ both in terms of specific contract characteristics and the populations they serve, with current ACOs providing care through contracts for Medicaid, Medicare, private payers, and different combinations of these groups.

One challenge associated with evaluating the success of ACOs, MCOs, or integrated delivery networks, is the fact that there may be a great deal of heterogeneity across these networks/organizations/plans in terms of their reimbursement incentives and other key programmatic features (Gaynor et al.,

* Corresponding author at: Department of Economics, Georgia State University, P.O. Box 3992, Atlanta, GA 30302-3992, United States. Tel.: +1 404 413 0256; fax: +1 404 413 0145.
E-mail addresses: marton@gsu.edu (J. Marton), aaron@uky.edu (A. Yelowitz), jtalb1@uky.edu (J.C. Talbert).
[1] Address: Department of Economics, University of Kentucky, 335 Business and Economics Building, Lexington, KY 40506-0034, United States. Tel.: +1 859 257 7634; fax: +1 859 323 1920.
[2] Address: College of Pharmacy, University of Kentucky, 237 BPC, 789 S. Limestone Street, Lexington, KY 40536-0596, United States. Tel.: +1 859 323 7141; fax: +1 859 323 0069.

[3] For a summary of state Medicaid expansion plans, see: http://kff.org/medicaid/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/.

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2004). For example, some plans may reimburse primary care providers via capitation while others may reimburse via fee-for-service (FFS). Research attempting to make blanket statements about the impact of ACOs or MCOs in improving quality and reducing costs seem to sweep this heterogeneity under the rug. This challenge, along with the concern about the non-random selection of participants, suggests that there is little convincing evidence on the impact of such plans on the utilization of health care services, health care costs, and health outcomes.

The purpose of our paper is to directly examine how reimbursement incentives and other key programmatic features among Medicaid accountable/managed care plans impact health care utilization and spending using a quasi-experimental approach that exploits the timing and county-specific implementation of Medicaid managed care mandates in Kentucky in the late 1990s.[4] The Medicaid program in Kentucky was changed from a FFS system to a managed care plan in two geographically distinct sub-sets of counties. We can compare recipients initially in each of the two sets of "treatment" counties before and after this reform with recipients initially in neighboring "control" counties that remained in a FFS system, in order to deal with any concerns about non-random selection into the plans.

Despite serving Medicaid recipients in the same state, and operating less than 100 miles apart, the two plans selected very different reimbursement mechanisms for physicians and diverged along other plan dimensions as well. These differences motivate our heterogeneous treatment effect approach of modeling the impact of each plan separately. The Louisville-centered plan (Passport) elected to reimburse physicians using a capitated payment scheme, while the Lexington-centered plan (Kentucky Health Select or KHS) opted for a modified FFS reimbursement scheme for physicians featuring a group withhold. Another important difference is that the Louisville-centered "capitated" plan contracted out administrative responsibilities, such as utilization review, to an experienced MCO while the Lexington-centered "withhold" plan decided to handle such responsibilities internally. These fundamental organizational differences between the two plans could have an impact upon their ability to improve quality, while at the same time reducing utilization and spending.

We find that both organizations/plans decreased the probability of any monthly outpatient utilization among the children in our sample, though the Louisville-centered "capitated" plan was able to do so to a greater degree (a 61 percent reduction versus a 17 percent reduction). In addition, both plans appear to have had a minimal impact on the probability of any monthly inpatient utilization for children, which may be explained by low baseline inpatient utilization rates. Our most striking finding is that the Louisville-centered "capitated" plan reduced the monthly probability of any professional (physician) utilization by 44 percent among children, while in the Lexington-centered "withhold" plan professional (physician) utilization actually increased by 6 percent. If we instead measure utilization along the intensive margin (using the number of monthly visits or monthly expenditures), we still find that the Louisville-centered "capitated" plan led to significant reductions in professional and outpatient utilization not matched by the Lexington-centered "withhold" plan.

Both plans increased the probability of having any monthly well child visits, though the Louisville-centered "capitated" plan did so to a greater degree. Therefore, the heterogeneous treatments generated by differences in plan design between the two regions led to different outcomes with respect to utilization. Finally, we find suggestive evidence that the reductions in utilization observed in the Louisville-centered "capitated" plan did not lead to adverse health outcomes for asthmatic children, as measured by inpatient hospitalizations. These results are robust to a variety of specification checks.

The rest of the paper is organized as follows: Section 2 provides a description of the policy change in Kentucky Medicaid. Section 3 reviews the relevant literature on physician reimbursement and Medicaid managed care and describes how our approach contributes to this literature. Our methodological approach and identification strategy is described in Section 4 and our data in Section 5. Sections 6 and 7 present our results and specification checks. Section 8 concludes with a discussion of policy implications.

2. The introduction of managed care in Kentucky Medicaid

2.1. Brief history

In October 1995, the Commonwealth of Kentucky received Centers for Medicare and Medicaid (CMS) approval to initiate a major restructuring of the Kentucky Medicaid program by dividing the state into eight regional managed care networks. Within each region public and private providers were expected to collaborate to form managed care partnerships to oversee the provision of Medicaid services, rather than contracting these services out to commercial managed care providers. The goals of this restructuring were to improve access and quality of care, stabilize cost growth, and emphasize primary care and prevention.

In November 1997, Medicaid managed care enrollment began in the two regions that contain the state's two major urban areas, region 3 (anchored by Louisville) and region 5 (anchored by Lexington).[5] These, along with the other regions, are labeled in Fig. 1. The managed care organization/plan covering region 3 was named the *Passport Health Plan* (Passport) and the managed care organization/plan covering region 5 was named the *Kentucky Health Select Plan* (KHS). Ultimately, the other six regions were not able to successfully create managed care partnerships. Passport, designed around the University of Louisville network, was charged with providing Medicaid managed care coverage to all Medicaid recipients in Jefferson County (containing Louisville) and 15 surrounding counties. Similarly, the KHS plan was designed around the University of Kentucky network and was charged with providing Medicaid managed care to all Medicaid recipients in Fayette County (containing Lexington) and 20 surrounding counties.[6]

Both organizations also agreed to continue reporting encounter data to the state as they had under Medicaid FFS reimbursement rules. Because the organizations were made up of local providers that were already accustomed to reporting claims to the state for billing purposes, this did not represent a change in reporting practice.[7] The region 5 partnership dissolved within two and a half years of its introduction. Today Medicaid recipients in region 3 are

[4] According to the Kaiser Family Foundation (2012), over sixty five percent of all Medicaid beneficiaries were enrolled in some form of a managed care plan by 2010.

[5] Currie and Fahr (2005) cite reports from the Health Care Financing Administration that classify the Medicaid managed care penetration rate in Kentucky as over 50 percent in 1992, 1993, and 1994. This is likely due to Kentucky Medicaid's primary care case management program (KENPAC) where recipients are assigned a specific primary care provider. Although a primary care "gatekeeper" physician is one part of most managed care programs, we do not consider this feature alone to be enough to characterize a plan as being managed care.

[6] There are some Medicaid recipients in these counties that are excluded from managed care. They include those in nursing facilities or psychiatric facilities for an extended stay, those served under home and community-based waivers, and those who must spend down to meet eligibility income criteria.

[7] This model of having a single community-organized health system (COHS) manage care in a given region without accepting commercial bids was one of several models used in California to implement Medicaid managed care.

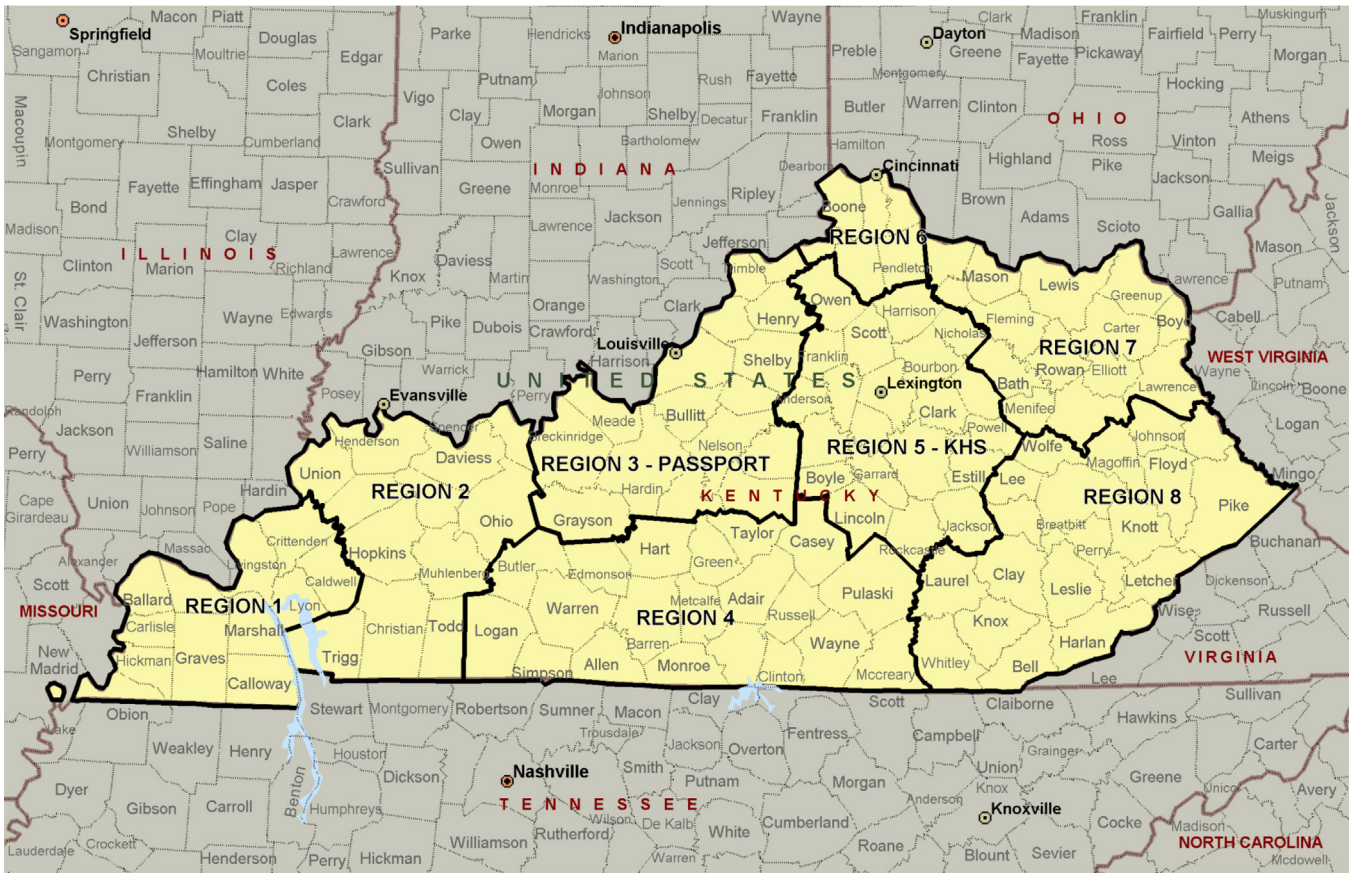


Fig. 1. Kentucky's 8 Regions, including passport counties (Region 3) and Kentucky Health Select (Region 5).

still covered under the Passport managed care plan, while Medicaid recipients in the rest of the state (including recipients in region 5) were covered under Fee-For-Service (FFS) Medicaid until late 2011.[8]

Table 1 provides trends in overall and managed care eligibility over time. The table suggests that these two regions account for almost half of the state's total population and roughly 35 percent of the state's Medicaid population. Table 1 also suggests that Medicaid is an important potential source of insurance coverage in Kentucky.

2.2. State capitation payments to Passport and KHS

Both Passport and KHS were given the responsibility of providing comprehensive health care coverage for their Medicaid enrollees in exchange for capitation payments (flat monthly fees per recipient based on their category of eligibility) negotiated with the state. The monthly capitation rates for most of the timeframe we analyze in this paper are presented in Table 2A. Appendix Table A1 presents a list of the services covered under these capitation payments and those excluded for both plans. The excluded services were to be covered by the state directly through FFS reimbursement or capitated through a separate waiver.

2.3. Plan reimbursement for providers

Passport elected to reimburse primary care providers (PCPs) on a capitated basis, with the capitation rate adjusted for the age, gender, and eligibility mix of their patients.[9] In addition, PCPs were eligible for performance-based bonuses based on such activities as extending office hours, maintaining an appointment reminder system, accepting new patients, and meeting goals for utilization of emergency room visits, inpatient days, and specialty referral costs. In order for Passport to better measure resource use, an encounter claims bonus of roughly $1 for every non-FFS claim submitted was also established for PCPs. Hospital reimbursement was set up on a per diem basis using the Medicaid fee schedule with a 10 percent withhold.[10]

KHS instead elected to reimburse physicians and hospitals on a FFS basis using the Medicaid fee schedule with a 20 percent withhold. This means that physicians would receive 80 percent of the fee associated with each service performed and the remaining 20 percent was held back until the end of the year to be used as a potential reward for meeting budget targets. PCPs were organized into "pools of doctors" or PODs with each POD assigned a budget by KHS. If actual health care expenditures attributed to the POD

[8] The discussion of the history and institutional structure of the Passport and KHS health plans presented here draws in large part from Bartosch and Haber (2004), a report completed by RTI International for the Centers for Medicare & Medicaid Services. To learn more about the most recent reforms to the Kentucky Medicaid program see: http://medicaidmc.ky.gov/Pages/index.aspx.

[9] When we say that Passport capitates primary care providers, we mean Passport makes capitated payments to primary care practices. These could include different numbers of individual primary care providers whose individual compensation from the practice is not observed.

[10] The current Medicaid fee schedule for Kentucky is available at the following URL: http://chfs.ky.gov/dms/fee.htm.

Table 1
Trends in Kentucky Population and Medicaid Enrollment (in thousands).

Year	Statewide population	Region 3 (Passport) population	Region 5 (KHS) population	Statewide Medicaid enrollment	Region 3 (Passport) Medicaid enrollment	Region 5 (KHS) Medicaid enrollment	Statewide Medicaid managed care	Statewide Medicaid FFS
1997	3953	1093	719	532	112	75	0	532
1998	3985	1102	730	521	109	73	181	340
1999	4018	1114	742	518	106	71	177	341
2000	4049	1125	810	557	114	79	114	443
2001	4066	1132	801	608	126	88	126	482
2002	4087	1139	790	627	131	91	131	496

Sources: Population estimates are from the Kentucky State Data Center (http://ksdc.louisville.edu/) and the Medicaid eligible estimates are from the Kentucky Cabinet for Health and Family Services (http://chfs.ky.gov/dms/stats.htm). Passport was implemented in Region 3 from 1998 onward. Kentucky Health Select (KHS) was implemented in Region 5 during 1998–1999.

Table 2A
Passport and Kentucky Health Select monthly capitation rates (in dollars).

Eligibility category	Passport		
	Prior to November 1997	November 1997 to June 1998	July 1998 to December 1998
AFDC/TANF	N/A	137.00	146.20
Foster Care	N/A	177.38	188.52
SOBRA	N/A	171.02	181.85
SSI with Medicare	N/A	117.00	125.24
SSI without Medicare	N/A	504.65	531.51
SCHIP	N/A	N/A	N/A
Eligibility category	**Kentucky Health Select**		
	Prior to November 1997	November 1997 to June 1998	July 1998 to December 1998
AFDC/TANF	N/A	124.18	150.39
Foster Care	N/A	166.26	194.52
SOBRA	N/A	160.28	188.67
SSI with Medicare	N/A	143.03	170.16
SSI without Medicare	N/A	382.39	421.14
SCHIP	N/A	N/A	N/A

Source: Adopted from Bartosch and Haber (2004).
Notes: AFDC/TANF refers to Medicaid recipients whose eligibility is tied to their eligibility for cash welfare, called Aid to Families with Dependent Children prior to the 1997 welfare reform and Temporary Assistance for Needy Families afterwards. SOBRA refers to Medicaid recipients eligible as a result of the Sixth Omnibus Budget Reconciliation Act, which expanded Medicaid eligibility for children and pregnant women. SSI refers to Medicaid recipients also eligible for Supplemental Security Income Program and SCHIP refers to the State Children's Health Insurance Program.

exceeded the budget, then the proportion of the 20 percent withhold returned to the POD at the end of the year would be reduced. If the POD came in under budget, then the entire withhold would be returned as well as the surplus.

2.4. Summary of the key differences between the plans

As summarized in Table 2B, a key difference between the two organizations was the way in which physicians were reimbursed. Passport used capitation, while KHS opted for FFS with a 20 percent withhold. Under the Passport plan, the marginal revenue generated for a PCP from an additional office visit is essentially zero. On the other hand, PCPs still received additional revenue from additional visits under the KHS plan. Although the withhold may have encouraged some utilization reduction, it is important to note that this bonus was not measured at the level of the individual provider. Therefore, each individual physician may have had an incentive to "free ride" off of the utilization reductions generated by other members of their POD, while keeping their own schedule full.

Another key difference between the two organizations was the way in which they performed basic administrative functions, such as claims processing, member/provider services, case management, and information sharing. Passport opted to outsource these responsibilities to an administrative service organization (ASO), AmeriHealth Mercy Health Plan, based in Philadelphia. KHS decided to handle these responsibilities internally, despite a lack of experience at managing a managed care network. To the extent that MCOs/ACOs reduce utilization/spending through increased coordination of care and careful review of physician practice patterns, experience in these basic administrative functions may be crucial. Passport's choice to outsource these functions to an experienced ASO may have contributed to its relative success at reducing utilization among its enrollees.

These initial choices described above made by the Passport organization (capitating reimbursement for PCPs and outsourcing important administrative functions to an experienced ASO) created a plan that was in many ways much closer to a "textbook" HMO/MCO/ACO than the KHS plan. Thus, we would anticipate Passport to be more successful at reducing utilization than KHS.

3. Literature review

Through our description of Kentucky's Medicaid reform outlined in previous section, we view our study as contributing to two distinct strands of literature in health economics.[11] First, although

[11] Note that there is a lengthy literature that examines the effects of private managed care plans as well as Medicaid managed care. See, for example, Luft (1981), Miller and Luft (1994, 1997), Glied (2000), Cutler and Zeckhauser (2000), and Cutler et al. (2000) for discussions of managed care, and Sparer (2012) for a recent

Table 2B
Summary of plan differences.

	Passport	KHS
Timeframe	November 1997–present	November 1997–June 2000
# Counties/Anchor	16 counties/Louisville	21 counties/Lexington
PCP reimbursement	Capitation	FFS based on Medicaid fee schedule with 20% withhold
Hospital reimbursement	FFS based on Medicaid fee schedule with a 10% withhold	FFS based on Medicaid fee schedule with 20% withhold
Specialist reimbursement	FFS based on Medicaid fee schedule with a 10% withhold	FFS based on Medicaid fee schedule with a 10% withhold
Administrative Responsibilities	Contracted out to AmeriHealth Mercy Health Plan	Handled internally
Report claims/encounters as in the pre-reform period?	Yes	Yes

Source: Adopted from Bartosch and Haber (2004).

many academic studies on different forms of managed care (such as ACOs, MCOs, HMOs, PCCMs and IPOs) have emphasized the incentives of capitation payments, the reimbursement to physicians *within the organization* can vary, even though the organization as a whole is paid on a capitated basis.[12] In particular, the KHS combination of FFS physician reimbursement and a group "withhold" for meeting budget targets has rarely been examined, and only in the context of a private managed care plan. Second, there is a somewhat larger "case study" literature that has examined the effects of a given state's changes in its Medicaid program on utilization, cost, and health outcomes.

With respect to physician reimbursement within an organization, Cooper and Rebitzer (2002) note that "most of the empirical literature on physician incentives and managed care organizations treats physician incentive systems as a black box whose internal operation is obscured from view." (p. 12). One exception is Gaynor et al. (2004), who study how PCPs in managed care networks respond to incentives to contain medical expenditures.[13] The HMO in that study divided physicians into panels of doctors (or PODS).[14] Part of the reimbursement for the group was withheld, and then the entire group was given financial rewards if they collectively contained costs. GRT found that there was significant free-riding when the size of the POD became too large. For example, PODs with three physicians were much more effective at coming in under the cap than PODs with six or more physicians. Our study sheds further light on the ineffectiveness of extremely large PODs, since the Lexington region had a similar withholding policy for physicians, and the POD size averaged 20 primary care physicians.[15]

Although there is a large literature on Medicaid managed care (see the recent summary contained in Duggan and Hayford, 2013), the most convincing studies in this area have either focused on the "case study" of California, which created a quasi-experiment set up by phasing in Medicaid managed care in different counties, or at the national level through different state-by-state implementations.[16] The published studies that take advantage of California's county-level Medicaid managed care mandates are most similar to our approach. Duggan (2004) examines the impact of managed care on Medicaid spending and birth outcomes. Aizer et al. (2007) also examine the impact of managed care on birth outcomes.[17] These studies emphasize the impact of the capitated payment that the state government offers to the managed care organization per patient, but do not discuss in detail the reimbursement of physicians.[18] To date, no study has systematically examined how physician reimbursement within managed care organizations has affected utilization in Medicaid. Unlike California, where there were a multitude of organizations who may have different reimbursement arrangements with their physicians, in Kentucky, Passport and KHS each had clear, and uniquely different reimbursement regimes for physicians.

There are several other differences between the Kentucky reform and the California reform that we exploit to our advantage. First, unlike in Kentucky, the California Medicaid managed care data used in the literature has no information on utilization for Medicaid managed care recipients. Duggan (2004) focuses on Medicaid capitation payments rather than utilization in his individual level analysis and looks at birth outcomes at the county level using hospital discharge data rather than Medicaid claims data. Aizer et al. (2007) focus on birth outcomes, rather than overall utilization, using the California Birth Statistical Master File and Birth Cohort files. A second issue with the California Medicaid data is that the mandates for managed care were not binding for much larger groups of recipients and services than in Kentucky. For example, in some California counties undocumented workers, SSI recipients, and foster children were not required to participate in Medicaid managed care. In Kentucky, Medicaid managed care is mandatory for SSI recipients and foster children if they live in any of the managed care counties. Both California papers attempt to deal with this issue in their analysis of birth outcomes by focusing on those in their data for whom the managed care mandate is most likely to be binding.

Song et al. (2012) also provide more recent "case study" evidence from Massachusetts by examining provider organizations that entered into an alternative contracting arrangement with Blue Cross Blue Shield in 2009–2010. This contracting arrangement consists of a global budget with pay-for-performance and places the participating provider organizations at risk for excessive spending. They found that rates of spending increases slowed in these provider organizations as compared to control practices, with a

summary on Medicaid managed care studies. For a discussion of Medicare managed care, see Kaiser Family Foundation (2007) Fact Sheet "Medicare Advantage" and for more discussion of Medicaid managed care, see Kaiser Family Foundation (2012) Policy Brief "Medicaid and Managed Care: Key Data, Trends, and Issues".

[12] See, for example, Burns and Pauley (2012) for recent discussion of ACOs.

[13] See Chalkley and Tilley (2006) and Dusheiko et al. (2006) for examples from the UK.

[14] There is also a theoretical literature that explores the consequences of organizational fragmentation in the health care system, which emphasizes that physicians are central to resource allocation and care processes within a hospital, but are largely independent of hospital management. See Cebul et al. (2008).

[15] Bartosch and Haber (2004, p. 23).

[16] Examples at the national level include Duggan and Hayford (2013), Herring and Adams (2011), Currie and Fahr (2005), and Kaestner et al. (2005).

[17] Barham et al. (2013) also examine birth and pregnancy outcomes in California and find that outcomes improve for the moderately disadvantaged but not the extremely disadvantaged.

[18] Duggan (2004) notes that in California "fee-for-service reimbursement rates for many providers, including physicians and pharmacies, were set at the state, and not at the provider level" (p. 2563). The only discussion of physician reimbursement within a managed care organization is anecdotal; Duggan notes that in one managed care organization – Cal Optima in Orange County – the physicians received "140% of the Medicaid fee schedule." (p. 2566).

bigger difference in the second year after implementation than the first.

4. Methods and identification strategy

4.1. Identifying the impact of medicaid managed care

It is well recognized by health economists that selection bias represents a key barrier to assessing the impact of managed/accountable care on utilization. In many settings, especially in the private market, consumers have the choice between some form of a managed care plan and a FFS plan. Since the managed care plan represents the cheaper, but less generous option, it will tend to be more attractive to healthier individuals.[19] We refer to this as "enrollee selection." Thus the lower costs per managed care enrollee may reflect more stringent financial incentives on providers and alternative delivery methods, a healthier pool of participants (enrollee selection), or both. To identify the "pure" managed care effect one needs to keep the health composition within each type of plan constant, and, in general, OLS estimates will fail to do so and thus overstate the pure managed care effect.

In the context of public health insurance, especially Medicaid, the selection issues are perhaps somewhat different. The Medicaid population is poor and typically faces no copayments, premiums, or deductibles. In some contexts – such as the California Medicaid managed care setting that Duggan (2004) and Aizer et al. (2007) studied – recipients were initially able to voluntarily choose Medicaid managed care or stay in FFS, and then some California counties later mandated managed care enrollment. At least in the voluntary setting, it is not clear that the financial incentives to be in a managed care plan are very strong because Medicaid FFS plans tend to have little patient cost-sharing. Thus, it is not clear whether the selection bias will be the same as in the private setting.

In the Kentucky context, the switch from FFS to managed care was mandatory for a large portion of the Medicaid population, occurred at essentially one point in time, and was implemented in some, but not all Kentucky counties. In other words, a Medicaid recipient could not simply choose to opt into a managed care program, instead enrollment was based purely on county of residence. Therefore, enrollees in certain counties were automatically enrolled in managed care, while those in neighboring counties outside the managed care boundaries were not. This description of managed care implementation in Kentucky suggests a "difference-in-differences" approach to identify the impact of managed care on health care utilization that is free from the "enrollee selection" problem that plagues much of the literature.

One option for implementing this difference-in-differences approach would be to collect monthly enrollment and utilization data on all Medicaid enrollees in all 120 Kentucky counties before and after the reform. We could run a regression with an indicator of any monthly utilization as the dependent variable and an indicator of managed care enrollment, which would equal zero for all recipients in the pre-period and equal one for those living in one of the 37 managed care counties in the post period, as the independent variable. Thus we would be comparing the monthly utilization of those living in the 37 managed care counties before and after the reform with those living in any of the other 83 counties (see Fig. 1).

While such an approach would shed light on the impact of managed care, it suffers from several problems. First, it would treat managed care counties containing Kentucky's largest cities (Louisville in Jefferson county and Lexington in Fayette county) the same as much more rural managed care counties. In addition, these cities served as the "hub" for managed care activities within their respective regions, so they are also different from more rural areas in that regard. It may be the case that because Jefferson county contains Louisville, it is too different from other Kentucky counties for any comparison to be feasible. Second, it may not be reasonable to use counties in the far eastern or western parts of the state as controls for managed care counties in central Kentucky. Table 3 provides a descriptive comparison of each of the eight proposed managed care regions using "QuickFacts" data from the U.S. Census and confirms that there are important differences between the regions.[20] Third, there are also important differences in utilization patterns in adults versus children, so an analysis of all enrollees would ignore these differences. Finally, it does not address the potential endogeneity of residence. Enrollees may move across county lines in order to opt in or opt out of managed care. We refer to this as "migration endogeneity", an issue recognized in the California Medicaid context by Aizer et al. (2007).

Given these concerns, an alternative approach would be to focus our attention on enrollees in the outermost counties in both managed care regions that share a border with a FFS county. These outermost managed care counties and their FFS neighbors are likely to make for much more homogenous treatment and control groups than would be the case if we used all 120 counties. These outermost managed care counties are also more likely to have been "followers" rather than "leaders" in terms of setting managed care policy for their regions. This "border county" approach is motivated by, among others, the Black (1999) analysis of the effects of school test scores on housing prices. By looking at geographic areas that are contiguous and relatively homogeneous – yet are treated very differently by the implementation of managed care – we feel more confident that any measured impacts do not represent other omitted county-level factors.

In order to address migration endogeneity, we use managed care eligibility based on county of residence in January 1997 as a proxy for actual managed care enrollment. Presumably, choice of residence in January 1997 is exogenous to the implementation of the Medicaid managed care that occurred in November 1997. We also follow the literature and focus on our attention on children, specifically children enrolled continuously from January 1997 to June 1999.[21] As a specification check, we replicate our analysis on

[19] Cutler and Reber (1998) show that younger and healthier individuals at Harvard switched to less generous health plans after cost-sharing arrangements were changed, leading to an "adverse selection death spiral."

[20] Table 3 suggests that the Passport region (region 3) has a lower percentage of white inhabitants than any other region and is among the highest in terms of high school graduation rates. The KHS region (region 5) has the second lowest percentage of white inhabitants and the lowest homeownership rate. The poverty rate in both managed care regions is much lower than in regions 4, 7, and 8.

[21] Some studies analyze individuals with Medicaid spells as short as one month, yet there are a number of challenges with using short Medicaid spells to measure the impact of managed care. First, Medicaid eligibility changes are often associated with other changes in socioeconomic circumstances (such as changes in income, private insurance status, and marital status of the parent) that are difficult to observe in administrative data but may independently affect health care utilization. For example, children who newly enroll in Medicaid due to a drop in parent's income (and perhaps loss in private health insurance) may have utilization that is incorrectly attributed to the managed care or FFS arrangement rather than the drop in income. On the other hand, children who are made eligible for Medicaid due to marital dissolution may be less likely to use health care due to the increased time constraints on the single parent. Second, lagged insurance coverage could affect current utilization. For example, uninsured children who enroll in Medicaid may initially have increased utilization due to pent-up health care demand, yet this could be incorrectly identified as a HMO effect. Third, as Cutler and Gruber (1996) note, there are children who are eligible, but not participating in the Medicaid program who might be viewed as having conditional Medicaid coverage. What this means is that when the child gets sick, it may be relatively easy to enroll the child in Medicaid. Similar to the pent-up demand story, conditional coverage may incorrectly attribute utilization to managed care or FFS plans. For each of these reasons, the results from an analysis

Table 3
Regional comparisons using the census.

	Region 1	Region 2	Region 3 (Passport)	Region 4	Region 5 (KHS)	Region 6	Region 7	Region 8
Total population, 2006	235	382	1177	472	799	400	250	491
Average county population	20	32	74	24	38	67	18	26
White (%)	90.5	88.0	80.7	92.5	86.9	93.0	96.0	96.9
Living in same house, 1995 and 2000 (%)	59.5	56.0	54.0	56.9	48.8	53.9	61.7	66.6
High school graduates In 2000 (%)	75.8	74.9	80.0	66.8	77.7	81.4	68.1	58.7
Homeownership In 2000 (%)	75.0	71.2	69.9	73.9	64.9	70.3	77.0	76.1
Poverty rate in 2004 (%)	15.6	15.8	13.7	18.9	14.7	10.6	20.0	26.3
Kentucky counties in region	Ballard, Caldwell, Calloway, Carlisle, Crittenden, Fulton, Graves, Hickman, Livingston, Lyon, Marshall, McCracken	Christian, Daviess, Hancock, Henderson, Hopkins, McLean, Muhlenberg, Ohio, Todd, Trigg, Union, Webster	Breckinridge, Bullitt, Carroll, Grayson, Hardin, Henry, Jefferson, Larue, Marion, Meade, Nelson, Oldham, Shelby, Spencer, Trimble, Washington	Adair, Allen, Barren, Butler, Casey, Clinton, Cumberland, Edmonson, Green, Hart, Logan, McCreary, Metcalfe, Monroe, Pulaski, Russell, Simpson, Taylor, Warren, Wayne	Anderson, Bourbon, Boyle, Clark, Estill, Fayette, Franklin, Garrard, Harrison, Jackson, Jessamine, Lincoln, Madison, Mercer, Montgomery, Nicholas, Owen, Powell, Rockcastle, Scott, Woodford	Boone, Campbell, Gallatin, Grant, Kenton, Pendleton	Bath, Boyd, Bracken, Carter, Elliott, Fleming, Greenup, Lawrence, Lewis, Mason, Menifee, Morgan, Robertson, Rowan	Bell, Breathitt, Clay, Floyd, Harlan, Johnson, Knott, Knox Laurel, Lee, Leslie, Letcher, Magoffin, Martin, Owsley, Perry, Pike, Whitley, Wolfe

Source: U.S. Census QuickFacts data for Kentucky: http://quickfacts.census.gov/qfd/states/21000.html.
Notes: Population measured in thousands.

partially enrolled children. The results are unchanged from what we present.

While this alternative approach is promising, there is one final issue to be addressed: whether or not it makes sense to model the managed care "treatments" in each region as being homogeneous. Our prior description of the differences in plan characteristics across the two regions clearly suggests that we should model the impact of managed care in each region separately. Our use of separate border county FFS control groups for each region should handle other baseline differences between the two regions, such as differences in baseline utilization.

To summarize our empirical strategy, we define separate treatment and control shared-border counties for each of the two managed care regions and track the utilization of all children that (i) live in those counties in January 1997 and (ii) are continuously enrolled in Medicaid until June 1999. Fig. 2 illustrates the 4 Passport treatment and 7 control counties as well as the 9 KHS treatment and 14 control counties used in this analysis.[22] Table 4 provides a descriptive comparison of the treatment and control counties using "QuickFacts" data from the U.S. Census. The first two columns describe the Passport treatment and control counties, followed by the KHS treatment and control counties. We also present descriptions of Passport and KHS counties that share a common border. For both Passport and KHS, the treatment and control counties are very similar in terms of measurable county-level characteristics. Observable differences across the two regions further motivate separate Passport and KHS analyses. Finally, it is interesting to observe how similar the Passport and KHS counties are that share a common border. Later we compare the impact of the different managed care "treatments" in each these two similar sets of counties.

4.2. Empirical model specification

The key issue which motivates the instrumental variables approach we adopt in this paper is that mobility across Kentucky's 120 counties is non-trivial, and could be correlated with the implementation of Medicaid managed care. Put differently, location could be endogenous to health care utilization and Medicaid generosity. In the broader literature on welfare benefits, Gelbach (2004) convincingly finds that among women likely to use welfare, movers move to higher-benefit states, and do so earlier in the life cycle. If one believes that state-to-state moves occur due to differences in cash welfare generosity, then county-to-county moves (which are clearly less costly for families) due to differences in Medicaid generosity may be an important issue to account for.

To do so, we argue that county of residence in January 1997 is exogenous to the implementation of the Medicaid managed

of non-continuous enrollment spells are likely to be biased if there are differential take-up rates in managed care and FFS counties. Although we observe long-run insurance status and utilization far more accurately than previous work, by restricting the sample of Kentucky children to those who were continuously enrolled, it is likely that the children are poorer and less mobile than other Medicaid recipients. In order to evaluate this formally, we examined data from the Survey of Income and Program Participation (SIPP) from 1997 to 1999. We find that children continuously enrolled in Medicaid tend to be more disadvantaged than those with intermittent Medicaid enrollment. Additionally, sources of health insurance coverage for these children when not formally participating in the Medicaid program varied with the length of time spent on Medicaid. This suggests that our results based on continuously enrolled children may not be generalizable to the Medicaid population as a whole.

[22] The Passport treatment counties are Breckinridge, Grayson, Larue, and Marion and the control counties are Hancock, Ohio, Butler, Edmonson, Hart, Green, and Taylor. The KHS treatment counties are Lincoln, Rockcastle, Jackson, Estill, Powell, Montgomery, Nicholas, Harrison, and Owen and the control counties are Pulaski, Laurel, Clay, Owsley, Lee, Wolfe, Menifee, Bath, Fleming, Robertson, Bracken, Pendleton, Grant, and Gallatin.

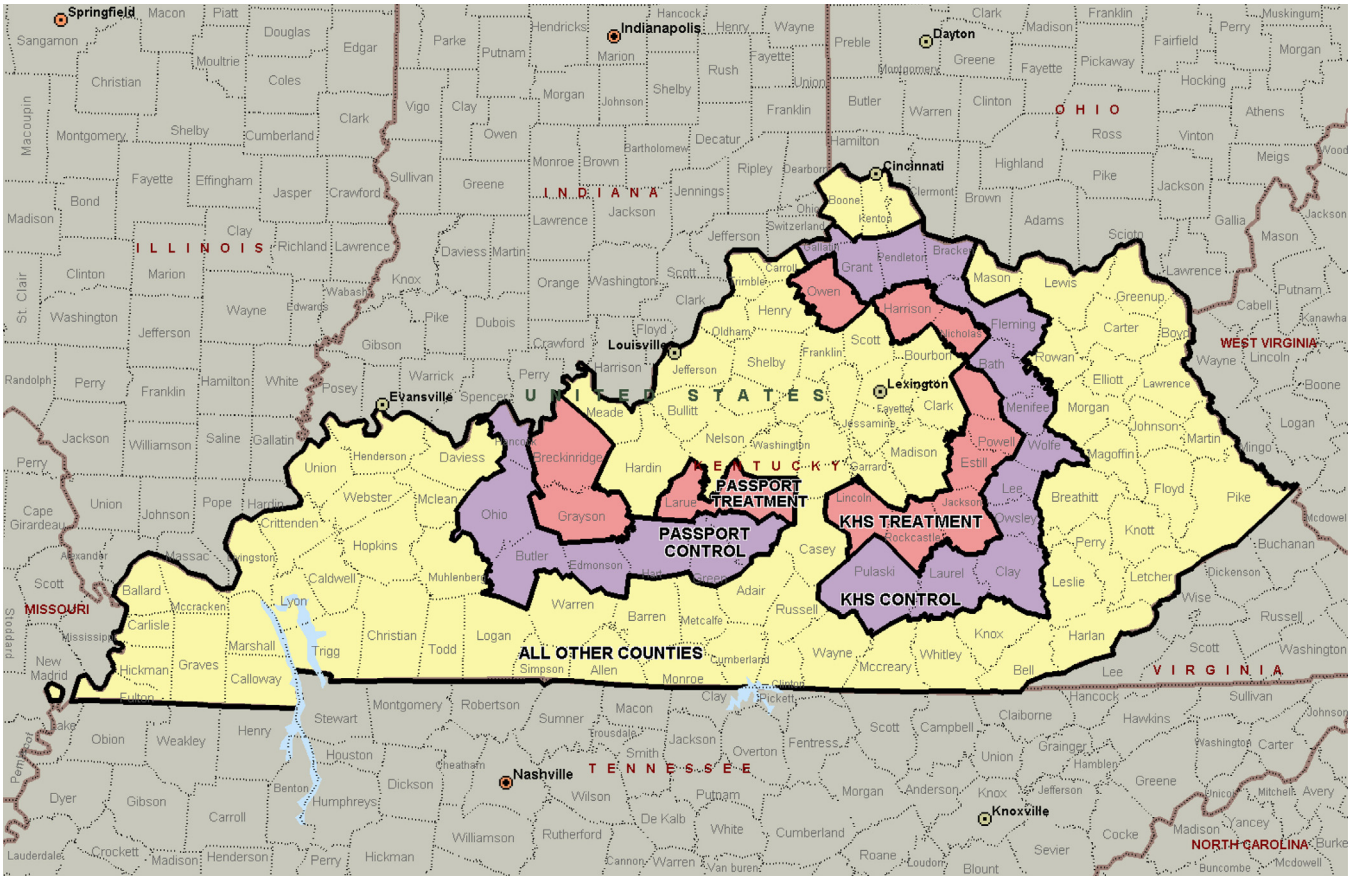


Fig. 2. The final study counties.

care that occurred in November 1997. This follows the approach of Aizer et al. (2007) who control for the endogeneity of location by assigning Medicaid managed care status based on the first county in which a recipient is observed. Thus, we predict managed care enrollment separately in each region based on the interaction of two variables: time period (pre- or post-implementation) and whether the initial county of residence becomes a managed care county. In other words, in each region we are using managed care eligibility based on county of residence in January 1997 as an instrument for actual managed care enrollment. This exogenous eligibility measure should not affect health care utilization except through its effect on actual managed care enrollment.

Our first stage models for each region, estimated as linear probability models, are given below:

$$HMO_{ijt} = \beta_0 + \beta_1 HMO\_elig\_Passport\_initial\_county_{it} + \beta_2 Age\_6 - 12_{it} + \beta_3 Age\_13 - 18_{it} + Month\_Year\_Dummies\beta_4 + \alpha_i + \varepsilon_{ijt} \quad (1a)$$

Table 4
Final study county comparisons using the census.

	Passport treatment	Passport control	KHS treatment	KHS control	Passport counties (shared border)	KHS counties (shared border)
Total population, 2006	77	112	147	253	126	119
Average county population	19	16	16	18	25	30
White (%)	93.9	95.0	96.5	96.3	89.3	89.0
Living in same house, 1995 and 2000 (%)	60.7	62.1	58.2	59.6	54.2	53.0
High school graduates in 2000 (%)	67.7	64.6	63.7	63.4	76.9	78.0
Homeownership in 2000 (%)	79.1	78.5	75.5	76.6	77.1	70.3
Poverty rate in 2004 (%)	16.7	17.8	19.0	20.6	12.1	12.7
Counties	Breckinridge, Grayson, Larue, Marion	Butler, Edmonson, Green, Hart, Hancock, Ohio, Taylor	Estill, Harrison, Jackson, Lincoln, Montgomery, Nicholas, Owen, Powell, Rockcastle	Bath, Bracken, Clay, Fleming, Gallatin, Grant, Laurel, Lee, Menifee, Owsley, Pendleton, Pulaski, Robertson, Wolfe	Henry, Nelson, Shelby, Spencer, Washington	Anderson, Boyle, Franklin, Mercer

Source: U.S. Census QuickFacts data for Kentucky: http://quickfacts.census.gov/qfd/states/21000.html.
Notes: Population measured in thousands.

$$HMO_{ijt} = \beta_0 + \beta_1 HMO\_elig\_KHS\_initial\_county_{it} + \beta_2 Age\_6-12_{it} + \beta_3 Age\_13-18_{it} + Month\_Year\_Dummies\beta_4 + \alpha_i + \varepsilon_{ijt} \quad (1b)$$

where *HMO* represents actual managed care enrollment for child *i* in county *j* at time *t*, *HMO_elig_Passport_initial_county* represents Passport eligibility for child *i* based on initial county of residence and current time period (i.e. it equals 1 if the child initially resided in a Passport county and the time period is November 1997 onward), *HMO_elig_KHS_initial_county* represents KHS eligibility for child *i* based on initial county of residence and current time period, and *Month_Year_Dummies* is a vector containing an indicator for each of the 30 months (January 1997 to June 1999) in our sample.[23] We also include two indicators for different child age groupings, child fixed effects (α_i), and ε_{ijt} represents a standard error term. The inclusion of child fixed effects controls for time-invariant child characteristics that are not observed in our administrative data.

Our primary second stage specification, which examines three types health care utilization (professional, outpatient, and inpatient services), is also estimated as a separate linear probability model for each region:

$$Any\_Monthly\_Utilization_{ijt} = \beta_0 + \beta_1 HMO_{ijt} + \beta_2 Age\_6-12_{it} + \beta_3 Age\_13-18_{it} + Month\_Year\_Dummies\beta_4 + \alpha_i + \varepsilon_{ijt} \quad (2)$$

where $Any\_Monthly\_Utilization_{ijt}$ is a dummy variable equal to 1 if child *i* in county *j* used one of our measures of health care utilization in month *t* (outpatient, professional, or inpatient), *HMO* represents actual HMO enrollment in our OLS specifications and predicted HMO enrollment from the first stage in our IV specifications, and the other variables are defined as before.[24] We will modify this specification where needed to accommodate different measures of utilization, such as a measure of the monthly number of visits or monthly medical expenditures.

5. Data

In order to implement our empirical analysis, we were provided with de-identified, linked Medicaid claims and enrollment data by the Kentucky Cabinet for Health and Family Services. As described above, for each region our sample consists of children that (i) live in the region's treatment or control counties in January 1997 and (ii) are continuously enrolled in Medicaid until June 1999.[25] During these 30 months, there were no changes in the company managing the Kentucky Medicaid information systems.

Electronic Data Systems (EDS) was responsible for managing Medicaid information systems for Kentucky from 1994 to 2000 and a new vendor, Unisys, began managing these databases in January 2000. We begin our analysis in January 1997 because data prior to that date from EDS were not available.[26] During transitions to new vendors with new database models, the medical claims information goes through a testing and verification period for about one year. We are not confident in the comparability of the new Unisys database with the previous system during this intermediate period, which is why we end our analysis in June 1999 (several months before the transition). The benefits of using this timeframe include the fact that it spans the reform we are investigating and we are assured the changes in utilization we observe are not being driven by vendor changes. The cost is that we cannot observe longer-run utilization changes.

After dropping a few children with age discrepancies, we are left with 4706 children in our Passport sample (1890 initially in one of the 4 Passport treatment counties we are interested in and 2816 initially in one of the 7 control counties) and 13,590 children in our KHS sample (4273 initially living in one of the 9 KHS treatment counties we are interested in and 9317 initially living in one of the 14 control counties). Descriptive statistics from our final samples for each region (split into treatment and control sample sub-categories) are shown in Table 5. Comparing the 1890 children initially in a Passport county with the 2816 initially in a bordering FFS county, we see that there was a slightly lower probability of moving across county lines among the Passport children (24 percent versus 26 percent). On the other hand, there are more movers among the children initially in a KHS county than their FFS controls. The amount of moving that we observe in both regions reinforces the motivation for our IV approach to control for migration endogeneity.[27] Table 5 reinforces the finding from Table 4 that we are comparing extremely homogenous sets of counties within each region. The children in our final Passport and KHS samples appear extremely similar to their FFS controls in terms of demographics and pre-reform utilization.

Our health care utilization data – which is recorded regardless of whether the payment arrangement is FFS or managed care – is at the monthly level. Inpatient services are defined to be services delivered in a hospital with an overnight stay, while outpatient services are services delivered in clinics or hospitals in which there is no overnight stay (such as an ER visit). Professional services typically represent physician services, but could also include services provided at locations other than physician offices, such as dental clinics and public health clinics. The bottom of Table 5 presents the monthly utilization rates for each type of service in the pre-period (January 1997–October 1997) and the post-period (November 1997–June 1999) for children in each set of counties of interest. These simple summary statistics in many ways tell the entire story. We see large reductions in outpatient and professional utilization for children initially living in the Passport counties that is not matched by children initially living in the non-Passport border counties. Children initially living in the KHS counties, while experiencing some reduction in outpatient utilization, actually have a slight increase in professional utilization. They tend to look much more similar to children initially in the non-KHS border counties (i.e., children continuing to receive FFS Medicaid).

[23] Recall that a child must be enrolled in Kentucky Medicaid for all 30 months in order to be included in our sample. Therefore a child that moves from Kentucky to another state would not be included even if their Medicaid coverage across the two states was uninterrupted.

[24] For a discussion of the use of linear probability models in two state least squares estimation see Angrist and Krueger (2001) and Kelejian (1971).

[25] Note that we are not requiring these children to live continuously in one of the treatment or control counties, only that they maintain Kentucky Medicaid enrollment. Therefore, a child may live in a Passport treatment county in January 1997 then move to any other part of the state for the remaining 29 months in our analysis and stay in the sample, as long as they maintain their public coverage.

[26] A longer time series of pre-reform data would have been preferable, but given that we have micro-level data measured at the monthly level, ten months of pre-reform utilization data allows us to sufficiently investigate the "common trendsässumption that is important in any difference-in-differences analysis.

[27] These high mobility rates can be corroborated with other data sets. Using the 43,111 unique Kentucky respondents in the 2008 American Community Survey (ACS), we find that nearly 16 percent of the sample moved in the last year, with approximately 80 percent being within-state moves. Almost half of the within-state moves were from one of Kentucky's 30 Public Use Microdata Areas (PUMA) to another. In the ACS, migration rates were higher among children (17 percent moved), and especially high among poor children (26 percent moved).

Table 5
Summary statistics using Kentucky administrative data.

	Children initially in a Passport treatment county	Children initially in a Passport control county	Children initially in a KHS treatment county	Children initially in a KHS control county
# children	1890	2816	4273	9317
# child months (30 months total)	56,700	84,480	128,190	279,510
% of children that switched county	23.9	26.0	25.2***	20.6
Demographics:				
Age on January 1, 1996	7.1*	6.8	7.1	7.1
% non-white	11.1	9.7	6.5	5.9
% female	48.9**	45.6	46.7	47.5
Number of siblings	0.8	0.8	0.8	0.7
Any Utilization? (percentage with any monthly Medicaid utilization):				
Outpatient Utilization – Pre-reform	9.8%***	8.6%	10.4%***	9.5%
Outpatient Utilization – Post-reform	5.2%***	8.0%	8.2%***	9.0%
Professional Utilization – Pre-reform	37.6%***	35.1%	32.2%***	36.1%
Professional Utilization – Post-reform	24.8%***	34.3%	32.5%***	35.5%
Inpatient Utilization – Pre-reform	0.5%	0.6%	0.4%***	0.5%
Inpatient Utilization – Post-reform	0.3%***	0.4%	0.3%***	0.4%
Well Child Visit Utilization – Pre-reform	3.9%**	3.4%	4.5%***	5.2%
Well Child Visit Utilization – Post-reform	3.4%***	2.3%	2.6%***	2.8%
Utilization Count? (number of monthly Medicaid visits):				
Outpatient visits – Pre-reform	0.126***	0.107	0.130***	0.123
Outpatient visits – Post-reform	0.067***	0.100	0.120**	0.116
Professional visits – Pre-reform	0.699***	0.604	0.560***	0.650
Professional visits – Post-reform	0.520***	0.642	0.604***	0.684
Inpatient visits – Pre-reform	0.006	0.007	0.004***	0.006
Inpatient visits – Post-reform	0.003***	0.005	0.004***	0.005
Well Child visits – Pre-reform	0.042**	0.037	0.048***	0.055
Well Child visits – Post-reform	0.040***	0.025	0.031	0.030
Expenditures | Expenditures > 0? (amount of monthly Medicaid spending):				
Outpatient spending – Pre-reform	$226.09	$247.93	$186.73***	$211.85
Outpatient spending – Post-reform	$160.13***	$254.89	$191.87***	$256.31
Professional spending – Pre-reform	$120.76***	$150.69	$113.01***	$123.96
Professional spending – Post-reform	$182.15*	$168.96	$134.57***	$144.26
Inpatient spending – Pre-reform	$2551.12	$2526.10	$3194.84	$2750.84
Inpatient spending – Post-reform	$2502.06	$2403.74	$2603.59***	$3238.53

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: The pre-reform time period is January 1997 to October 1997 while the post-reform time period is November 1997 to June 1999. The stars represent the results of tests for difference in means or proportions between the treatment and control counties within each region.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

6. Results

In this section we report our empirical results and in the next section we discuss a series of specification checks. We then synthesize the results and discuss how they contribute to the previous literature.

6.1. Effects of HMO enrollment on health care utilization – descriptive evidence

The heterogeneous impact of the two different managed care "treatments" is made especially clear in Figs. 3 and 4. Fig. 3 compares for each of the three types of services differences in the monthly utilization rate for the 1890 children initially living in a Passport county (labeled "treatment") to the utilization rate for the 2816 children initially living in a non-Passport border county (labeled "control"). We see similar utilization rates in the pre-period for each type of service in both the treatment and control groups (visual support for the "common trends" assumption) and then striking reductions in outpatient and professional utilization for the Passport treatments relative to their controls. There seems to be less of a managed care impact on inpatient utilization, but the extremely low baseline utilization rate makes the possibility of a significant reduction less likely, as does the fact that inpatient stays were still reimbursed on a FFS schedule with a withhold, rather than with a capitated payment.

Fig. 4 provides the same comparison for our KHS treatment and control samples. These graphs clearly tell a different story. We again see similar utilization rates between the treatment and control counties in the pre-period. The KHS pre-period utilization rates also appear to be very similar to the Passport pre-period utilization rates, with slightly lower outpatient and professional rates and a slightly higher inpatient rate. In the post-period, we see very little difference between the KHS treatment utilization rates and the controls. Therefore, these graphs suggest a very strong impact of the managed care treatment associated with the Passport program and almost no impact of the managed care treatment associated with the KHS program.

6.2. Effects of HMO enrollment on health care utilization – extensive margin regressions

The top panel of Table 6 presents the results of a series of regressions based on equation (2) for the Passport region where the dependent variable in each model is a (0, 1) indicator of any monthly utilization of professional, outpatient, or inpatient Medicaid services. The key independent variable of interest is managed care enrollment (*HMO*). In order to isolate the effect of the Passport managed care program on utilization, each model includes a series of month year dummies and child fixed effects. The OLS estimate presented in column 1a suggests that the introduction of the Passport program led to a statistically significant 16 percentage point

Table 6
Effects of HMO enrollment on health care utilization – extensive margin.

	Passport					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1a)	IV (1b)	OLS (2a)	IV (2b)	OLS (3a)	IV (3b)
HMO enrollment	−0.159*** (0.007)	−0.174*** (0.007)	−0.055*** (0.003)	−0.060*** (0.004)	−0.001 (0.001)	−0.001 (0.001)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*36%*	*36%*	*9%*	*9%*	*0.6%*	*0.6%*
Percent change:	*−44%*	*−48%*	*−61%*	*−66%*	*−20%*	*−24%*
	KHS					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1c)	IV (1d)	OLS (2c)	IV (2d)	OLS (3c)	IV (3d)
HMO enrollment	0.021*** (0.004)	0.012*** (0.004)	−0.016*** (0.002)	−0.021*** (0.002)	0.001 (0.0005)	0.001 (0.001)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*35%*	*35%*	*10%*	*10%*	*0.5%*	*0.5%*
Percent change:	*6%*	*3%*	*−17%*	*−21%*	*14%*	*15%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age. Standard errors are in parentheses. Passport regressions include 4706 children followed for 30 months (N = 141,180), while the KHS regressions include 13,590 children followed for 30 months (N = 407,700).
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

decline in the probability of any Medicaid professional utilization for the children in our sample. This is relative to a monthly professional utilization rate of 36% in the pre-reform period, thus representing a 44% reduction in the overall monthly probability of any Medicaid professional utilization. The other OLS estimates suggest a statistically significant 5.5 percentage point decline (61% reduction) in the monthly probability of any outpatient utilization and a more modest 0.1 percentage point decline (20% reduction) decline in the monthly probability of any inpatient utilization.

Table 6 also presents results of a similar specification estimated using our Kentucky Health Select (KHS) sample. The OLS estimate presented in column 1c suggests that the introduction of the KHS program actually led to a statistically significant 2 percentage point increase (6% increase relative to baseline) in the probability of any Medicaid professional utilization. The other OLS estimates suggest a statistically significant 2 percentage point decline (17% relative to the pre-reform baseline) in the monthly probability of any outpatient utilization and a 0.1 percentage point increase (14% increase) in the monthly probability of any inpatient utilization.[28]

Identification in the OLS models is achieved through the assumption that this Medicaid reform in Kentucky is an exogenous change to insurance type, not driven in a given county by some sort of related changes in Medicaid spending/utilization (policy endogeneity) or because of changes in the characteristics of recipients (migration endogeneity).[29] In our IV models we address migration endogeneity by instrumenting actual managed care enrollment with Passport or KHS eligibility based on initial county of residence.[30] Because we first observe each child in our sample in January 1997, our identifying assumption is that their county of residence in January 1997 is exogenous to the implementation of managed care in November 1997.[31] The results reported in Table 6 illustrate that using an IV approach leaves the coefficient estimates largely unchanged. This suggests migration endogeneity is not a major source of bias to our OLS estimates of the impact of Passport and KHS on health care utilization. Although we do observe children moving, those moves do not appear to be motivated by differences in Medicaid provision across counties.

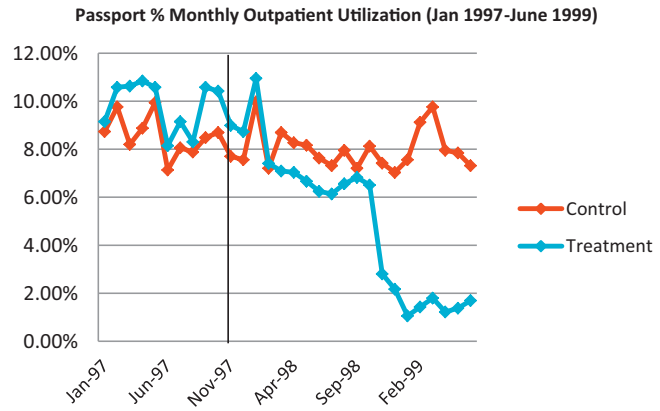
Our primary results suggest that both Passport and KHS decreased outpatient utilization among the children in our sample along the extensive margin, though Passport was able to do so to a greater degree (61% reduction versus 17% reduction). In addition, both programs appear to have had a minimal impact on inpatient care utilization for children along the extensive margin, which is probably not surprising given the low overall utilization of inpatient services for children. A key difference between the effects of the two programs is that Passport reduced professional utilization by 44% along the extensive margin, while KHS actually increased professional utilization by 6%. We now consider changes along the intensive margin and changes in health care spending. Given that migration endogeneity and policy endogenity do not appear to bias

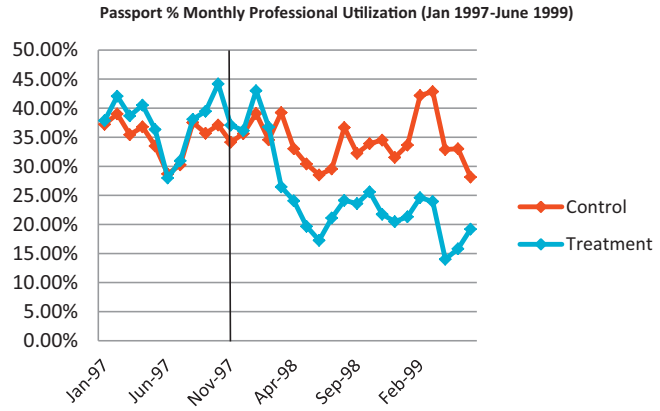
[28] Although outpatient and inpatient services were not capitated under the Passport plan, one would expect that both the capitation of primary care providers and their role as gatekeepers, as well as other aspects of managed care, such as utilization review, would have an effect on these services. As discussed in Baicker et al. (2013), the literature on managed care spillover suggests that such effects are important to consider.

[29] As is argued in Duggan (2004) in the case of California, one could argue in Kentucky that since the planning for the introduction of managed care preceded the actual implementation by multiple years, policy endogeneity is unlikely to be a major issue. Moreover, the cost dynamics in these border counties are likely to have been far less important in policy decisions than the urban centers of the managed care regions.

[30] Aizer et al. (2007) take a similar approach to control for the endogeneity of location by assigning managed care status to each woman in their sample based on the first county in which she is observed.

[31] Appendix Table A2 presents the results of the first stage regressions in which Passport or KHS eligibility based on initial county of residence is used to predict actual managed care enrollment (*HMO*). The instrument is clearly a very strong predictor of actual managed care enrollment with a marginal managed care participation rate of 69 percent for Passport and 79 percent for KHS. The estimated marginal take-up rate is not 100 percent in either case because of difficulty in measuring managed care enrollment in the first 4 months of the reform and some children moving across county lines, potentially into the adjacent managed care area.





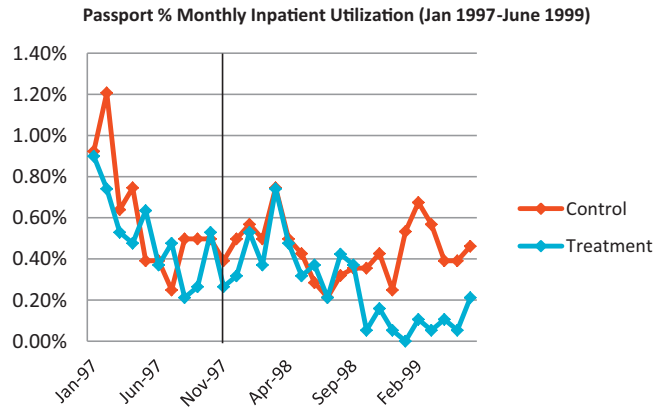
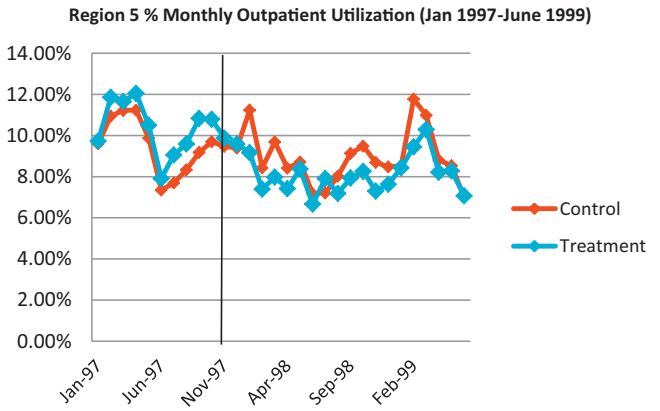
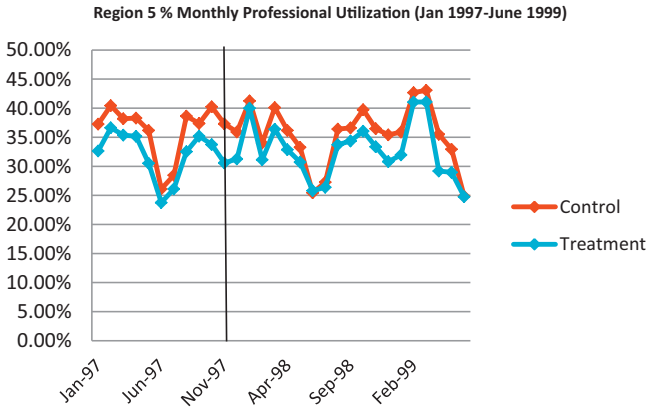


Fig. 3. Child healthcare utilization before and after Passport.





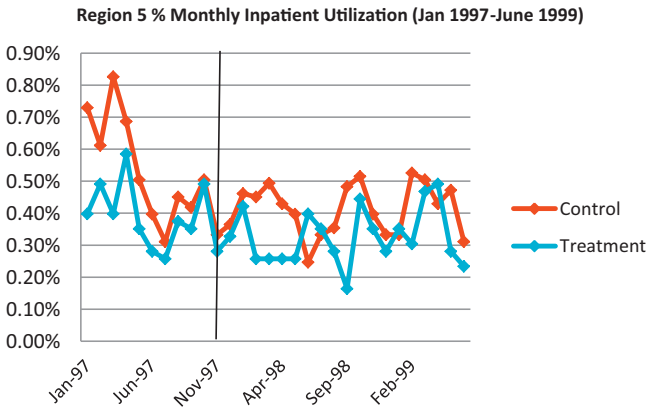


Fig. 4. Child healthcare utilization before and after KHS.

our results, we do not instrument for HMO status in our subsequent analysis.[32]

6.3. *Effects of HMO enrollment on health care utilization – intensive margin regressions*

In order to analyze changes along the intensive margin, we modify Eq. (2) by replacing the dependent variable with a count for the number of monthly professional, outpatient, or inpatient visits. Since each of these dependent variables includes a large number of zeros, we estimate these regressions as Poisson models. The results of the Poisson models for both Passport and KHS are given in Table 7, where the marginal effects associated with HMO enrollment are presented for each outcome of interest.

Similar to the impact along the extensive margin, the introduction of the Passport program led to reductions in the number of monthly professional, outpatient, and inpatient visits along the intensive margin, with all three reductions being statistically significant in this case. We see no statistically significant change in the number of outpatient or inpatient visits associated with the KHS plan, but a statistically significant increase in the number of monthly professional visits. Thus, the KHS plan was associated with increases in professional visits along both the intensive and extensive margin, while the Passport plan was associated with reductions in professional visits along both margins.

[32] This finding with respect to migration endogeneity mirrors the results of a study (Schwartz and Sommers, 2014) that investigates changes in state-to-state migration after recent public insurance expansions.

Table 7
Effects of HMO enrollment on health care utilization – intensive margin.

	Passport		
	Number of professional visits (1a)	Number of outpatient visits (2a)	Number of inpatient visits (3a)
HMO enrollment	−0.398*** (0.033)	−0.650*** (0.059)	−0.210** (0.106)
30 month–year dummies?	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes
Sample size:	*137,910*	*100,530*	*13,680*
	KHS		
	Number of professional visits (1b)	Number of outpatient visits (2b)	Number of inpatient visits (3b)
HMO Enrollment	0.059** (0.023)	0.002 (0.025)	0.086 (0.095)
30 month–year dummies?	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes
Sample size:	*397,140*	*302,550*	*35,790*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions are all estimated as Poisson models and include monthly controls for child age. Standard errors are in parentheses.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

6.4. Effect of HMO enrollment on health care spending

Next we turn our attention to the effects of HMO enrollment on monthly health care spending. The results reported in Table 6 can be viewed as changes in health care spending along the extensive margin. In other words, those results tell us whether or not managed care had an impact on the likelihood that an enrollee had any monthly health care expenditure. The estimates presented in Table 8 focus on the intensive margin; those months in which a patient had positive expenditures. These results come from a modified version of Eq. (2) where the dependent variable is the log of monthly spending on professional, outpatient, or inpatient care, conditional on having non-zero monthly spending. We estimate each equation using OLS. Table 8 suggests that both programs led to statistically significant reductions in monthly health care spending, conditional on non-zero monthly spending. The magnitude of the effect is larger for Passport than KHS.

We also take an alternate approach to model monthly health care spending that allows us to determine where on the distribution of medical spending any observed reductions in utilization are coming from. For example, is the 61% reduction in the monthly probability of consuming any outpatient services observed in the Passport region achieved by reducing utilization among "heavy" users of outpatient services? The regressions reported in Table 9 address this question for outpatient and professional services in both the Passport and KHS regions. We create new dependent variables equal to 1 in months where the child's professional or outpatient Medicaid spending exceed the 50th percentile of the respective monthly spending distribution (conditional on having positive spending). In the first column, the dependent variable equals 1 in a given month if a child has professional service spending/claims above $50 (approximately the 50th percentile of professional spending), and in second column the dependent variable equals 1 if in a given month a child has outpatient spending/claims above $100 (approximately the 50th percentile of outpatient spending).

Table 9 reports that Passport led to a 92% reduction in the probability of having monthly outpatient spending above $100. This suggests a far stronger impact of Passport on outpatient utilization for those with relatively high outpatient spending/claims. For professional services we see that Passport focuses on the left tail of the distribution. Passport leads to a 32% reduction in the probability of having any monthly professional spending above $50, as compared to a 44% reduction in the probability of having any monthly professional spending (Table 6). For KHS, more of the action for both outpatient and professional spending is coming from high spenders, though the interpretation differs because the signs differ. The *reduction* in the overall probability of any monthly outpatient spending for KHS is driven more strongly by reductions among the high spenders, while the *increase* in the overall probability of any monthly professional spending is being driven more strongly by increases among the high spenders.

6.5. Effect of HMO enrollment on well child utilization – extensive and intensive margins

While our previous results examine broad categories of utilization, one specific type of service is of particular interest, well child office visits.[33] If managed or Accountable Care Organizations want to reduce utilization through improvements in preventive care, then we would expect them to promote such office visits. There may be some concern, however, that the incentives created by the Passport capitation of primary care providers may reduce such visits.

Table 10 examines the impact of the introduction of Passport and KHS on monthly well child utilization along both the extensive and intensive margins. Both plans increased both the probability of having a monthly well child visit (extensive margin) as well as the number of well child visits received (intensive margin). The magnitudes of the increases are larger for Passport than for KHS. In particular, the introduction of Passport led to a 31% increase in the probability of having a well child visit in a particular month, while the introduction of the KHS plan led to a 9% increase.

6.6. Effect of HMO enrollment on health outcomes

Our Passport results provide compelling evidence that utilization can be reduced through the high-powered incentives provided in typical managed care arrangements. One common criticism, however, is that this reduction in utilization comes at a real cost: patients do not receive some of the appropriate or necessary care they were getting under FFS. Above we examined a particular type of service associated with such concerns (well child visits). Now we

[33] We define well child visits as visits identified with CPT codes 99382, 99393, 99392, 99393 and IDC-9 codes V20.2, V70.0, V70.3, V70.5, V70.6, V70.8, and V70.9, as suggested by the National Committee for Quality Assurance (NCQA).

Table 8
Effects of HMO enrollment on health care spending (conditional on positive monthly spending).

	Passport		
	Log spending on professional visits (1a)	Log spending on outpatient visits (2a)	Log spending on inpatient visits (3a)
HMO enrollment	−0.19*** (0.03)	−1.26*** (0.07)	−0.82** (0.27)
30 month–year dummies?	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes
Sample size:	*45,690*	*10,719*	*614*
Avg. monthly spending:	*$160.21*	*$231.16*	*$2476.60*
Marginal effect:	*−17%*	*−72%*	*−56%*
	KHS		
	Log spending on professional visits (1b)	Log spending on outpatient visits (2b)	Log spending on inpatient visits (3b)
HMO enrollment	−0.10*** (0.02)	−0.36*** (0.03)	−0.38* (0.20)
30 month–year dummies?	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes
Sample size:	*141,377*	*37,029*	*1714*
Avg. monthly spending:	*$134.48*	*$225.09*	*$2987.70*
Marginal effect:	*−9%*	*−30%*	*−31%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions are estimated using OLS and include monthly controls for child age. Standard errors are in parentheses.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

Table 9
Effects of HMO enrollment on large health care spenders.

	Passport	
	Indicator for expenditure of $50 or more on professional visits during month	Indicator for expenditure of $100 or more on outpatient visits during month
HMO	−0.060*** (0.005)	−0.050*** (0.002)
30 month–year dummies?	Yes	Yes
Child fixed effects?	Yes	Yes
Pre-reform avg. monthly utilization rate:	*18.7%*	*4.3%*
Percent change:	*−32%*	*−92%*
	KHS	
	Indicator for expenditure of $50 or more on professional visits during month	Indicator for expenditure of $100 or more on outpatient visits during month
HMO	*0.016*** (0.002)*	*−0.019*** (0.001)*
30 Month–Year Dummies?	Yes	Yes
Child Fixed Effects?	Yes	Yes
Pre-reform avg. monthly utilization rate:	*17.34%*	*5.11%*
Percent change:	*9%*	*−37%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: Sample includes all 4706 children from the Passport sample, for all 30 months.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

examine a particular type of enrollee, children with asthma. If the utilization reductions in Passport we observe imply poorer primary care for this vulnerable population, we would expect a higher hospitalization rate after Passport is implemented among this group (Aizer and Currie, 2002; Aizer, 2007).

Table 11A provides regression results on utilization for various groupings of Kentucky counties. The first set of columns breaks out the 4706 children from the 4 treatment and 7 control counties for Passport into 323 asthmatic children and 4383 others.[34] As in the full sample, we see no statistically significant change in inpatient utilization for asthmatics along the extensive margin. Asthmatics also have similar changes in outpatient and professional utilization. For comparative purposes, the second column reports the regression results for the non-asthmatic children.

Because the asthmatic sample size is relatively small, we expanded the sample in two ways. First, we expand the sample to include all 30 month enrolled children in all 16 Passport counties as the treatment group and all 30 month enrolled children in all 19 Region 4 counties to the south (see Fig. 1) as the control group. As the second set of columns show, this increases the number of asthmatics to 2027, but the basic conclusions do not change. Second, we also expand the sample by including all 30 month enrolled children in Regions 4 (19 counties) and 2 (12 counties) as the control group. The third set of columns show that this increases the number of asthmatics to 2447. Again the results do not change. Because we find that hospitalizations did not go up for asthmatic children, we take this as suggestive, but certainly not conclusive, evidence that there were not detrimental health impacts associated

[34] We define an asthmatic as a child with at least one occurrence of the ICD-9 code associated with asthma (493) in the 10 month pre-reform time period.

Table 10
Effects of HMO enrollment on well child utilization – intensive and extensive margins.

	Passport	
	Any well child visits? (1a)	Number of well child visits (1b)
HMO enrollment	0.011*** (0.002)	0.287*** (0.048)
30 month–year dummies?	Yes	Yes
Child fixed effects?	Yes	Yes
Sample size:	*141,180*	*73,020*
Pre-reform avg. monthly utilization rate	*4%*	
Percent change:	*31%*	
	KHS	
	Any well child visits? (2a)	Number of well child visits (2b)
HMO enrollment	0.004*** (0.001)	0.127*** (0.024)
30 month–year dummies?	Yes	Yes
Child fixed effects?	Yes	Yes
Sample size:	*407,700*	*226,770*
Pre-reform avg. monthly utilization rate	*5%*	
Percent change:	*9%*	

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age. The regressions on the left are estimated as linear probability models using OLS and the regressions on the right are estimated as Poisson models. Standard errors are in parentheses.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

Table 11A
The impact of passport managed care on asthmatic children and all other children.

	(1) Original treatment and control counties		(2) All 16 Passport counties versus all 19 region 4 counties		(3) All 16 Passport counties versus all 19 region 2 and all 12 region 4 counties	
	Asthmatic children	All other children	Asthmatic children	All other children	Asthmatic children	All other children
Any professional visits?	−0.238*** (0.019)	−0.155*** (0.005)	−0.130*** (0.007)	−0.071*** (0.001)	−0.141*** (0.006)	−0.073*** (0.001)
Baseline rate:	*57%*	*35%*	*54%*	*29%*	*55%*	*30%*
Percent change:	*−42%*	*−44%*	*−24%*	*−24%*	*−26%*	*−24%*
Any outpatient visits?	−0.107*** (0.013)	−0.052*** (0.003)	−0.051*** (0.005)	−0.030*** (0.001)	−0.056*** (0.004)	−0.032*** (0.001)
Baseline rate:	*17%*	*8%*	*17%*	*7%*	*17%*	*7%*
Percent change:	*−63%*	*−65%*	*−30%*	*−43%*	*−33%*	*−46%*
Any inpatient visits?	−0.0001 (0.005)	−0.0014*** (0.001)	−0.004** (0.002)	−0.001*** (0.0002)	−0.003* (0.002)	−0.001*** (0.0002)
Baseline rate:	*3.0%*	*0.4%*	*2.8%*	*0.4%*	*2.8%*	*0.4%*
Percent change:	*−.4%*	*−36%*	*−16%*	*−16%*	*−11%*	*−17%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: The OLS regressions in this table estimate similar models to those in Table 6. The first set of results divides the sample of 4706 children into asthmatic children ($N = 323$), and all others ($N = 4383$). The second set of results – with a larger geographic coverage – examines 2027 asthmatic children compared to 31,305 other children. The final set of results examines 2447 asthmatic children compared to 38,840 other children. Three stars, two stars, and one star imply statistically significant parameter estimates at the 1%, 5% and 10% levels, respectively.

Table 11B
The impact of KHS managed care on asthmatic children and all other children.

	(1) Original treatment and control counties		(2) All 16 KHS counties versus all 33 region 7 and 8 counties		(3) All 16 KHS Counties versus all 39 region 6, 7 and 8 counties	
	Asthmatic children	All other children	Asthmatic children	All other children	Asthmatic children	All other children
Any professional visits?	0.021 (0.022)	0.021*** (0.004)	−0.009 (0.011)	0.004 (0.002)	−0.008 (0.011)	0.004* (0.002)
Baseline rate:	*59%*	*34%*	*58%*	*33%*	*58%*	*33%*
Percent change:	*4%*	*6%*	*−2%*	*1%*	*−1%*	*1%*
Any Outpatient Visits?	−0.045*** (0.014)	−0.015*** (0.002)	−0.020*** (0.006)	−0.008*** (0.001)	−0.019*** (0.006)	−0.008*** (0.001)
Baseline rate:	*21%*	*9%*	*21%*	*10%*	*21%*	*10%*
Percent change:	*−21%*	*−16%*	*−10%*	*−8%*	*−9%*	*−8%*
Any Inpatient Visits?	−0.0006 (0.004)	0.0007 (0.0004)	0.0079*** (0.0020)	0.0006** (0.0003)	0.0074*** (0.002)	0.0006** (0.0002)
Baseline rate:	*2.0%*	*0.4%*	*3.3%*	*0.5%*	*3.3%*	*0.5%*
Percent change:	*−3%*	*16%*	*24%*	*12%*	*23%*	*11%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services. *Notes*: The OLS regressions in this table estimate similar models to those in Table 6. The first set of results divides the sample of 13,590 children into asthmatic children ($N = 664$), and all others ($N = 12{,}926$). The second set of results – with a larger geographic coverage – examines 4168 asthmatic children compared to 47,374 other children. The final set of results examines 4481 asthmatic children compared to 51,833 other children.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

Table 12
Specification check – allow for partial enrollment effects of HMO enrollment on health care utilization – extensive margin.

	Passport					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1a)	IV (1b)	OLS (2a)	IV (2b)	OLS (3a)	IV (3b)
HMO enrollment	−0.141*** (0.005)	−0.158*** (0.005)	−0.047*** (0.003)	−0.052*** (0.003)	−0.0001 (0.001)	0.0003 (0.001)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*35%*	*35%*	*9%*	*9%*	*0.7%*	*0.7%*
Percent change:	*−40%*	*−45%*	*−52%*	*−57%*	*−1%*	*4%*
	KHS					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1c)	IV (1d)	OLS (2c)	IV (2d)	OLS (3c)	IV (3d)
HMO enrollment	0.013*** (0.003)	0.007** (0.003)	−0.014*** (0.002)	−0.019*** (0.002)	0.0003 (0.0004)	0.0004 (0.0005)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*34%*	*34%*	*10%*	*10%*	*0.6%*	*0.6%*
Percent change:	*4%*	*2%*	*−14%*	*−19%*	*5%*	*7%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age. Standard errors are in parentheses. Passport regressions include 8693 children followed for up to 30 months (N = 234,058), while the KHS regressions include 23,825 children followed for up to 30 months (N = 646,820).
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

with Passport utilization reductions. Table 11B reports the results of similar analysis for the KHS plan. Splitting our initial KHS sample into asthmatics and non-asthmatics also shows no statistically significant change in inpatient admissions for asthmatic children. A full analysis of the health impacts of managed care is beyond the scope of this paper, but will be the subject of future research.

7. Specification checks

In this section we consider a variety of specification checks to test the robustness of our primary results. We expand our sample by allowing for children that were partially enrolled and by allowing for children that live in non-border counties. We then restrict our sample to a one year post-reform timeframe. Next we formally test the common trends assumption associated with difference-in-differences analysis. We then examine utilization changes for children that live on the Passport – KHS border and conclude by considering changes in provider participation in Medicaid.

7.1. Allow for partial enrollment

Table 12 replicates our primary specifications estimated in Table 6 with an expanded sample that allows for children that were not enrolled in Medicaid for all 30 months in our data. This increases the number of children in the Passport analysis from 4706 children to 8693 children and the KHS sample from 13,590 children to 23,825 children. Focusing on the OLS results, we see that expanding the sample in this way does not change our primary results. Passport still led to large reductions in professional and outpatient utilization, while KHS led to a more modest reduction in outpatient utilization and an increase in professional utilization. Neither plan had a statistically significant impact on inpatient utilization. This implies that our primary results are not being driven by selection into continuous Medicaid coverage over our timeframe.

7.2. Allow for non-border counties

Next we consider how our conclusions would change if we used a larger, but more geographically diverse sample. Recall that our "Passport experiment" used only four of sixteen counties in Region 3 for the treatment group, as well as seven contiguous counties outside of Region 3 for the control group. The "KHS experiment" used nine of twenty-one counties in Region 5 for the treatment group, and fourteen counties outside of Region 5 for the control group. In addition, given the differences in plan design, the managed care "treatment" was fundamentally different in the two regions.

Table 13 shows the results of expanding the sample using the same OLS models that were used in Table 6 (the coefficients from that table are presented in the first two rows of Table 13 as reference). We begin by combining the treatment regions, estimating the effect of managed care without regard to the underlying differences between the two regions. As might be expected, the treatment effect of managed care is essentially a weighted average of the treatment effects in the two managed care regions. Overall, professional utilization falls by 4 percentage points, far smaller than the 16 percentage point drop in the Passport region, but a substantially larger drop than the 2 percentage point increase observed in the KHS region. The conclusions for outpatient utilization mirror those for professional utilization, while the effect on inpatient utilization is in all cases insignificant.

We conclude that ignoring the underlying incentives created by different forms of managed/accountable care can lead to very different conclusions about the magnitude of its effect on utilization. This implies that studies that ignore such heterogeneity across MCOs or ACOs, which is often the case in the literature, may end up with biased estimates of the impact of such financing and care provision arrangements.

Next, we expand our sample to include continuously-enrolled children in all Region 3 and Region 5 counties as the treatment group, and all continuously-enrolled children in the other six regions as the control group. It should be clear from our previous comparison of the eight regions (Table 3) that doing so makes the treatment and control groups far more heterogeneous. Relative to the approach of focusing on geographically contiguous regions, our estimated impacts of managed care are roughly 15 to 20 percent smaller. We interpret this difference as suggesting that un-modeled, omitted factors are correlated with both the implementation of managed care and utilization in the larger sample; for

Table 13
Specification check – allow for non-border counties effects of HMO enrollment on health care utilization – extensive margin.

	Any professional visits?	Any outpatient visits?	Any inpatient visits?
HMO enrollment in Passport	−0.159*** (0.007)	−0.055*** (0.003)	−0.001 (0.001)
HMO enrollment in KHS	0.021*** (0.004)	−0.061*** (0.002)	0.001 (0.0005)
HMO enrollment – Combined Regions	−0.035*** (0.004)	−0.028*** (0.002)	0.0001 (0.0004)
HMO enrollment – All 120 Counties, Combined Regions	−0.043*** (0.001)	−0.022*** (0.001)	0.0002 (0.0002)

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: All models estimated using our OLS specification. The results for Passport and KHS are for the specification in Table 6. There are 4706 observations for the Passport specification, 13,590 for the KHS specification, 18,296 for the Combined Regions specification, and 101,649 for the All Counties, Combined Regions specification.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

example, it is possible that utilization trends in urban areas trended differently over time than utilization in rural areas, and the urban areas also adopted managed care.

7.3. Restrict sample to one year post-reform timeframe

Fig. 3 suggests a dip in outpatient utilization one year after the implementation of the Passport program (November 1998) that is larger than the utilization reduction that occurs immediately after Passport began operating. We investigate the sensitivity of our results to this dip by restricting the post-reform timeframe in the models reported in Table 6 to 12 months. Thus for these models the pre-reform timeframe is January 1997 through October 1997 (10 months) and the post-reform timeframe is November 1997 through October 1998 (12 months).

Table 14 shows that restricting the post-reform timeframe to 12 months reduces the magnitude of the Passport reduction in professional utilization from 44% to 38% and the reduction in outpatient utilization from 61% to 29%. In both cases the results for professional and outpatient services are highly statistically significant, while the estimated impact on inpatient utilization is not. Restricting the post-reform timeframe in this way makes almost no change to the KHS results. Therefore, restricting attention to one year post-reform does not change our primary result: Passport led to large reductions in professional and outpatient services that were not matched by the KHS plan.

7.4. Test for common trends in the pre-period

In order to formally test whether or not there were differential utilization trends between the treatment and control counties in each region prior to the reform, we re-estimated the models reported in Table 6 with a treatment indicator interacted with dummies for each of the first eight months of the pre-reform time period. As shown in Table 15, in our Passport models for professional, outpatient, and inpatient utilization we cannot reject the null hypothesis that these pre-reform interaction terms are jointly equal to zero. In our KHS models we cannot reject this same null hypothesis in our outpatient and inpatient utilization models. There does seem to be some evidence of differential trends in professional utilization. Overall these results formalize what we can observe in Figs. 3 and 4, that there do not appear to be major differential utilization trends in the pre-reform time period for either region.

Table 14
Specification check – restrict post-reform timeframe to 12 months effects of HMO enrollment on health care utilization – extensive margin.

	Passport					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1a)	IV (1b)	OLS (2a)	IV (2b)	OLS (3a)	IV (3b)
HMO enrollment	−0.139*** (0.007)	−0.147*** (0.009)	−0.026*** (0.004)	−0.031*** (0.006)	0.001 (0.001)	0.001 (0.001)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*36%*	*36%*	*9%*	*9%*	*0.6%*	*0.6%*
Percent change:	*−38%*	*−41%*	*−29%*	*−35%*	*20%*	*10%*
	KHS					
	Any professional visits?		Any outpatient visits?		Any inpatient visits?	
	OLS (1c)	IV (1d)	OLS (2c)	IV (2d)	OLS (3c)	IV (3d)
HMO enrollment	0.021*** (0.004)	0.015*** (0.005)	−0.019*** (0.002)	−0.022*** (0.003)	0.0004 (0.001)	0.001 (0.001)
30 month–year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Child fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Pre-reform avg. monthly utilization rate:	*35%*	*35%*	*10%*	*10%*	*0.5%*	*0.5%*
Percent change:	*6%*	*4%*	*−19%*	*−22%*	*9%*	*13%*

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age. Standard errors are in parentheses. Passport regressions include 4706 children followed for 22 months (N = 103,532), while the KHS regressions include 13,590 children followed for 22 months (N = 298,980).
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

Table 15
Specification check – testing common pre-reform trends assumption effects of HMO enrollment on health care utilization – extensive margin.

	Passport		
	Any professional visits? 1(a)	Any outpatient visits? 2(a)	Any inpatient visits? 3(a)
HMO enrollment	−0.159***	−0.055***	−0.001
	(0.008)	(0.004)	(0.001)
Treatment × month 1 interaction	−0.012	−0.006	0.001
	(0.014)	(0.008)	(0.003)
Treatment × month 2 interaction	0.012	−0.002	−0.004
	(0.015)	(0.009)	(0.003)
Treatment × month 3 interaction	0.014	0.014	0.0000
	(0.014)	(0.009)	(0.002)
Treatment × month4 interaction	0.019	0.010	−0.002
	(0.014)	(0.009)	(0.002)
Treatment × month 5 interaction	0.010	−0.004	0.004
	(0.014)	(0.009)	(0.002)
Treatment × month 6 interaction	−0.025*	0.0002	0.001
	(0.014)	(0.008)	(0.002)
Treatment × month 7 interaction	−0.011	0.001	0.003*
	(0.014)	(0.009)	(0.002)
Treatment × month 8 interaction	−0.013	−0.006	−0.002
	(0.014)	(0.008)	(0.002)
F test that all interactions are equal to 0:			
Fstat	1.41	0.72	1.48
Pvalue	0.1849	0.6722	0.1583
	KHS		
	Any professional visits? 1(b)	Any outpatient visits? 2(b)	Any inpatient visits? 3(b)
HMO enrollment	0.0003	−0.015***	0.029***
	(0.001)	(0.003)	(0.005)
Treatment × month 1 interaction	−0.0023*	−0.004	0.006
	(0.001)	(0.006)	(0.009)
Treatment × month 2 interaction	−0.0002	0.004	0.014
	(0.001)	(0.006)	(0.009)
Treatment × month 3 interaction	−0.0033**	−0.001	0.024*
	(0.001)	(0.006)	(0.009)
Treatment × month4 interaction	0.00001	0.003	0.021**
	(0.002)	(0.006)	(0.009)
Treatment × month 5 interaction	−0.0005	0.001	−0.005
	(0.001)	(0.006)	(0.009)
Treatment × month 6 interaction	−0.0001	0.0005	0.028***
	(0.001)	(0.005)	(0.009)
Treatment × month 7 interaction	0.0005	0.009	0.028***
	(0.001)	(0.005)	(0.009)
Treatment × month 8 interaction	0.0003	0.008	−0.009
	(0.001)	(0.005)	(0.009)
F test that all interactions are equal to 0:			
Fstat	1.12	0.7	3.98
Pvalue	0.3452	0.6924	0.0001

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age and interaction terms between indicators for each of the first eight months in the data (pre-reform time period) and an indicator for those in the treatment group in each region. Standard errors are in parentheses. Passport regressions include 4706 children followed for 30 months (N = 141,180), while the KHS regressions include 13,590 children followed for 30 months (N = 407,700).
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

7.5. Comparing treated border counties

As Fig. 1 illustrates, the Passport and KHS regions also share a border, meaning that as an additional specification check we can compare utilization pre- and post-reform for 5 Passport (Washington, Nelson, Spencer, Shelby, and Henry) and 4 KHS (Boyle, Mercer, Anderson, and Franklin) counties that were excluded from the previous analysis. The final two columns of Table 4 suggest that these counties are extremely similar, other than the managed care region they were assigned to. Fig. 5 presents outpatient, professional, and inpatient utilization comparisons. The figure suggests similar utilization rates in both sets of counties prior to the reform, then stronger utilization reductions in the Passport counties relative to their KHS neighbors. These graphs therefore lend further support to the notion that the Passport plan was better able to reduce utilization than the KHS plan.

7.6. Provider participation

Our final specification check examines provider participation. Are the reductions in Passport utilization coming from reduced access to health care (i.e., fewer providers participating in the

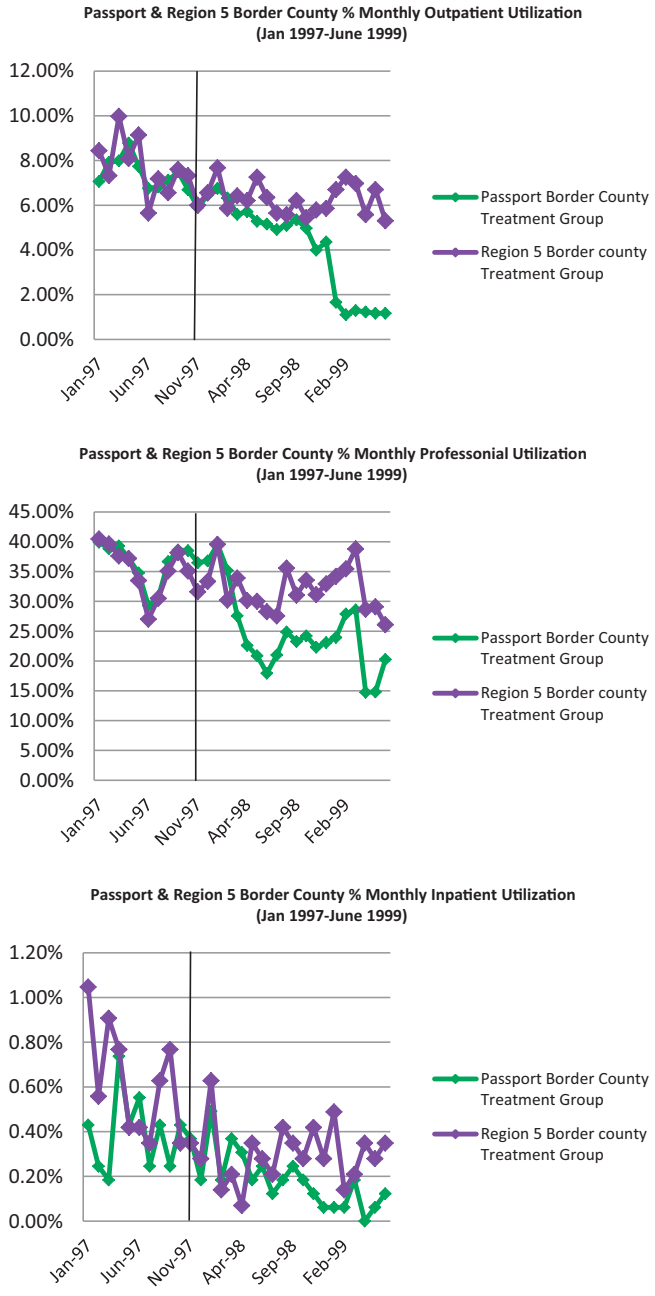


Fig. 5. Healthcare utilization in bordering Passport and KHS counties.

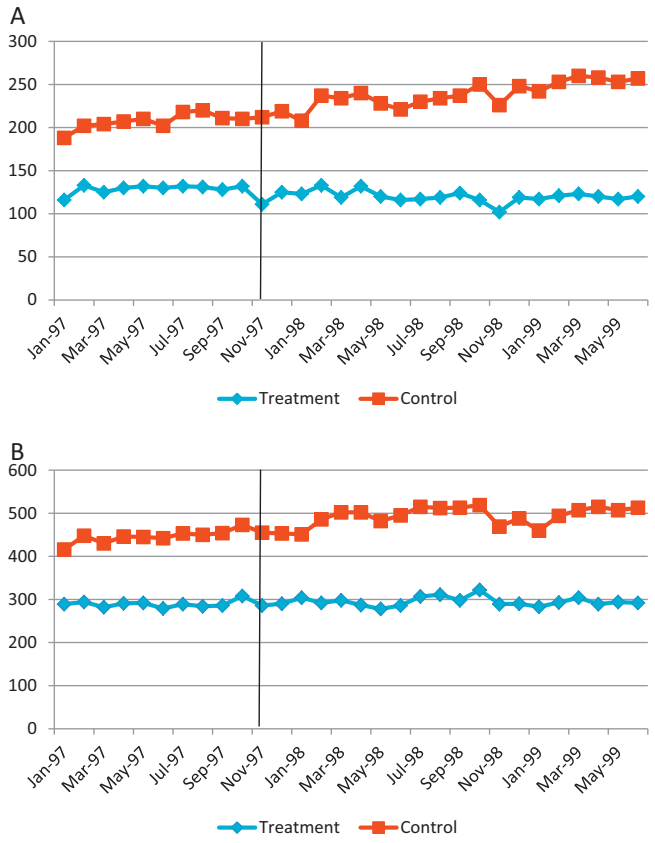


Fig. 6. (A) Monthly count of unique medicaid provider identifiers in passport (treatment) and non-passport (control) counties. (B) Monthly count of unique medicaid provider identifiers in KHS (treatment) and non-KHS (control) counties.

program), rather than more efficient delivery of services? A managed care network would likely restrict the number of doctors, but were those restrictions so severe as to cause the reduction we observe? From the universe of Medicaid recipients in the treatment/control counties, we are able to extract unique provider identifiers. Fig. 6A illustrates that although the number of Medicaid providers did not grow in the Passport counties (as they did in the control counties), they did not shrink either. In addition, the figure shows that the number of providers did not abruptly change with the implementation of managed care, even though utilization did. The differences in levels seem to reflect population size differences. Fig. 6B shows a similar pattern for the KHS plan. As a result, it is difficult to believe that the sharp drop in utilization we observe within Passport is the result of reduced access.

8. Discussion and conclusion

The unique introduction of managed care in the Kentucky Medicaid program allows us to document and analyze organizational differences between two Medicaid managed care plans that started at the same time, operated in close proximity to one another, and served relatively homogeneous sets of enrollees. In particular, we focus on differences in physician reimbursement systems used by the two plans because such reimbursement systems are, according to Copper and Rebitzer (2002), often considered a "black box whose internal operation is obscured from view." We also consider differences in other administrative functions between the two plans. Overall, we find that Passport's choices of using capitation to reimburse primary care physicians and contracting out some other basic managed care administrative responsibilities to be more effective in reducing utilization than KHS's choices to use a modified FFS reimbursement scheme and handle all administrative responsibilities in house.

Whether utilization is measured along the extensive (probability of any monthly visits) or intensive margin (number of monthly visits or monthly expenditure), we find that the Passport "capitated" program led to significant reductions in professional and outpatient utilization not matched by the KHS "withhold" plan. In fact, professional utilization actually increased within the KHS "withhold" plan. This can likely be explained by differences in the financial incentives PCPs within each plan faced. Due to capitation, the marginal revenue associated with an additional visit was zero for Passport physicians. In contrast, KHS attempted to incentivize physicians through the use FFS reimbursement with a group withhold. As predicted by the literature on optimal group size (GRT

(2004)), the typical group size of 20 that was used by the KHS "withhold" plan was much too big to serve as an effective deterrent to free-riding.

Given the magnitude of the utilization reductions we observe within the Passport "capitated" program, we investigated a host of reasons, besides changes in physician financial incentives, which could explain such reductions. First, we examined whether or not access to Medicaid-participating physicians fell within the Passport region. We found that the number of providers serving our Passport "capitated" sample remained extremely steady during our 36-month timeframe. Second, we considered whether or not particular services of interest (well child visits) or particular populations of interest (asthmatic children) where differentially targeted within the Passport "capitated" plan. We found no change in hospitalization rates for asthmatic children and observed an increase in well child visit utilization, consistent with the idea that managed care promotes preventive services.

A third concern would be that the utilization reductions we observe were driven by changes in reporting rather than actual reductions in service provision. Unlike the California transition to Medicaid managed care (Aizer et al., 2007; Duggan, 2004), providers in Kentucky were required to report encounter data and were given a modest financial incentive to do so. From the perspective of the plans, both Passport and KHS had strong incentives to measure their provision of care as such information would be useful in negotiating future capitation rates with the state.

One may also wonder if there are flaws in our "quasi-experimental" research design. Relative to other investigations of Medicaid managed care we would argue we have a number of advantages. First, unlike within California, enrollment in managed care in Kentucky was mandatory for virtually all children in the "treatment" counties. Second, as shown, our "treatment" and "control" counties are extremely balanced on observable characteristics. Third, the implications of our story stand up to all robustness checks that we investigated – including partial Medicaid spells, expanding to a broader set of counties, testing pre-existing trends, etc.

Thus, at the end of the day, we then are left with the most likely story: financial incentives for physicians – which are transparently laid out in the Kentucky context but not others – matters greatly for utilization. The utilization declines found in our study stand in contrast with the zero or positive expenditure findings in other Medicaid managed care studies (Duggan, 2004; Herring and Adams, 2011; Duggan and Hayford, 2013). Although there are many differences between the studies, including the nature of the reforms and populations being analyzed, this contrast may highlight the importance of the distinction between true resource utilization (Q) and negotiated reimbursement levels (P) that impact expenditures ($P \times Q$).

That being said, there is more work that needs to be done to better understand the impact of Medicaid managed care. This paper focuses on a specific group of enrollees (children) and broad measures of utilization (inpatient, outpatient, and professional) within one state (Kentucky), which raises potential concerns regarding external validity.[35] We can address this to some degree in future work by using our identification strategy to do an analysis of the impact managed care on adult Medicaid enrollees in Kentucky or focus on more specific types of services, such as prescription drugs. In particular, we would not want to extrapolate our current findings with respect to the health outcomes for asthmatic children to other types of Medicaid recipients, such as pregnant women or those dually eligible for Medicare, or other types of vulnerable children, such as newborns.

Even if we answered every possible question about Medicaid managed care in the Kentucky context, it is not necessarily clear how well these findings would translate to other states. For example, Kentucky ranks 45th out of 50 states in overall health according to the United Health Foundation, with above average rates of preventable hospitalizations, obesity, smoking, infant mortality, and children in poverty, among other measures.[36] On the other hand, as is often the case with research involving state Medicaid programs, there is a trade-off between the number of states included in the analysis and the ability to fully understand the details of the reforms of interest in order to develop a strong research design that allows for causal inference. This suggests the need for more work on Medicaid-related topics to come from other states. State Medicaid expansions under the ACA will no doubt be a catalyst for such work in the future.

Despite these limitations, our results should be of interest to policymakers considering Medicaid managed care as a cost-containment measure, given the specific fiscal challenge of Medicaid expansion under the Affordable Care Act (ACA). Such financial difficulties have recently led to further transition toward Medicaid managed care in Kentucky. In November 2011, Kentucky expanded Medicaid managed care to the 104 non-Passport counties.[37] The expansion is projected to save the program $1.3 billion. In addition, Florida recently approved a massive overhaul of its Medicaid system, which will shift hundreds of thousands of Medicaid recipients into HMOs. Plan sponsor, Representative Rob Schenck (R-Spring Hill, FL), said "We get to save billions of dollars, and we get to deliver better health care."[38] It is anticipated that Medicaid managed care will be available in all areas of Florida by October 2014.[39] Finally, Governor Sam Brownback announced in late 2011 a massive restructuring of Kansas Medicaid, called KanCare. KanCare was implemented in January 2013, is projected to save $853.1 million during its first five years, and would make Kansas the only state with managed care companies providing care statewide to all Medicaid enrollees.[40] Our analysis suggests that up front plan design decisions, such as the choice of reimbursement mechanism for physicians, may in large part determine the eventual success or failure of any expansions of managed care.

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[35] Of course, focusing on children is not that restrictive because over half of Medicaid recipients are children. For more information, see: http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Population/By-population.html.

[36] For more information, see: http://www.americashealthrankings.org/Ranking.

[37] See http://migration.kentucky.gov/newsroom/governor/20111028managedcare.htm.

[38] See http://www.kaiserhealthnews.org/Stories/2011/May/08/Florida-Legislature-Passes-Massive-Medicaid-Overhaul.aspx.

[39] See http://www.ahca.myflorida.com/Medicaid/statewide_mc/pdf/mma/Overview_of_Managed_Medical_Assistance_program_02-12-2013.pdf.

[40] See http://media.khi.org/news/documents/2012/04/26/KanCareBrief_Final.pdf and http://www.kancare.ks.gov/whats_kancare.htm.

Table A1
Services covered by the state capitation payments to the plans.

	Capitated services	Excluded services
Inpatient hospital services	Dental services	Mental Hospitals
Outpatient hospital services	Medical transportation	Psychiatrists
Urgent and emergency services	EPSDT services	Psychiatric Beds (Inpatient Hospital)
Outpatient surgical services	Vision care	Non-Emergency Transportation (Mental Health)
Medical services provided by:	Preventive Health Services provided by:	AIS/MR Services
• Physicians	• Public Health Departments	ICF/MR
• Advanced Practice RNs	• FQHCs	Targeted Case Management (Behavioral Health)
• Physician Assistants	• Rural Health Centers	Home and Community-Based Waiver Services
• FQHCs	Hearing Services (under age 21)	Certain Medicare-Only Services:
• Primary Care Centers	Durable Medical Equipment	• CORF Services
• Rural Health Clinics	Alternative Birthing Services	• Chiropractors
Laboratory	Podiatry Services	• Physicians Assistant
X-rays	Family Planning Clinic Services	• Physical and Occupational Therapy
Appropriate Escort Meals and Lodging	Renal Dialysis	• Psychologist
Therapeutic Evaluation and Treatment:	Hospice Services	• Clinical Social Worker
• Physical Therapy	Organ Transplant Services	Nursing Facility Services
• Speech Therapy	Specialized Case Management for Children and Adults with Complex Conditions	EPSDT Special Services (Behavioral Health)
• Occupational Therapy	Behavioral Health (Limited to PCP)	School-Based Services for Disabled Students
Home Health Services	Medical Detoxification	Early Intervention Services for Infants and Toddlers with Disabilities
Pharmacy and Limited OTC Drugs		

Source: Bartosch and Haber (2004).

Table A2
First stage regression results of monthly HMO enrollment on HMO eligibility.

	Passport program	KHS program
Child is Eligible For Managed Care (Based On Initial County of Residence and Time Period)	0.690*** (0.002)	0.789*** (0.001)
30 Month–Year Dummies?	Yes	Yes
Child Fixed Effects?	Yes	Yes
R^2	0.69	0.75
# children	4706	13,590
# child – months	141,180	407,700

Source: De-identified, linked Medicaid claims and enrollment data provided by the Kentucky Cabinet for Health and Family Services.
Notes: These regressions also include monthly controls for child age. Standard errors are given in parenthesis.
* Statistically significant difference at 10% level.
** Statistically significant difference at 5% level.
*** Statistically significant difference at 1% level.

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Appendix A.

See Appendix Tables A1 and A2.

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