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# The effects of integrating behavioral health into primary care for low-income children

Megan B. Cole PhD, MPH[1] | Qiuyuan Qin MS[2] | Radley C. Sheldrick PhD[1] | Debra S. Morley PhD[2] | Megan H. Bair-Merritt MD, MSCE[2,3]

[1]Department of Health Law, Policy, and Management, Boston University School of Public Health, Boston, Massachussets

[2]Department of Pediatrics, Boston Medical Center, Boston, Massachussets

[3]Department of Pediatrics, Boston University School of Medicine, Boston, Massachussets

**Correspondence**
Megan B. Cole, PhD, MPH, Department of Health Law, Policy, and Management, Boston University School of Public Health, 715 Albany Street, Talbot Building 2nd floor, Boston, MA 02118.
Email: mbcole@bu.edu

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## Abstract

**Objective:** To evaluate the impact of TEAM UP—an initiative that fully integrates behavioral health services into pediatric primary care in three Boston-area Community Health Centers (CHCs)—on health care utilization and costs.

**Data Sources:** 2014-2017 claims data on continuously enrolled children from a Massachusetts Medicaid managed care plan.

**Study Design:** We used a difference-in-difference approach with inverse probability of treatment weights to compare outcomes in children receiving primary care at TEAM UP CHCs versus comparison site CHCs, in the pre (2014-2016*q2*)- versus post (2016*q3*-2017)-intervention periods. Utilization outcomes included emergency department visits, inpatient admissions, primary care visits, and outpatient/professional visits (all cause and those with mental health (MH) diagnoses). Cost outcomes included total cost of care (inpatient, outpatient, professional, pharmacy). We further assessed differential effects by baseline MH diagnosis.

**Principal Findings:** After 1.5 years, TEAM UP was associated with a relative increase in the rate of primary care visits (IRR = 1.15, 95% CI 1.04-1.27, or 115 additional visits/1000 patients/quarter), driven by children with a MH diagnosis at baseline. There was no significant change in avoidable health care utilization or cost.

**Conclusions:** Expanding the TEAM UP behavioral health integration model to other sites has the potential to improve primary care engagement in low-income children with MH needs.

KEYWORDS
behavioral health integration, cost, mental health, pediatrics, utilization

## 1 | INTRODUCTION

Approximately 1 in 5 US children have a behavioral health problem,[1] with low-income children bearing a disproportionate burden of risk.[2] Children with behavioral health problems, particularly those that are underdiagnosed or undertreated, may be more likely to visit the emergency department (ED),[3,4] and mood disorders are the most common primary diagnosis among hospitalized children.[5] For Medicaid-enrolled children in particular, those using behavioral health services are estimated to have health care spending levels that are five times that of children using physical health services only.[6] Collectively, these factors contribute to $13.9 billion in spending on pediatric mental health care as of 2012, accounting for 12 percent of total pediatric spending and making it the most costly condition among children.[7]

In 2006, the former Institute of Medicine (IOM), now the National Academy of Medicine (NAM), advised that "primary care and specialty

  

[behavioral health care] providers should transition along a continuum of evidence-based coordination models," with the goal of ultimately delivering "mental, substance use, and primary health care through clinically integrated practices of primary and [behavioral health] care providers."[8] Although this IOM/NAM report was published over a decade ago, progress to integrate primary and behavioral health care has been slow, particularly for low-income children. While efforts to integrate primary and behavioral health care for adults have increased in recent years, with evidence of positive effects on quality and cost of care,[9-12] efforts in pediatrics have lagged. This lack of progress is despite emerging evidence suggesting that pediatric integration models are associated with improved behavioral health outcomes in children,[13-15] leading to critical missed opportunities to intervene early for children with behavioral health issues and to positively impact their health and developmental trajectories into adulthood.

There is substantial unmet mental health care need in pediatrics. It is estimated that only 20 percent to 25 percent of children with mental health needs receive treatment.[16] Delays between onset of symptoms and treatment for children with mental health disorders are significant: an estimated 6-8 year delay for those with mood disorders and 9-23 year delay for those with anxiety disorders.[17] Even when children are referred by a primary care physician (PCP) to a mental health specialist, it is estimated that over a third of those children do not actually see the mental health specialist within 6 months.[18] Contributing to these unmet needs are systemic barriers, which especially affect low-income and minority populations.[19,20] These include shortages of child psychiatrists and behavioral health practitioners[21,22] and insufficient training for PCPs in addressing children's behavioral health needs.[23] In light of these barriers, many consider the pediatric medical home to be an ideal location to deliver behavioral health prevention and treatment because of the near universality of well-child visits, and because of the longitudinal relationship between providers and families.[24] As over 90 percent of children have a usual source of primary care,[25] enabling system-wide change where behavioral health disorders can be prevented, diagnosed, and treated in pediatric primary care settings would therefore minimize unmet need and existing systemic barriers.

Providing care to over 8 million low-income children each year,[26] federally funded Community Health Center (CHC) providers in particular are uniquely positioned to increase access to integrated care for children, as all CHCs provide comprehensive primary care, tailor care to needs of low-income and demographically diverse patient populations, are located in medically underserved areas or in areas with medically underserved populations,[27] and nearly 90 percent provide some behavioral health services.[28] Thus, starting in June 2016 after a 6 month planning period, three Boston-area pediatric medical home CHC sites began implementing the Transforming and Expanding Access to Mental Health Care in Urban Pediatrics (TEAM UP) model.

The TEAM UP model includes two major components that aim to address unmet need and systemic barriers within pediatric behavioral health: (a) provider and staff training focused on recognizing and diagnosing child behavioral health problems, engaging families in appropriate self-care, and providing evidence-based therapeutic interventions when necessary and (b) full integration of behavioral health clinicians (BHCs), community health workers (CHWs), and psychiatry consultation into the medical team, allowing for "in the moment" support and intervention with families. More specifically, each TEAM UP CHC received funding for both clinical and administrative staff (2-3 BHCs, 2-3 CHWs, a clinical champion, a project manager, and an analyst) and received implementation and evaluation support. Together with an academic implementation team, the TEAM UP CHCs codeveloped and implemented a comprehensive plan for integrated care delivery with two primary objectives. First, the intervention aimed to transform CHC *operational systems* by optimizing reimbursement for integrated care, developing roles and responsibilities for team members, and tracking process and clinical data, for example. Second, the intervention aimed to transform CHC *clinical delivery systems* by implementing workflows for screening and intervention for child behavioral health problems, parental depression, family material needs, and other social determinants of health; delivering evidence-based therapeutic interventions; tracking service referrals; and providing navigational support. While the intervention was available to all children at intervention sites, this study focuses specifically on children enrolled Boston Medical Center (BMC) HealthNet: one of the major Medicaid managed care plans for children served by the intervention sites.

Our objectives were twofold: (a) to examine the impact of TEAM UP on health care utilization for children seeking care in TEAM UP versus non-TEAM UP CHCs and (b) to examine the impact of TEAM UP on total cost of care for children. We hypothesized that TEAM UP would increase primary care utilization in children in part as a result of increased family engagement in care. Consistent with the Chronic Care Model,[29] this relationship has been supported in prior literature, including findings from the Healthy Steps for Young Children Program showing that integrated behavioral health care can improve adherence to recommended well-child visits[30,31] and recent findings from the Veterans Health Administration suggesting that integration increased primary care visit rates.[32] Previous research also suggests that integration of community health workers can increase uptake of primary care services.[33,34] We further hypothesized that receipt of integrated behavioral health services in primary care would reduce ED visits and hospitalizations that are sensitive to behavioral health; this may in turn reduce total cost of care through avoided ED and hospital use, but these effects may not be observable in the first study year. Finally, we hypothesized that children with a baseline mental health diagnosis would experience the largest reductions in avoidable utilization and costs, as these children may disproportionately benefit from the TEAM UP intervention.

## 2 | METHODS

### 2.1 | Data source

Our primary data source was 2014-2017 claims data from BMC HealthNet: a Medicaid managed care plan in Massachusetts. This

included data from medical, pharmacy, member, provider, and product files. Data provided to our study team included complete claims for children whose assigned primary care site, based on their assigned primary care physician (PCP), was either one of our three intervention CHC sites or one of six geographically proximal and demographically similar CHC sites that were purposively selected as comparison sites. Data from the 2017 American Community Survey were also used to obtain zip code-level sociodemographic information.

## 2.2 | Study sample and attribution

Our base study population included children age 17 and younger with Medicaid coverage, who were enrolled in BMC HealthNet, and who had a PCP visit within the last 18 months (n = 73 514 person-quarters). We excluded children ≤3 months old (n = 2505 person-quarters), children without continuous enrollment (allowing for a one-quarter gap in the pre- and a one-quarter gap in the postperiod) (n = 26 442 person-quarters), and quarters in which otherwise eligible children were not enrolled (n = 97 person-quarters). From our analyses, we further excluded quarters 2 and 3 of 2016 to account for intervention ramp-up.

Children were attributed to TEAM UP versus comparison sites based on primary care utilization in the last 18 months. If a child received the plurality of their primary care visits from a TEAM UP site or one of our six comparison sites, then they were assigned to that site. If a child received the plurality of their primary care visits from a site that was not included in our study, then they were excluded. Our final analytic study sample included 33 988 person-quarters, representing 2616 unique patients.

## 2.3 | Treatment and comparison group definitions

Our treatment group included all children in the study sample who were attributed to one of our three intervention CHCs (N = 9556 person-quarters). Our comparison group included all children in the study sample who were attributed to one of our six comparison group CHCs (N = 24 432 person-quarters). To minimize the potential influence of patient selection, our primary analyses assigned patients to a site based on pre-intervention attribution, thus using an intent-to-treat approach. While all children in the intervention and comparison groups were enrolled in the same Medicaid managed care plan, received care at a CHC with National Committee for Quality Assurance medical home recognition, and resided in the Boston area, to better account for any systematic differences between the two groups, we used propensity weighting to balance on observable patient characteristics (described below). Site-level characteristics of each intervention and comparison site are also further described in the Appendix S1 (Tables S1 and S2).

## 2.4 | Outcome measures

Utilization outcomes, measured as counts per patient per quarter, included number of all-cause ED visits, inpatient admissions, primary care visits, and outpatient or other professional visits; all visit types were mutually exclusive. For all measures, we also examined utilization with evidence of a mental health diagnosis, although we were unable to assess mental health inpatient admissions due to low prevalence and high variance in our data. For ED visits only, we examined visits with an asthma diagnosis, as asthma often co-occurs with mental health disorders[35-37] and is further associated with stress and violence,[38] where this comorbidity has been associated with increased ED visits. Cost of care outcomes included total cost of care, inpatient, outpatient, professional, and pharmacy costs, based on a modified version of the Health Care Cost Institute methodology.[39] All cost data were based on claims and thus measured from the payers' perspective, were reported as mean patient cost per quarter, were based on allowed amounts, and were capped annually at $120k per person based on HealthPartners Total Cost of Care Methodology.[40] For more details on study outcome measures, including how they were defined and identified in the claims data, please see Appendix S1 (Table S1).

## 2.5 | Empirical approach

All outcome measures were calculated on a quarterly basis for each patient in the study population in quarter *q*. A propensity score-weighted difference-in-difference (DID) framework was used to estimate the effect of the intervention on intervention site patients, relative to the comparison group, both before and after the intervention. Using a DID framework allows for mean baseline differences between groups while accounting for secular trends.[41]

To further account for potential sociodemographic and clinical differences between patients receiving care at the intervention versus comparison sites, we used inverse probability of treatment weights (IPTWs) based on propensity scores to balance on observable characteristics.[42] To do so, we first used a logistic model to estimate a propensity score for each patient, which is defined as the probability of being attributed to an intervention site given a vector of observable, baseline covariates. Covariates used in the propensity score model included baseline age, sex, presence of select diagnoses based on International Classification of Diseases (ICD)-9 and ICD-10 codes (asthma, any mental health disorder, any substance use disorder, attention deficient disorder, depression, anxiety, adjustment disorder, oppositional defiant disorder, conduct disorder, mood disorder, and autism spectrum disorder), and patient zip code-level covariates (median income, percent nonwhite, percent speaking a language other than English). After generating the propensity scores, the distribution of each covariate was balanced between the treatment and comparison groups, with a standardized difference of no more than 10 percent.[42] All weights were calculated to estimate average treatment effects on the treated (ATT).[43,44] Weights were stabilized to a mean of one and truncated at the 99th percentile to avoid the influence of extreme weights.[45,46] We also graphically and statistically tested for differences in preperiod quarterly trends for the weighted treatment versus comparison groups.

To estimate the effect of TEAM UP on utilization, we used generalized estimating equations (GEEs) with a negative binomial distribution and log link. For cost measures, we used standard two-part GEE models to estimate effects.[47,48] This breaks down the estimation into: (a) the probability of having any cost, and (b) for those with costs greater than zero, a model of the level of costs. The first part has a dependent variable of whether there was any cost greater than zero, where a binomial distribution with a logit link was used.[49] The second part, where the dependent variable is the level of cost for those with greater than zero cost, used a gamma distribution with log link. All effects were estimated using the general model structure below:

$$[Y_{iq}] = \beta_0 + \beta_1 * \text{TEAM UP}_i + \beta_2 * \text{Post Period}_q + \beta_3 * (\text{TEAM UP}_i * \text{Post Period}_q) + \beta_4 \text{Quarter}_q + \beta_5 * \text{Member Months}_{iq} + \beta_6 * X'_{iq} + \mu_i + \varepsilon_{iq}$$

where outcome variable $Y_{iq}$ was indexed to patient *i* in quarter *q*. For both utilization and cost models, independent variables included a dummy for whether a patient was in an intervention site (TEAM UP), a dummy for the pre (2014-2016q2)- versus postperiod (2017) (*Post)*, and an interaction term between intervention status and postperiod (TEAM UP*Post). The interaction term represents the parameter of interest or the DID. The model also controlled for a quarterly time trend (Quarter), the number of eligible member months in quarter *q* for patient *i* (Member Months), a vector of member-level covariates (eg, age, sex, zip code-level demographics) as to produce doubly robust estimates,[50,51] and site fixed effects (μ). All models apply IPTWs, with errors clustered at the site-level and using robust standard errors to account for repeated patient measures.[52]

To estimate differential effects of TEAM UP on children with a baseline mental health diagnosis, we examined each of our main outcomes using the model specification above by stratifying on an indicator of mental health diagnosis at baseline. Stratification allowed us to examine all outcomes, including outcomes related to mental health, as opposed to using a three-way interaction approach.

## 2.6 | Sensitivity analyses

Several sensitivity analyses and robustness checks were conducted to assess whether results were sensitive to assumptions and specifications. First, to examine whether preperiod trends between TEAM UP and comparison patients were parallel, which is required for internal validity of difference-in-difference models, for all outcomes, we tested the interaction between linear quarter and TEAM UP status in the preperiod. Second, while our primary analyses used propensity weighting, to see whether our findings were robust to this propensity approach, we used propensity matching using 1:1 nearest neighbor matching without replacement [53,54]; we used weighting in our primary analyses because there is some evidence suggesting that matching has potential to increase covariate imbalance and bias.[55] Third, we estimated all main results without the use of propensity scores since propensity scores alter the characteristics our of comparison group; however, these results should be interpreted with caution, as there are some systematic differences between our treatment and comparison groups. Fourth, we used generalized linear models in place of GEE models, as GEE models are sensitive to missing data.[56,57] Finally, we examined differential effects by age-group. For full details on sensitivity analyses, including results, see Appendix S1.

# 3 | RESULTS

## 3.1 | Study population characteristics

At baseline, patients receiving care at TEAM UP CHCs were more likely to have asthma and any mental health disorder, relative to comparison site patients. TEAM UP patients also lived in zip codes with lower median incomes, higher percentages of residents who were nonwhite, and lower percentages of residents whose primary language was not English. After applying IPTWs, however, there were no measured differences in observable patient characteristics for TEAM UP versus comparison patients—all standardized differences were <0.1 (Table 1).

## 3.2 | Effect on health care utilization

As shown in Table 2, after approximately 1.5 years of implementation time, compared to comparison sites, TEAM UP was associated with a relative increase in the rate of primary care visits (incidence rate ratio [IRR] = 1.15, 95% confidence interval [CI] 1.04, 1.27), representing an additional 116 visits/1000 patients/quarter (95% CI 33, 200). While a relative increase in primary care visits was observed, utilization of primary care services declined in both the TEAM UP and comparison groups in the postperiod. No statistically significant changes were observed for ED visits (all cause, mental health, or asthma), inpatient admissions, or other outpatient/professional visits (all cause, mental health) when comparing TEAM UP versus comparison group patients in the pre- versus postperiods; however, overall rates of both all-cause ED visits and inpatient admissions in the TEAM UP group were about half that of the comparison group.

## 3.3 | Effect on total cost of care

TEAM UP was not associated with a change in total cost of care after 1.5 years (DID = −$8/ patient/quarter, 95% CI −$98, $83) (Table 3). For inpatient spending, for TEAM UP patients versus comparison site patients, there was a directional but not statistical reduction in the odds of having any inpatient costs (odds ratio [OR] = 0.67, 95% CI 0.28, 1.61), but an increase in the level of costs among those with inpatient spending (IRR = 1.99, 95% CI 1.02, 3.90), together resulting in no aggregate change in inpatient spending (DID = $15/patient/quarter, 95% CI −$53, $83).

**TABLE 1** Baseline patient characteristics before and after propensity weighting

| | Before weighting | | After weighting | | Standardized difference after weighting |
|---|---|---|---|---|---|
| | TEAM UP | Comparison | TEAM UP | Comparison | |
| Age (mean) | 9.40 | 9.42 | 9.40 | 9.19 | 0.044 |
| Female (%) | 49.1% | 49.4% | 49.1% | 49.8% | 0.013 |
| Select conditions (%) | | | | | |
| Asthma | 20.7% | 13.7% | 20.7% | 20.0% | 0.017 |
| Any mental health disorder | 31.2% | 24.9% | 31.2% | 31.0% | 0.005 |
| Any substance use disorder | 0.2% | 0.5% | 0.2% | 0.1% | 0.018 |
| ADD | 5.5% | 4.4% | 5.5% | 5.6% | 0.002 |
| Depression | 4.4% | 3.2% | 4.4% | 4.4% | 0.002 |
| Anxiety | 3.7% | 3.1% | 3.7% | 3.3% | 0.009 |
| Adjustment disorder | 8.0% | 5.3% | 8.0% | 6.3% | 0.065 |
| Oppositional defiant disorder | 2.8% | 1.9% | 2.8% | 2.9% | 0.010 |
| Conduct disorder | 1.5% | 1.2% | 1.5% | 1.7% | 0.010 |
| Mood disorder | 1.7% | 1.3% | 1.7% | 1.3% | 0.032 |
| Autism | 1.5% | 1.4% | 1.5% | 1.3% | 0.018 |
| Median income in zip code ($) | $50 182 | $52 820 | $50 182 | $50 820 | 0.037 |
| Other zip code-level characteristics | | | | | |
| % nonwhite | 64.7% | 49.4% | 64.7% | 65.4% | 0.076 |
| % speaking language other than Eng. | 39.0% | 50.3% | 39.0% | 38.2% | 0.003 |
| Medicaid (%) | 100% | 100% | 100% | 100% | NA |
| CHC is primary site of primary care (%) | 100% | 100% | 100% | 100% | NA |

Abbreviations: ADD, attention deficit disorder; CHC, Community Health Center.

### 3.4 | Differential effect among children with baseline mental health diagnosis

When assessing the effect of TEAM UP among children with a baseline mental health diagnosis (Table 4), TEAM UP was associated with an increase in primary care utilization (IRR = 1.26, 95% CI 1.06, 1.50), representing an additional 236 visits/1000 patients/quarter (95% CI 53, 419), or about twice the number of additional visits compared to the full TEAM UP patient population. TEAM UP was also associated with a relative increase in primary care visits for mental health (IRR = 1.31), but this was not statistically significant at $\alpha = 0.05$. TEAM UP was not associated with any statistically significant changes in avoidable health care utilization in the first 1.5 years among those with a baseline mental health diagnosis. TEAM UP was also not associated with an increase or decrease in total cost of care for children with a baseline mental health diagnosis, although the odds of having any professional costs increased (OR = 1.40, 95% CI 1.09, 1.79), as likely driven by increases in primary care visits. For children *without* a baseline mental health diagnosis, no statically significant effects were observed (see Appendix S1, Tables S1-S4).

### 3.5 | Sensitivity analyses

Sensitivity analyses were largely consistent with our main results, where TEAM UP was associated with relative increases in primary care visit rates under alternative specifications. In addition, when using propensity matching in place of propensity weighting, TEAM UP was associated with a relative decrease in the rate of outpatient and other professional visits (IRR = 0.78, 95% CI 0.73, 0.83) and a decrease in outpatient and other professional visits with mental health diagnoses (IRR = 0.76, 95% CI 0.71, 0.82), although there was no statistical change in primary care visits for mental health. Use of propensity matching also estimated that TEAM UP was associated with a $105/patient/quarter reduction in total cost of care (95% CI −$211, −$1). Additional details on sensitivity results and interpretation of results are described in the Appendix S1.

## 4 | DISCUSSION

Our study examines the short-term impact of the TEAM UP pediatric behavioral health integration model on health care utilization and cost of care in children. We find after 1.5 years of implementation time, TEAM UP was associated with relative increases in primary care visit rates, without increasing or decreasing total cost of care; primary care visit rate increases were largely driven by children with a baseline mental health diagnosis. TEAM UP was not associated with reductions in avoidable utilization in the short term.

Increases in primary care visits associated with the intervention suggest that TEAM UP led to greater engagement in primary care, especially for children with mental health disorders. Importantly,

**TABLE 2** Effect of TEAM UP on health care utilization/1000 patients/quarter: Difference-in-differences

| | TEAM UP | | Comparison | | Difference-in-difference (IRR) | Difference-in-difference (marginal effect) |
|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | | |
| Avoidable utilization | | | | | | |
| ED visits—all | 78.1 | 104.8 | 183.0 | 214.3 | 1.15 (0.91, 1.45) | 17 (−12, 45) |
| ED visits—MH diagnosis | 10.8 | 7.3 | 4.0 | 1.6 | 1.69 (0.66, 4.37) | 3 (−2, 8) |
| ED visits—asthma diagnosis | 5.8 | 9.8 | 33.8 | 41.1 | 1.38 (0.61, 3.12) | 4 (−7, 15) |
| Inpatient admissions—all | 5.5 | 8.5 | 6.7 | 16.9 | 0.60 (0.15, 2.43) | −4 (−14, 6) |
| Other utilization | | | | | | |
| Primary care visits | 924.2 | 825.1 | 808.9 | 627.4 | 1.15 (1.04, 1.27)** | 116** (33, 200) |
| Primary care visits—MH diagnosis | 107.5 | 79.0 | 137.4 | 94.1 | 1.07 (0.77, 1.49) | 7 (−30, 42) |
| Outpatient[a]/professional visits | 2193.7 | 1583.8 | 1222.2 | 872.9 | 1.01 (0.68, 1.51) | 16 (−547, 579) |
| Outpatient[a]/professional visits—MH diagnosis | 1212.9 | 797.9 | 1098.2 | 682.5 | 1.06 (0.59, 1.89) | 56 (−516, 628) |

*Note:* Pre- and postestimates represent the mean number of visits/1000 patients/quarter, or the margins, in the pre (2014-q22016)- versus the post (2017)-periods. The difference-in-difference estimates represent the interaction between TEAM UP status and postperiod status. All major utilization types are mutually exclusive. 95% confidence interval (CI) in parentheses. An incidence rate ratio (IRR) <1.0 coefficient means that utilization was lower for TEAM UP patients compared to non-TEAM UP patients. MH is mental health.

[a]Outpatient visits exclude ED visits.

***$P < .001$;

**$P < .01$;

*$P < .05$;

^$P \leq 0.10$.

TEAM UP increased primary care visits without increasing costs. To the extent that increased engagement in primary care leads to earlier diagnosis and treatment of mental health conditions, this may result in longer-term health care savings while better meeting the needs of children. This also creates opportunity for early intervention in children with mental health needs, which may positively impact their health and developmental trajectories into adulthood.

We did not observe a decline in ED visits, where ED visits directionally but not statistically increased in our primary analyses. This lack of effect may be due to the fact that at baseline, TEAM UP patients had much lower rates of ED use as compared to demographically and clinically similar comparison group patients, suggesting that TEAM UP sites may have already been doing a better job at preventing ED use and had lesser opportunity for improvement. Across all primary and sensitivity analyses, we also observed a directional reduction in inpatient admissions. While our study sample size coupled with low rates of inpatient admissions in our study population limited our ability to detect statistically significant changes in admissions, this signal may suggest potential reductions in the full population.

Although our results suggest that TEAM UP was associated with a relative increase in primary care visits, of note, primary care visits declined in both groups over time. This is likely because we focus on a continuously enrolled group of patients who are enrolled in both the pre- and postperiods in our study. As such, these children age over time and require less frequent preventive visits as they age.[58] Children are also less likely to have *any* primary care visits as they age.[59] This may also reflect a broader trend in declining office visit rates.[60]

Additionally, while our sensitivity analyses using propensity matching suggest that TEAM UP was associated with marginal increases in primary care visits *and* decreases in non-primary care outpatient visits, thereby suggesting a potential substitution effect, as well as decreases total cost of care, because these results are not robust to specification, we cannot conclude any effect on these outcomes. However, this signals a need to continue to evaluate changes in these outcomes over time.

It is important to note that any future reductions in total cost of care may be predicated on the theory that reductions in costs via avoidable utilization will be greater than increases in costs associated with more use of mental health services. While this "offset effect" has been historically documented in other literature,[61-64] it is indeed a high bar requirement for behavioral health that is often not applied to other types of medical care such as cancer or heart disease. Measured improvement in pediatric mental health also holds value on its own—cost effectiveness over cost savings may a more reasonable objective. Furthermore, as our analyses are conducted from the payer perspective, to generate system-level cost savings, patient-level savings would have to exceed the total costs of the intervention, which were substantial—costs that likely could not be supported by most CHCs alone.

This study adds to the limited evidence base on integration of behavioral health into pediatric primary care. One 2015 meta-analysis that examined 31 randomized control trial studies on integrated behavioral health in children and adolescents found that integrated interventions were associated with improved behavioral health outcomes, as compared to a usual nonintegrated source of

**TABLE 3** Effect of TEAM UP on cost of care/patient/quarter: Difference-in-difference results

| | TEAM UP | | Comparison | | Difference-in-difference |
|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | |
| Total cost of care | | | | | |
| Part 1 | 0.65 | 0.60 | 0.61 | 0.56 | 0.98 (0.86, 1.12) |
| Part 2 | $688 | $620 | $895 | $794 | 1.01 (0.82, 1.25) |
| Combined marginal effect | | | | | −$8 (−$98, $83) |
| Inpatient | | | | | |
| Part 1 | 0.004 | 0.005 | 0.006 | 0.011 | 0.67 (0.28, 1.61) |
| Part 2 | $3032 | $5198 | $10 525 | $9049 | 1.99* (1.02, 3.90) |
| Combined marginal effect | | | | | $15 (−$53, $83) |
| Outpatient | | | | | |
| Part 1 | 0.24 | 0.20 | 0.17 | 0.14 | 0.96 (0.80, 1.16) |
| Part 2 | $468 | $399 | $1301 | $1188 | 0.93 (0.72, 1.21) |
| Combined marginal effect | | | | | −$13 (−$49, $24) |
| Professional | | | | | |
| Part 1 | 0.57 | 0.56 | 0.48 | 0.44 | 1.12^ (0.98, 1.28) |
| Part 2 | $497 | $419 | $444 | $428 | 0.88 (0.65, 1.17) |
| Combined marginal effect | | | | | −$21 (−$78, $36) |
| Pharmacy | | | | | |
| Part 1 | 0.40 | 0.34 | 0.38 | 0.32 | 0.94 (0.81, 1.08) |
| Part 2 | $129 | $97 | $217 | $118 | 1.38 (0.80, 2.37) |
| Combined marginal effect | | | | | $14.6 (−$3, $33) |

*Note:* Pre- and postestimates represent the mean costs/patients/quarter, or the margins, in the pre (2014-q22016)- versus the post (2017)-periods. Part 1 represents the odds of having any quarterly cost, where the difference-in-differences represents the odds ratio (OR), or the interaction coefficient between TEAM UP status and postperiod status. Part 2 represents the mean quarterly costs of those with>$0 in costs, where the difference-in-difference estimates in Part 2 represent the incidence rate ratio (IRR). The combined marginal effect for the interaction between TEAM UP status and postperiod status is also shown. A negative coefficient means that cost of care was lower for TEAM UP patients compared to non-TEAM UP patients. 95% confidence interval (CI) in parentheses.

***$P < .001$;

**$P < .01$;

*$P < .05$;

^$P < .10$.

care.[12] It also found that the strongest effects were observed in interventions that specifically targeted mental health conditions or that used collaborative care models.[12] However, most of these studies were narrow in scope and none assessed health care utilization or cost. Another recent study assessed the 5-year impact of a multicomponent, integrated behavioral health model into a large pediatric primary care network in Massachusetts. Authors found that the program was associated with increases in psychotherapy and behavioral health visits, increased ambulatory medical spending, and a reduction in total behavioral health ED spending, with no long-term change in ED visits for behavioral health.[15] However, this study did not use an experimental or quasi-experimental design, including lack of a comparison group. Another recent study assessed how a single colocated behavioral health and care coordination integration model in a single urban pediatric primary care office was associated with changes in patient experience, provider experience, population health quality (eg, the Pediatric Symptom Checklist, PHQ-9 Adolescent Depression Scale, Vanderbilt Assessment Scale), and medical expenditures. Results suggested that the intervention was associated with some measured improvements in population health quality and decreases in cost.[65] However, the study was descriptive only; it did not report statistical significance nor did it include a comparison group. Our study serves as the first known study to assess the impact of a pediatric behavioral health integration model on health care utilization and cost using quasi-experimental methods.

Our findings have three major implications. First, TEAM UP increased primary care use without increasing total patient spending. This means that, notwithstanding the direct investment of implementing the intervention, integrating behavioral health into the pediatric medical home for low-income children has measurable value in as little as 1.5 years, without further increasing patient spending. If increased

**TABLE 4** Effects of TEAM UP on utilization and cost among those with a mental health diagnosis: difference-in-difference results

| | Team up | | Comparison | | |
|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Difference-in-difference |
| Avoidable utilization/1000 patients/quarter | | | | | |
| ED visit—all | 110.5 | 156.8 | 149.7 | 164.8 | 1.29 (0.84, 1.98) |
| ED visits—MH diagnosis | 38.4 | 27.5 | 8.9 | 3.3 | 1.96 (0.65, 5.92) |
| ED visits—asthma diagnosis | 7.3 | 9.1 | 39.0 | 33.8 | 1.44 (0.38, 5.42) |
| Inpatient admission—all | 18.1 | 27.9 | 5.7 | 8.8 | 0.99 (0.17, 5.89) |
| Other utilization/1000 patients/quarter | | | | | |
| Primary care visits | 1349.4 | 1226.8 | 882.2 | 636.8 | 1.26*** (1.06, 1.50) |
| Primary care visits—MH diagnosis | 330.2 | 203.2 | 322.0 | 151.3 | 1.31 (0.93, 1.85) |
| Outpatient + and professional visits | 5432.1 | 2859.2 | 2819.0 | 1340.9 | 1.11 (0.70, 1.74) |
| Outpatient[a] and professional visits—MH diagnosis | 3919.2 | 1853.2 | 2778.4 | 1163.0 | 1.13 (0.65, 1.95) |
| Cost/patient/quarter | | | | | |
| Total cost of care | | | | | |
| Part 1 | 0.79 | 0.71 | 0.69 | 0.55 | 1.22 (0.94, 1.59) |
| Part 2 | $1294 | $1018 | $1018 | $771 | 1.04 (0.77, 1.41) |
| Combined marginal effect | | | | | $28 (–$173, $230) |
| Inpatient | | | | | |
| Part 1 | 0.010 | 0.013 | 0.006 | 0.010 | 0.84 (0.26, 2.77) |
| Part 2[b] | $5943 | $9566 | $4046 | $5164 | 1.26 (0.16, 9.63) |
| Combined marginal effect | | | | | $8 (–$307, $323) |
| Outpatient | | | | | |
| Part 1 | 0.35 | 0.24 | 0.18 | 0.11 | 1.05 (0.75, 1.46) |
| Part 2 | $695 | $527 | $1159 | $737 | 1.19 (0.80, 1.77) |
| Combined marginal effect | | | | | $30 (–$17, $77) |
| Professional | | | | | |
| Part 1 | 0.70 | 0.66 | 0.58 | 0.46 | 1.40** (1.09, 1.80) |
| Part 2 | $869 | $606 | $705 | $563 | 0.87 (0.57, 1.33) |
| Combined marginal effect | | | | | –$16 (–$190, $158) |
| Pharmacy | | | | | |
| Part 1 | 0.54 | 0.45 | 0.42 | 0.32 | 1.08 (0.84, 1.39) |
| Part 2 | $191 | $215 | $127 | $116 | 1.23 (0.78, 1.95) |
| Combined marginal effect | | | | | $3 (–$18, $24) |

*Note:* Pre- and postestimates represent the mean utilization or costs, as measured by the margins, in the pre (2014-q22016)- versus the post (2017)-periods. The difference-in-difference estimates represent the interaction between TEAM UP status and postperiod status. For utilization and Part 2 cost estimates, difference-in-differences are reported as incidence rate ratios (IRRs). For Part 1 cost estimates, difference-in-differences are reported as odds ratios (ORs). All major utilization types are mutually exclusive. 95% confidence interval (CI) in parentheses.
For results on those without a baseline mental health diagnosis, and for marginal effects for utilization outcomes, see Appendix S1.
Abbreviation: MH, mental health.
[a]Outpatient visits exclude ED visits.
[b]Part 2 of inpatient costs is generated using a generalized linear model rather than a generalized estimating equation due to lack of model convergence.
**$P < .01$.
***$P<0.001$.

engagement in primary care leads to earlier and improved treatment for children with mental health conditions, longer-term cost savings could result. Second, findings suggest that expanding the TEAM UP behavioral health integration model to other sites of care has potential to improve access to and utilization of primary care services for low-income children, especially with mental health needs. Given widespread and systematic barriers to accessing timely, evidence-based mental health care in pediatrics, especially within low-income and racially diverse populations, this is particularly important. As CHCs and other primary care providers across the country consider how

to best meet the behavioral health needs of their pediatric patients, TEAM UP may serve as a promising model, particularly for urban pediatric sites with the resource capacity to support the intervention. Alternatively, it may be more feasible to support system-wide pediatric behavioral health integration, inclusive of the core components of TEAM UP, through value-based based payment models or managed care contracts that allow for flexible resource use. Third, more broadly, integrating behavioral health into pediatric primary care, particularly in sites serving low-income children, may serve as an important mechanism in addressing unmet need and in overcoming systemic barriers to mental health care for children; for health systems or practices, this may include investing in additional staff, conducting ongoing provider and staff trainings, and/or operationalizing new workflows and screening protocols, for example. Additional research is necessary to better understand how different types of integration models help to achieve these objectives and how different components of such models affect health outcomes, utilization, and cost.

Our study has several limitations. First, claims data are limited in that they exist for billing purposes only, lack important clinical indicators, and may lead to misclassification of disease status. However, claims data allow us to longitudinally follow a large sample of the same patients over time and any misclassification of patients should not be differential between the treatment and comparison groups. Second, site participation in TEAM UP was nonrandom, where selected sites may have been more invested in behavioral health and may have had greater baseline capacity and motivation to support change. To account for selection, we used a DID framework coupled with propensity weighting; however, residual confounding likely exists, as we were only able to adjust for and balance on available patient-level characteristics, which does not account for other important site-level characteristics. Third, our data come from a single Medicaid health plan and thus do not represent all children served by the TEAM UP CHCs. While we have no reason to believe that these children are systematically different from other Medicaid-enrolled children at the CHCs, they may differ from privately insured or uninsured children, and therefore, our findings may not be generalizable to these populations. This also limits available sample size and thus our power to detect change, particularly for less common types of utilization such as inpatient admissions, and precludes us from assessing inpatient admissions with mental health diagnoses due to extremely low prevalence. Fourth, our cost findings are measured from the payer perspective only and do not account for the costs associated with implementing the intervention. Finally, our results reflect 1.5 years of postperiod observation time and thus represent early findings only. Additional implementation time is needed to determine whether increased use of primary care services will translate into reductions in avoidable utilization and cost.

## 5 | CONCLUSION

As one of the first known studies to assess the impact of a pediatric behavioral health integration model on health care utilization and cost, we find that after 1.5 years, the TEAM UP model was associated with increases in primary care visit rates, particularly among children with mental health disorders, and with no changes in total cost of care. This suggests that expanding core elements of TEAM UP to other sites of care has the potential to improve access to and utilization of services for low-income children with mental health needs. Additional implementation time is necessary to determine whether increased primary care engagement will translate into reductions in avoidable utilization and cost.

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## ORCID

*Megan B. Cole* https://orcid.org/0000-0001-8731-4210

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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