Quality of Care for Childhood Attention-Deficit/Hyperactivity Disorder in a Managed Care Medicaid Program

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Objective: To examine whether clinical severity is greater among children receiving attention-deficit/hyperactivity disorder (ADHD) care in primary care compared with those in specialty mental health clinics, and to examine how care processes and clinical outcomes vary by sector across three 6-month time intervals. **Method:** This was a longitudinal cohort study of 530 children aged 5 to 11 years receiving ADHD care in primary care or specialty mental health clinics from November 2004 through September 2006 in a large, countywide managed care Medicaid program. **Results:** Clinical severity at study entry did not differ between children who received ADHD care in solely primary or specialty mental health care clinics. At three 6-month intervals, receipt of no care ranged from 34% to 44%, and unmet need for mental health services ranged from 13% to 20%. In primary care, 80% to 85% of children had at least one stimulant prescription filled and averaged one to two follow-up visits per year. Less than one-third of children in specialty mental health clinics received any stimulant medication, but all received psychosocial interventions averaging more than five visits per month. In both sectors, stimulant medication refill prescription persistence was poor (31%–49%). With few exceptions, ADHD diagnosis, impairment, academic achievement, parent distress, and parent-reported treatment satisfaction, perceived benefit, and improved family functioning did not differ between children who remained in care and those who received no care. **Conclusion:** Areas for quality improvement are alignment of clinical severity with provider type, follow-up visits, stimulant use in specialty mental health, agency data infrastructure to document delivery of evidence-based psychosocial treatment, and stimulant medication refill prescription persistence. J. Am. Acad. Child Adolesc. Psychiatry, 2010;49(12):1225–1237. **Key Words:** ADHD, quality of care, primary care, managed care, Medicaid

Improving the quality of mental health care for publicly insured children has been identified as a national priority in multiple reports[1-4] and health care reform legislation.[5] The landmark Patient Protection and Affordable Care Act expands Medicaid eligibility to all who earn less than 133% of the federal poverty level, and mandates that mental health services be included as basic services in Medicaid plans.[6] The Children's Health Insurance Program Reauthorization Act of 2009 also adds $33 billion in federal funds to provide health insurance coverage to an estimated 4.1 million children in Medicaid and State Children's Health Insurance Program by 2013.[7] Yet, if access to mental health services for children is increased under these new health policies, what is the quality of mental health care that children are anticipated to receive?

Within this context, the quality of care for attention-deficit/hyperactivity disorder (ADHD) among children enrolled in Medicaid is significant because it is the most common childhood psychiatric disorder affecting 3% to 7% of U.S. children,[8-10] and more than one-third of the na-

This article is discussed in an editorial by Dr. Mark Olfson on page 1183.

Supplemental material cited in this article is available online.

tional healthcare expenditures for child mental disorders are paid for by Medicaid.[11] During the past decade, ADHD medication prescriptions have doubled[12,13] and stimulant medication may be overused.[14] In California's Medicaid outpatient specialty mental health clinics, based on medical record data, medication treatment was found to be poorly monitored, and slightly less than one-half of children received acceptable care for ADHD, depression, and conduct disorder (CD)[15]; rates similar to national estimates of quality of health care for children and adults.[16,17]

In addition, care for ADHD is anticipated to increasingly occur in primary care settings as child mental health care is forecast to "constitute a significant part of general pediatric practice by 2020."[18] An estimated 6% to 42% of children are identified as having a mental health problem during a primary care visit[19-22]; more than 70% of general pediatricians report being responsible for treating ADHD[23]; and primary care clinician receptivity to adhering to evidence-based practices has improved.[24] Nevertheless, studies based on provider survey data suggest that target areas for quality improvement include use of diagnostic criteria and rating scales, evidence-based behavior therapy, and more frequent follow-up care.[25-27] For children enrolled in Medicaid, administrative barriers to the integration of mental health care in primary care settings include lack of diagnostic and procedural parity for Medicaid reimbursement and limitations on payments for same-day billing for physical and mental health services.[28,29]

Within Medicaid, the quality of care in managed care is of relevance because enrollment of Medicaid beneficiaries has increased from 56% to 71% between 2000 and 2008,[1] and unmet need for mental health services has been found to be higher among children enrolled in managed care compared with those in fee for service.[30] In California, similar to several states, specialty mental health services are "carved out," and Medicaid reimbursement requires that a child meet medical necessity criteria.[31,32] Evidence that use of specialty mental health services is reserved for the care of children with greater clinical severity, however, is mixed,[25,33,34] but earlier studies did not hold insurance status constant. In managed care Medicaid programs with behavioral health carve-outs, comparison of clinical severity across care sectors is also problematic because Medicaid data is fragmented between primary care and specialty mental health agencies.[35] Differences in clinical severity of ADHD across sectors have not been examined to explore whether the policy's intention to reserve specialty mental health services for children of greater clinical need is met. Furthermore, little is known about the quality of ADHD care delivered in primary care clinics, how it compares with that provided in specialty mental health programs, and whether clinical outcomes differ by sector.

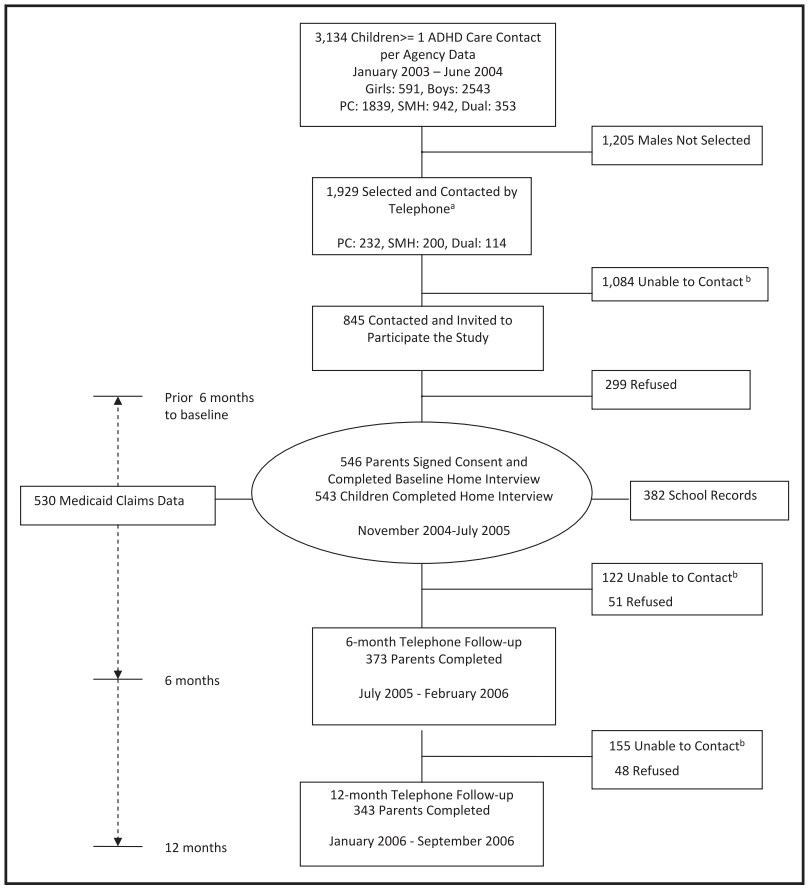
To address these questions, this study merges Medicaid data from primary care and specialty mental health care clinics and integrates child-level data from parent and child interviews as well as school records to describe ADHD care in one of the nation's largest managed care Medicaid programs.[1] Clinical severity and unmet need for mental health services are described using standardized measures of symptoms and impairment. Across three 6-month time intervals, data on ADHD care processes and clinical outcomes by sector are aligned with the interview dates of the baseline, 6- and 12-month follow-up parent surveys. The study objectives are as follows: (1) to examine whether clinical severity is greater among children receiving outpatient ADHD care in primary care compared with those in specialty mental health clinics; (2) to examine how broadly defined care processes (i.e., no care, unmet need, cross-sector contact, treatment type, stimulant medication refill prescription persistence, service use intensity) vary by sector; and (3) to explore how clinical outcomes compare between children who receive care in primary or specialty mental health clinics and those who receive no care, adjusting for potential selection effects. We hypothesize that children receiving ADHD care in outpatient specialty mental health settings will have greater clinical severity and thus will be more likely to receive combined treatment (i.e., psychosocial and medication) and more intensive services than children in primary care. The analysis examining how clinical outcomes vary by care sector is exploratory, as there are few empirical data on ADHD care within a managed care Medicaid program.

METHOD

Study Population

The study population comprised children aged 5 to 11 years who were identified by the agency as receiving any ADHD care in a large managed care Medicaid program in primary or specialty mental health care

FIGURE 1 Flowchart of participants in the Partners in Care for Children Study. Note: Agency data available for constructing sampling frame: January 2003 to June 2004 in specialty mental health care (SMH), and January 2003 to February 2004 in primary care (PC). Dual refers to one or more contacts for attention-deficit/hyperactivity disorder (ADHD) or stimulant medication filled in both sectors. [a]Included all female participants (n = 591) and randomly selected male participants (n = 1,338) stratified by care sector. [b]Parents could not be reached because of problems with locator information (moved, disconnected telephones) or because they did not respond to telephone messages within the 10 attempts made during three different time periods of the day (i.e., morning, midday, early evening).



outpatient settings between January 1, 2003, and June 30, 2004. The health plan serves nearly 750,000 County of Los Angeles residents of all ages enrolled in managed care Medicaid, and specialty mental health services are carved-out to the County of Los Angeles Department of Mental Health (DMH).[36]

Sample

Medicaid service encounter and pharmacy claims data from the primary care and specialty mental health care agencies were used to construct the sampling frame and to define the study time intervals (Figure 1). A child was identified as receiving ADHD care if he or she had at least one visit with a primary diagnosis of ADHD (ICD9: 314.00, 314.01, or 314.9) or at least one claim for a stimulant prescription during the sampling time period. The other eligibility criteria were age 5 to 11 years, primary language Spanish or English, and Los Angeles County residence. For children identified from DMH, membership in the managed care Medicaid health plan was verified before entry into the sampling frame. We identified 3,134 children who were eligible for the study. We included all girls (n = 591) and randomly selected boys (1,338/2,543; 53%), yielding 1,929 children who were eligible for enrollment. Of these children, 56% were not reachable, with the most common reason being incorrect contact information (84%; 910/1,084). Of the 845 parents or primary care givers contacted (hereafter referred to as parents), 546 (65%) participated in the home interviews, and of these, almost all children (n = 542, 99%) completed depression and anxiety screenings. Of the 546 parents enrolled, 530 children had Medicaid claims data available between January 2003 to December 2006. This analysis is based on these 530 children. Selection of boys,

reachable status, and participation varied by sector; therefore enrollment weights were created to adjust for the probability of selection, reachability, and nonresponse bias. Description of sampling procedure and enrollment weights is included in the supplemental materials accompanying this article (Table S1, available online).

Parent and child home interviews were completed between November 2004 and July 2005, and follow-up parent telephone surveys were administered at approximately 6 and 12 months. The 6-month survey was conducted between July 2005 and February 2006, with a response rate of 68% (n = 373), and the 12-month survey was conducted between January through September 2006, with a response rate of 63% (n = 343). Of the children, 77% (n = 421) had parent-reported data from at least one follow-up survey, and 54% (n = 295) had parent survey data at all three time points. On average, 6-month follow-up interviews were completed 7.2 months (SD, 1.4) and 12-month interviews were completed 13.4 months (SD, 1.3) from the date of the first parent interview. For each child, agency data were abstracted for three 6-month study time intervals. School record data were obtained for 70% of the children (n = 382).

Procedures

Study and consent procedures were approved by the State of California Department of Health Care Services and University of California–Los Angeles Institutional Review Boards. Interviews were conducted in English or Spanish at home or at a convenient meeting place. Following the interview, parents were asked to authorize the release of school records. Parents received $50 and children were given a $5 gift certificate for their participation. The interview team included bilingual, bicultural interviewers with an average of 7 years' survey experience, including interviewing low-income children and their families. All interviewers received 3 days of training and were certified for data collection if they had at least 90% agreement on three standardized videotaped parent/child interviews. Survey responses were reviewed for accuracy within 2 weeks of the interview, and subjects were re-contacted by phone to correct any errors. School record data were abstracted using a computerized record abstraction tool developed for this study using FileMaker database software.

Study Variables

Construction of the study variables to describe the clinical characteristics and care processes is summarized in the supplemental tables (Tables S2 and S3, available online). To align the time frames for describing care processes and clinical outcomes over time, school record data, and Medicaid claims data were aligned with the interview dates of the baseline, 6- and 12-month follow-up parent surveys. Agency data were used to construct three 6-month time intervals: namely, the time between the 6 months before the parent baseline interview to baseline interview, between the baseline and 6-month interviews, and between the 6-month and 12-month interviews. For children whose parent did not complete a follow-up survey, an interview date was extrapolated based on the distribution of the interview dates.

Data Analysis

The sociodemographic and clinical characteristics assessed at baseline were described using means and standard deviations for continuous variables, and percentages for categorical variables. Each variable was cross-tabulated with the three care sector contact groups at sampling (i.e., the sector from which the child received ADHD care when determined to be eligible for the study), namely primary care, specialty mental health, and dual. Weighted estimates applicable to the population of eligible children were calculated using SUDAAN 10.0 software (http://www.rti.org/SUDAAN/) to account for sampling procedures and unit nonresponse. Distribution of sample characteristics by the follow-up survey response status at 6 and 12 months is included in the supplemental materials (Table S4, available online). We performed nonresponse analyses for the 6- and 12-month surveys and developed weights that account for nonresponse bias. The products of the enrollment weights and nonresponse weights were used for follow-up analyses.

To compare the rates of no care and unmet need across initial care sectors (primary care, specialty mental health, dual) over 18 months, we estimated multiple logistic regression models. To account for confounding and the multi-level data structure with repeated measurements nested within children, we used a generalized estimating equations (GEE) method incorporated in SUDAAN to fit a longitudinal repeated measure logistic regression model using data at baseline, 6 months, and 12 months.[37] In these models, we included main effects of care sector, wave, and their interaction, as well as main effects of child age, gender, race/ethnicity, primary language, type of ADHD care when selected (visit only, stimulant prescription filled, both). Significance of comparisons by care sector at each wave was based on regression coefficients. F-test is used to designate statistical significance of 0.05 or stronger for the overall test of the difference among the three care groups and *t* test is used for a comparison between two groups. To facilitate interpretation of the estimates, we present the predicted probabilities for each care group along with 95% confidence intervals.

Descriptive summaries are provided for service use patterns. Among children who received ADHD care at three 6-month intervals (T1: 6 months before the baseline interval, T2: baseline to 6 month, T3: 6 to 12 months) the service use patterns were compared be-

tween primary and specialty mental health care. A small group of children who received ADHD care from both care sectors (18 from T1, 16 from T2, 9 from T3) were excluded to improve the homogeneity of the care sector groups. The χ^2 test was used to test for differences among categorical variables, and t test was used for continuous variables.

For clinical outcomes at three 6-month intervals (i.e., ADHD diagnosis, functional impairment, ≥C average academic grade, parent poor mental health, positive parent treatment perception), the GEE method described above was used. To examine differences in clinical outcomes by care sector contact status (i.e., no care, primary care, specialty mental health), we fit longitudinal repeated measure logistic regression models with the covariates of child age, gender, race/ethnicity, parent marital status, and education.

For all logistic regression models, we assessed the sensitivity of the findings to adjustment for additional covariates (biologic parent) as well as in unweighted analyses. Findings using unweighted data that are adjusted for selected covariates were qualitatively similar to those based on weighted data.

RESULTS

Sociodemographic Characteristics

The average child age was 9.9 years (SD, 1.9), 68% were male (n = 370), and most (n = 474, 87%) were from minority racial or ethnic backgrounds. Nearly one quarter (n = 125, 23%) were African-American, 54% (n = 293) were Latino, 13% (n = 72) were Caucasian, and 10% (n = 56) were reported by their parents as being from two or more ethnic backgrounds or from other ethnic groups. Of the Latino children, 75% (208/277, 16 missing data) were in the family's first U.S. born generation. Of the parents, 40% (n = 218) had less than 12 years of education, 34% (n = 182) had graduated from high school, and 27% (n = 144) had 13 or more years of education. A total of 40% (n=216) were married, 26% (n = 139) were widowed, separated, or divorced, and 35% (n = 191) had never been married. Only 11% of children (n = 61) were living with a nonbiologic parent and 4% (n = 21) had a foster parent. One-quarter of the parents (n = 141; 26%) screened positive for high psychological distress. Demographic characteristics did not vary by care sector in pairwise comparisons, with few exceptions. Children living with a nonbiologic or foster parent were more likely to be receiving care in specialty mental health clinics than in primary care ($p < .017$).

Clinical Characteristics

Slightly more than three-fourths of the children (n = 411; 76%) met diagnostic criteria for ADHD in the past year, and the combined subtype was most common (n = 264; 48%) followed by inattention type (n = 97; 18%) and hyperactive/impulsivity type (n = 50; 9%). Of those children with ADHD, 63% (n = 258) also met diagnostic criteria for a disruptive behavior disorder (oppositional defiant disorder [ODD]: n = 254, 62%, CD: n = 57, 14%), and 26% (n = 106) screened positive for depression or anxiety. Overall, 82% (n = 446) of the children had symptoms of at least one common childhood psychiatric disorder, and of these, 45% (n = 243) had high functional impairment. To conservatively estimate need for mental health services, 41% (n = 220) met diagnostic criteria for ADHD and had high functional impairment, and 43% (n = 234) had at least one common disorder and were impaired. One-half of the children received a grade of C or better in English (n = 153; 50%), and 41% (n = 128) received an average grade or higher in math during the most recently completed grading period. Almost 40% of children (n = 214) had a history of being suspended (n = 207; 38%) or expelled (n = 42; 8%) from school.

Clinical severity and academic variables did not differ significantly between children who received ADHD care in solely primary and specialty mental health care at study entry. Children who had contacted both sectors for ADHD care at study entry had higher functional impairment than children who had initial contact in only one sector ($p < .017$), and compared to children served in only primary care, had a higher rate of being suspended ($p < .017$) (Table S5, available online).

No Care, Unmet Need, and Cross-Sector Contact Over Time

Adjusted percentages of no care and unmet need for each 6-month study time interval by the initial care sector from which the child was sampled are summarized in Table 1. Slightly more than one-third of the children (34%) were receiving no care during the 6 months before the baseline home interview, and 44% were receiving no care between the 6- and 12-month follow-ups. For children who had contact for ADHD care in only primary care at sampling, 52% received no care at the 6- to 12-month time interval. Among the total sample, 13% to 20% of children met

TABLE 1 Adjusted Percentage of Children Who Receive No Care and Have Unmet Need during 18-Month Study Time Period by the Care Sector Contact at Sampling

						Difference Across Care Sectors							
	Analytic	Overall	PC	SMH	Dual	PC vs. SMH		PC vs. Dual		SMH vs. Dual		Group Test	
	N	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	*t*	*p*	*t*	*p*	*t*	*p*	χ^2	*p*
No care													
6 Months before baseline	530	33.6 (28.9–38.2)	41.3 (33.8–48.7)	25.7 (20.0–31.5)	15.7 (8.7–22.8)	3.2	<0.01	4.3	<.001	1.9	0.06	22.6	<.001
Baseline to 6 months	530	38.6 (33.8–43.4)	48.0 (40.4–55.5)	29.5 (23.4–35.5)	15.2 (8.2–22.3)	3.6	<.001	5.3	<.001	2.6	<0.01	32.5	<.001
6–12 Months	530	43.8 (38.9–48.7)	51.9 (44.5–59.4)	34.4 (28.0–40.8)	27.2 (18.6–35.8)	3.4	<.001	4.0	<.001	1.2	0.23	20.3	<.001
Unmet need													
Any ADHD + impairment + no care[a]													
6 Months before baseline	529	12.7 (9.3–16.1)	16.1 (10.5–21.8)	8.5 (4.9–12.0)	8.1 (2.8–13.3)	2.4	0.01	1.8	0.08	0.1	0.90	7.1	.03
Baseline to 6 months	360	18.7 (12.8–24.5)	25.9 (16.0–35.8)	11.6 (6.9–16.3)	5.7 (0.6–10.8)	2.8	0.01	3.2	<0.01	1.4	0.16	13.5	<.01
6–12 Months	334	20.3 (14.8–25.7)	25.0 (16.2–33.9)	14.3 (8.6–20.0)	9.7 (0.7–18.8)	2.1	0.03	1.9	0.06	0.8	0.45	6.2	.04
No care among any ADHD + impairment[b]													
6 Months before baseline	216	31.8 (24.5–39.1)	43.9 (32.1–55.8)	18.8 (11.0–26.6)	16.0 (6.1–25.9)	3.4	<.001	3.3	<0.01	0.4	0.68	16.7	<.001
Baseline to 6 months	186	35.1 (25.7–44.4)	50.6 (37.7–63.5)	17.6 (10.3–25.0)	12.9 (2.0–23.7)	4.3	<.001	3.7	<.001	0.7	0.49	23.8	<.001
6 to 12 Months	179	37.4 (28.7–46.2)	50.1 (36.7–63.5)	23.4 (13.6–33.2)	18.3 (2.6–33.9)	3.1	<0.01	2.6	0.01	0.5	0.60	12.0	<.01

Note: Data are adjusted for child age, gender, race/ethnicity, primary language, type of attention-deficit/hyperactivity disorder (ADHD) care when selected (visit only, stimulant prescription filled, both), and sampling weights. For 'Unmet Need', nonresponse weighting was also used to extrapolate from the observed 6-month and 12-month sample to the enrolled sample. ADHD = attention-deficit/hyperactivity disorder; CI = confidence interval; Dual = one or more contact for ADHD or stimulant medication filled in both sectors; PC = primary care; SMH = specialty mental health care.

[a]*Any ADHD: Six or more inattentive or hyperactive symptoms in past year; Impairment: Columbia Impairment Scale (CIS) score ≥15.*

[b]*Analytic sample limited to those who had six or more inattentive or hyperactive symptoms in past year and CIS score ≥15.*

TABLE 2 Treatment Type, Stimulant Medication Refill Persistence, and Service Use Intensity Among Children Who Receive Care From Only Primary Care (PC) or Specialty Mental Health (SMH)

	6 Months Before Baseline		Baseline to 6 Months		6–12 Months	
	PC (N = 139)	SMH (N = 206)	PC (N = 127)	SMH (N = 197)	PC (N = 124)	SMH (N = 178)
Any psychosocial, %						
Any mental health visit	39.1	100	31.8	100	28.0	100
Any medication, %						
Any psychotropic medication	95.2	40.1***	97.6	39.9***	95.5	35.0***
Only psychotropic medication	60.9	0.0***	68.2	0.0***	72.0	0.0***
Any stimulant medication	85.1	30.3***	85.2	29.3***	79.8	28.2***
Only stimulant medication	61.1	21.3***	63.4	18.1***	54.0	17.3***
Stimulant medication + other psychotropic medication	24.0	9.1**	21.8	11.2*	25.9	11.0**
Only other psychotropic medication	10.1	9.8	12.4	10.6	15.7	6.8*
Stimulant medication refill persistence[a]	35.9	31.3	40.8	39.9	48.6	49.2
Combined, %						
Mental health visit + psychotropic medication	34.3	40.1	29.4	39.9	23.5	35.0*
Service use intensity						
Average no. of visits per month, mean (SD)	0.2 ± 0.7	5.3 ± 5.9***	0.2 ± 0.4	5.6 ± 6.0***	0.1 ± 0.5	5.2 ± 5.7***

Note: Data are presented as n (%) unless otherwise indicated. Data are limited to children who had service contact from primary care or specialty mental health care. χ^2 tests were used for the comparisons of PC vs. SMH (see p values below).

[a]*Stimulant medication available for more than 67% of total day supply. Sample sizes for PC at 3 time intervals are 113, 105, 96 and 67, 62, 51 for SMH respectively.*

*p < .05, **p < .01, ***p < .001.

criteria for past-year ADHD diagnosis and high functional impairment and were receiving no care during the 6-month study time intervals. Applying a stricter definition of unmet need for mental health services, among children with ADHD and high functional impairment, 32% to 37% were receiving no care during the 6-month study time intervals. At each 6-month interval, children who had contact for ADHD care in only primary care clinics at sampling were more likely to receive no care and to have unmet need for mental health services than children who had contact in only specialty mental health care clinics or both care sectors at study entry.

Of the children that had initial contact in one care sector, none crossed over to the other at each 6-month time interval (Table S6, available online). Of the 21% of children (110/530) who had contact with both care sectors at study entry, 65% transitioned to only specialty mental health care 6 months before baseline interview, and very few (6%) went back to receiving mental health services in only primary care. A very similar pattern persisted during the two follow-up time intervals.

ADHD Care in Primary and Specialty Mental Health Settings

Treatment type, stimulant medication refill prescription persistence, and service use intensity among children who remained in only primary care or specialty mental health clinics by 6-month time intervals are summarized in Table 2. Treatment type and service use intensity differed strikingly by sector. Only 39% of children receiving mental health services in primary care clinics had a visit for any psychiatric diagnosis during the 6 months before the baseline home interview, and mental health visits declined to 28% at the 6- to 12-month time interval. For each time interval, the majority of children receiving mental health services in primary care had at least one psychotropic medication prescription filled (95%, 98%,

96% at three time intervals, respectively) and about two-thirds of children (61%, 68%, 72% at three time intervals, respectively) received only medication treatment. The rates of stimulant medication treatment in primary care clinics was consistently at least 2.8 times greater than that found in specialty mental health programs over the three time intervals. During each time interval, most children in primary care clinics (85%, 85%, and 80% at three time intervals, respectively) were significantly more likely to have at least one stimulant medication prescription filled compared to less than one third (30%, 29%, and 28% at three time intervals, respectively) of children in specialty mental health programs. However, stimulant medication refill prescription persistence was poor in both sectors, ranging from 33% to 44% in primary care and 31% to 49% in specialty mental health care.

In addition, about one-quarter of the children receiving mental health services in primary care clinics had at least one prescription filled for a stimulant medication and another class of psychotropic medication. Combined psychotropic medication treatment was more likely among children receiving mental health services in primary care than specialty mental health clinics during each time interval. Rates of combined psychotropic medication prescriptions among children with ADHD and comorbid ODD or CD were also similar to those among the larger sample of children receiving any care in primary care or specialty mental health clinics (Table S7, available online).

Between 26% and 43% of children received medication and psychosocial treatment at each time interval, and receipt of combined treatment did not vary by care sector. In contrast, service use intensity varied widely between primary care and specialty mental health clinics. On average, children in primary care had only one to two mental health visits per year compared with an average of five visits per month among children receiving care in specialty mental health clinics. Among children receiving care in specialty mental health, more than 90% received supportive services, and more than three-quarters received psychotherapy at each 6-month time interval (Table S8, available online). Only 29% to 34% of children had at least one visit for psychotherapy and at least one psychotropic medication prescription filled for each time interval. The average number of contacts per month for supportive services ranged from 1.8 to 2.3, and the average number of visits per month for psychotherapy ranged from 2.3 to 2.7.

Clinical Outcomes

Clinical outcomes among children who received no care and those who remained in care are summarized in Table 3. With a few exceptions at specific time intervals, clinical outcomes did not vary between children receiving and not receiving ADHD care or between those in primary care or specialty mental health clinics. Compared with children receiving no care, children in specialty mental health clinics were more likely to have high functional impairment at 6- and 12-month follow-up. Of the parents, 24% of parents had high psychological distress at baseline, and the proportion of parents with high distress did not vary by whether their child was receiving or not receiving care. Despite little evidence of clinical improvement, most parents had very positive perceptions of treatment that remained stable over time regardless of treatment status. At baseline, 75% of parents were satisfied or very satisfied with treatment, 86% reported tremendous or some treatment benefit and 83% reported improved family relationships.

DISCUSSION

Care for childhood ADHD in the managed care Medicaid program studied failed to meet the Institute of Medicine's definition of quality that requires "consistency with current professional knowledge" and "improved likelihood of desired health outcomes."[2] More than one-third of children were receiving no care when interviewed at baseline, a rate double the national rate for adults.[38] Despite similar clinical severity, treatment approaches for children were strikingly different in primary care and specialty mental health clinics. Children in primary care received predominantly medication treatment, as recommended by treatment guidelines,[8,39,40] at rates that exceed earlier estimates in community-based primary care.[27] Follow-up visits, however, were on average roughly once per year, a rate similar to that found in other primary care settings.[25] The low follow-up visit rate falls short of the National Quality Forum-endorsed standards[41] and substantially below nationally recommended psychotropic medication treatment and monitoring.[42] In contrast, almost all children in

TABLE 3 Clinical Outcomes Among Children Who Receive No Care or Remain in Care During 18-Month Study Period[a]

	Analytic	Overall	No Care	PC	SMH	Difference Across Care Sectors							
						No Care vs. PC		No Care vs. SMH		PC vs. SMH		Group Test	
	N	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	*t*	*p*	*t*	*p*	*t*	*p*	χ^2	*p*
Child													
Any ADHD													
Baseline	512	76.8 (72.7–80.9)	77.8 (70.7–84.9)	75.1 (66.7–83.5)	77.4 (72.3–82.6)	0.5	.63	0.1	0.93	−0.5	0.64	0.3	.87
6-Month follow-up	349	72.6 (67.6–77.7)	75.6 (67.1–84.1)	68.7 (57.5–79.8)	70.8 (63.4–78.2)	1.0	.33	0.8	0.41	−0.3	0.75	1.1	.58
12-Month follow-up	328	69.5 (63.7–75.3)	65.1 (55.6–74.6)	70.0 (57.9–82.2)	78.7 (71.5–85.8)	−0.6	.54	−2.3	0.02	−1.3	0.21	5.3	.07
Impairment													
Baseline	511	43.5 (38.7–48.2)	41.3 (32.2–50.4)	41.4 (32.1–50.7)	48.0 (41.7–54.3)	−0.0	.99	−1.2	0.24	−1.1	0.25	2.0	.36
6-Month follow-up	348	61.6 (55.9–67.3)	50.6 (39.4–61.9)	66.5 (55.5–77.5)	67.5 (60.0–75.1)	−2.0	.05	−2.4	0.01	−0.2	0.88	6.6	.04
12-Month follow-up	328	59.8 (53.7–66.0)	51.5 (41.2–61.8)	61.8 (49.0–74.6)	72.7 (64.5–80.9)	−1.2	.22	−3.0	<0.01	−1.4	0.15	9.3	.01
Any ADHD + impairment													
Baseline	511	40.0 (35.3–44.8)	38.6 (29.6–47.6)	37.8 (28.7–46.9)	43.8 (37.4–50.1)	0.1	.91	−0.9	0.36	−1.0	0.30	1.5	.48
6-Month follow-up	348	53.9 (47.9–59.8)	48.9 (37.6–60.2)	54.1 (41.9–66.4)	56.9 (48.9–64.9)	−0.6	.54	−1.1	0.26	−0.4	0.71	1.3	.52
12-Month follow-up	328	54.4 (48.1–60.6)	47.7 (37.3–58.2)	54.3 (40.6–67.9)	66.9 (58.3–75.5)	−0.7	.46	−2.7	0.01	−1.5	0.12	7.4	.02
English C equivalent grade or better													
Baseline	293	51.1 (44.6–57.6)	54.0 (43.3–64.8)	49.8 (36.8–62.8)	48.5 (39.7–57.3)	0.5	.61	0.8	0.43	0.2	0.87	0.7	.72
6-Month follow-up	262	49.0 (40.6–57.4)	47.9 (34.5–61.2)	53.7 (35.5–71.9)	44.2 (31.0–57.3)	−0.5	.60	0.4	0.70	0.8	0.40	0.7	.70
12-Month follow-up	211	46.6 (36.9–56.3)	42.2 (27.5–56.9)	51.7 (31.2–72.3)	55.0 (39.8–70.1)	−0.8	.44	−1.2	0.24	−0.2	0.80	1.5	.47
Math C equivalent grade or better													
Baseline	298	44.1 (37.7–50.6)	38.7 (27.4–49.9)	56.2 (43.6–68.8)	36.8 (28.3–45.3)	−2.0	.04	0.3	0.79	2.5	0.01	6.7	.04
6-Month follow-up	265	42.7 (34.5–50.9)	40.7 (27.3–54.2)	52.8 (36.1–69.5)	40.2 (27.7–52.7)	−1.1	.26	0.1	0.95	1.2	0.23	1.7	.43
12-Month follow-up	216	51.1 (41.5–60.7)	41.1 (26.3–55.9)	62.1 (44.1–80.0)	55.5 (40.4–70.6)	−1.7	.08	−1.4	0.18	0.6	0.58	3.4	.18
Parent/Caregiver													
Parent distress (MHI-5 <56)													
Baseline	512	23.7 (19.8–27.5)	25.5 (17.7–33.2)	19.1 (12.2–25.9)	28.6 (22.9–34.3)	1.3	.21	−0.6	0.53	−2.1	0.04	4.2	.12
6-Month follow-up	347	18.1 (13.8–22.4)	14.1 (7.6–20.6)	19.7 (10.8–28.7)	21.4 (14.5–28.4)	−1.0	.30	−1.5	0.14	−0.3	0.76	2.3	.32
12-Month follow-up	325	19.2 (14.1–24.3)	17.3 (9.1–25.5)	20.4 (10.3–30.4)	18.8 (11.2–26.3)	−0.5	.64	−0.3	0.79	0.3	0.80	0.2	.89
Treatment perception[b]													
Satisfaction (very satisfied/ satisfied)													
Baseline	223	74.3 (67.6–81.0)		72.7 (62.2–83.2)	77.3 (70.2–84.5)					−0.7	0.46		
6-Month follow-up	167	76.0 (68.9–83.2)		66.4 (50.8–81.9)	82.7 (75.4–89.9)					−2.0	0.05		
12-Month follow-up	138	76.6 (68.3–84.9)		76.1 (62.9–89.4)	78.0 (68.8–87.2)					−0.2	0.81		

TABLE 3 Continued

	Analytic	Overall	No Care	PC	SMH	Difference Across Care Sectors							
						No Care vs. PC		No Care vs. SMH		PC vs. SMH		Group Test	
	N	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	*t*	*p*	*t*	*p*	*t*	*p*	χ^2	*p*
Perceived benefit of treatment													
Baseline	222	85.7 (80.3–91.0)		84.9 (76.6–93.2)	87.9 (82.2–93.6)					−0.6	0.55		
6-month follow-up	164	72.9 (65.5–80.3)		66.2 (50.6–81.8)	77.5 (69.4–85.5)					−1.4	0.17		
12-Month follow-up	139	75.3 (67.1–83.6)		73.2 (60.3–86.0)	79.2 (69.0–89.5)					−0.7	0.46		
Family relationships improved													
Baseline	210	82.4 (76.3–88.5)		80.1 (70.4–89.9)	85.8 (80.1–91.4)					−1.0	0.30		
6-Month follow-up	162	79.6 (72.8–86.4)		79.2 (65.5–92.8)	82.2 (74.3–90.0)					−0.4	0.70		
12-Month follow-up	137	78.9 (70.8–86.9)		79.2 (66.5–91.8)	77.1 (67.0–87.1)					0.3	0.79		

Note: Data are limited to children whose administrative data showed "no care," "PC only" (primary care), "SMH" (specialty mental health care) from the 6 months before the baseline parent interview date to the 12 months follow-up. Any attention-deficit/hyperactivity disorder (ADHD): 6 or more inattentive or hyperactive symptoms in past year; Impairment: Columbia Impairment Scale (CIS) ≥15. MHI = Mental Health Inventory.
[a]Data are adjusted for child age, gender, race/ethnicity, parent marital status, education level, and sampling weights. Nonresponse weighting was also used to extrapolate from the observed 6-month and 12-month sample to the enrolled sample.
[b]Data are limited to children who had service contact from PC or SMH.

specialty mental health clinics received psychosocial interventions, averaging about five visits per month, and less than one-third of children had at least one stimulant medication prescription filled, a rate consistent with other community-based samples.[43,44] In both sectors, documentation of evidence-based psychosocial treatment for ADHD (i.e., behavior therapy) was missing in the agency databases, and stimulant medication refill prescription persistence was poor but also at rates similar to other community-based populations.[43,45] Despite substantial differences in treatment and service use intensity, children remained symptomatic over time whether or not they were in care, with few exceptions.

Contrary to our hypothesis, children with greater clinical severity were not more likely to access specialty mental health care. There was also little evidence of cross-care sector contact over time. In this large countywide program, prior authorization from the primary care provider (i.e., "gatekeeper") is not required to access Medicaid-funded specialty mental health services. Parents may also directly access specialty mental health services, which are supported by a patchwork of Medicaid-funded and state-legislated programs. Furthermore, there is little infrastructure or incentives to support the transfer of children stabilized in mental health clinics back to primary care or more clinically complex children from primary care to specialty mental health clinics. Together, these findings raise questions about whether the policy that requires medical necessity for Medicaid reimbursement is sufficient to reserve specialty mental health resources for those with greater need. In addition, these findings support future research to develop quality improvement interventions, which are ideally compatible with health information technologies, which promote alignment of the child's clinical severity with provider type as well as improved coordination of care across primary and specialty mental health care providers.

The striking differences in treatment approaches may reflect variation in provider training or clinic workflow. In community-based specialty mental health programs, clinic workflow does not usually follow the medical model found in primary care clinics. Children in specialty mental health clinics may be more likely to have a trial of psychosocial treatment because access to therapists is greater.[2] During this study's time period, at the county agency level there was no

implementation of treatment protocols that specify a trial of behavior therapy before medication evaluation (personal communication, W. Arroyo, June, 14, 2010). Low rates of stimulant medication treatment in specialty mental health clinics may occur because access to the physician is often restricted to children identified by non–medically trained professionals as meriting a medication evaluation.[28] Nevertheless, differences in provider training do not explain the greater use of combined psychotropic medication in primary care, and is consistent with pediatrician opinion that psychopharmacology is a priority area for continued medical education.[22] In future research, comparisons of ADHD care across providers in primary care and specialty mental health care settings should consider adding a study arm for children served in specialty mental health clinics in which the intake evaluation is conducted by a child psychiatrist followed by referral to a therapist to examine whether detection of ADHD, adherence to evidence-based practices, clinical outcomes, and cost savings over time are improved compared with those in usual care in specialty mental health programs.

Although linking of child-level data with Medicaid data is a "powerful and under-used resource for health services research,"[35] this study's findings also underscore the need for improved Medicaid data infrastructure to assess and monitor even broad indices of quality of care for children with ADHD.[5] A substantial proportion of children had poor contact information in their Medicaid data, suggesting that these data have limited capacity to be used by agencies for quality improvement interventions, such as parent education or prevention programs. The use of recommended behavior therapy, such as parent training, may be underestimated in both sectors because procedure codes for Medicaid service encounter data do not specify use of evidence-based psychosocial treatments. Mental health visits in primary care may be underreported because of lack of procedural parity in Medicaid reimbursement for mental health services delivered in primary care.[28,29] In addition, within specialty mental health clinics, similar procedure codes for psychosocial interventions may be billed for by therapists from a variety of disciplines, making it problematic to examine how quality of care varies by provider type. Furthermore, there is no single standard for measuring prescription refill persistence using Medicaid pharmacy claims data.[35] The cut-point for acceptable stimulant medication availability, which accounts for possible drug holidays on weekends, was developed for this study. This approach may overestimate medication refill persistence because some children may receive treatment with two stimulant medications daily, or may underestimate refill persistence because the gap between prescriptions filled for each specific type of stimulant medication was not measured.[46] Future data analyses will examine the agreement between parent-reported care processes and medication adherence with Medicaid data and will explore predictors of agreement in service use and medication treatment.

Of note, conclusions about the effectiveness of treatment cannot be made because children were not randomized to treatment groups. Unlike the Multimodal Treatment Study of Children with ADHD that included a community care arm,[47] this is an observational study for which a natural comparison group emerged over time. High functional impairment among children who remained in specialty mental health clinics compared with children receiving no care is consistent with prior studies that suggest clinical need drives service use.[15] Some clinical outcomes may also have been missed because it was beyond the scope of this study's design and budget to conduct follow-up home interviews for this relatively large community-based population of children and to administer a more comprehensive battery of clinical measures. Furthermore, the consistently high rate of positive treatment perceptions by parents may not necessarily be incongruent with poor clinical outcomes, as these are not indicators of good technical care[48] and have been found to be only minimally associated with youth-reported improvement in functioning.[49]

This study has several additional limitations. More than one-half (56%) of the children eligible for enrollment into the study could not be contacted by telephone, and weighting adjustment for selection and nonresponse does not include unmeasured variables that could also contribute to selection bias. Thus, even weighted data may not be representative of children who met eligibility criteria within the managed care Medicaid program for the study time period. Unmet need for mental health services may be underestimated because impairment due to ADHD symptoms was required for the diagnosis[50] as well as global impairment,[51] and duration of symptoms

was not included in the operational definition of clinical severity. Using only past-year ADHD diagnosis as the indicator of mental health service need, 26% to 28% of children had unmet need during the three 6 month-time intervals. Unmet need also may be overestimated if asymptomatic patients included those who were successfully treated, but this is less likely because stimulant medication refill prescription persistence was poor. Conclusions about medication treatment appropriateness cannot be made because some disorders for which psychotropic medication treatment may be clinically indicated was not assessed. Initial and maintenance phases of treatment also cannot be defined to assess adherence to most national quality indicators for ADHD because children did not enter the study when starting a new episode of care. Furthermore, findings are not generalizable to children in other managed care Medicaid programs or other states because administrative approaches of mental health services by state Medicaid agencies widely varies.[32,52]

Nevertheless, this is the first quality of care study for childhood ADHD in a large managed care Medicaid program that combines four data sources and examines how care processes and clinical outcomes compare across primary care and specialty mental health clinics over time. Findings from this study identify several areas for quality improvement for ADHD care within the managed care Medicaid program studied. These areas are alignment of the child's clinical severity with provider type, frequency of follow-up visits, stimulant medication use in specialty mental health, agency data infrastructure to document delivery of evidence-based psychosocial treatments, and stimulant medication refill prescription persistence. The enduring symptoms, impairment, and poor academic achievement of the children who remain in care and those untreated underscores the public health significance of improving the quality of care for publicly insured children with ADHD. As advocacy for diagnostic and procedural parity in Medicaid reimbursement for mental health services across primary and specialty mental health care sectors continues, may there also be public investment in improving the quality of care delivered in both care sectors. &

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TABLE S1 Distribution of Demographics at Partners in Care for Children Study (PCC) Sampling Stages and Weighting Procedure for Enrollment Weight[e]

	All Eligible to PCC Study[a] (N = 3,134)	Stage-1 Eligible Boys (N = 2,543)		Stage-2 Contacted by Telephone (N = 1,929)		Stage-3 Reached by Telephone (N = 845)	
		Not Selected (N = 1,205)	Selected[b] (N = 1,338)	Unreachable[c] (N = 1,084)	Reachable (N = 845)	Refusals (N = 299)	Participants[d] (N = 546)
Gender							
Male	2,543 (81.1)	1,205	1,338	763 (57.0)	575 (43.0)	205 (35.7)	370 (64.4)
Female	591 (18.9)	0	591	321 (54.3)	270 (45.7)	94 (34.8)	176 (65.2)
Agency			***		***		
PC	1,839 (58.7)	1,022 (69.1)	457 (30.9)	440 (53.9)	377 (46.1)	145 (38.5)	232 (61.5)
SMH	942 (30.0)	159 (21.5)	581 (78.5)	484 (61.8)	299 (38.2)	99 (33.1)	200 (66.9)
Dual	353 (11.3)	24 (7.4)	300 (92.6)	160 (48.6)	169 (51.4)	55 (32.5)	114 (67.5)
Race/ethnicity			***		**		***
African American	741 (23.6)	233 (42.0)	322 (58.0)	322 (63.4)	186 (36.6)	64 (34.4)	122 (65.6)
Hispanic	1512 (48.2)	602 (47.0)	680 (53.0)	497 (54.6)	413 (45.4)	123 (29.8)	290 (70.2)
Other	222 (7.1)	88 (46.8)	100 (53.2)	67 (50.0)	67 (50.0)	24 (35.8)	43 (64.2)
White	695 (21)	282 (54.4)	236 (54.6)	198 (52.5)	179 (47.5)	88 (49.2)	91 (50.8)
Primary language					***		***
English	2,311 (73.7)	860 (47.1)	966 (52.9)	854 (58.9)	597 (41.1)	233 (39.0)	364 (61.0)
Spanish	823 (26.3)	345 (48.1)	373 (51.9)	230 (48.1)	248 (51.9)	66 (26.6)	182 (73.4)
Type of ADHD care when selected			***				
Visit only	1,352 (43.1)	406 (44.1)	604 (55.9)	506 (57.8)	370 (42.2)	124 (33.5)	246 (66.5)
Stimulant prescription filled only	999 (31.9)	457 (56.3)	355 (43.7)	297 (54.8)	245 (45.2)	86 (35.1)	159 (64.9)
Both	783 (25)	272 (41.8)	379 (58.2)	281 (55.0)	230 (45.0)	89 (38.7)	141 (61.3)
Age (y)			*				
5–8	1,711 (54.6)	623 (45.4)	748 (54.6)	612 (56.3)	476 (43.7)	175 (36.8)	301 (63.2)
9–11	1,423 (45.4)	582 (49.7)	592 (50.3)	472 (56.1)	369 (43.9)	124 (33.6)	245 (66.4)

Note: ADHD = attention-deficit/hyperactivity disorder; Dual = one or more contact for ADHD or stimulant medication filled in both sectors; PC = primary care; SMH = specialty mental health care.

[a]*Agency data for constructing sampling frame: January 2003 to June 2004 in SMH; January 2003 - February 2004 in PC. Eligibility criteria: receiving ADHD care, ages 5-11 years, primary language was Spanish or English, and Los Angeles County residence.*

[b]*All girls (n = 591) and randomly selected boys were included.*

[c]*Most common reason for being unreachable was incorrect contact information.*

[d]*Consent forms signed and home interviews conducted.*

[e]*Enrollment weights are the products of the three adjustment factors defined as follows: (1) sampling weights for the selection of boys, (2) adjustment of nonreachable patients, and (3) adjustment of nonparticipating patients among those located. For each weight stage, a propensity weighting method was used, with predictors listed above and with analysis stratified by agency.*

*p < .05, **p < .01, ***p < .001.

TABLE S2 Data Summary: Interview/School Record Data

Domain	Data Source	Measure	Psychometric Properties	Variable
Demographic				
	C0	Survey		Age, gender, race/ethnicity, child born in US
	P0	Survey		Caregiver's age, gender, race/ethnicity, education, marital status, foster parent status, born in US, parents born in US, nonbiologic parent
Clinical characteristic				
ADHD and comorbid externalizing disorders	P0 P1 P2	NIMH DISC-4.0 Module E	A structured diagnostic interview with moderate to high test-retest reliability for ADHD (r = 0.79), ODD (r = 0.54), and CD (0.43) in English[1] and for ADHD, fair to moderate reliability in Spanish[2]	Past year diagnoses of ADHD, ODD, CD
Probable depression	C0 C1 C2	CDI	A 27-item self-report measure depressive symptoms in the past 2 weeks using a 0–2 severity rating, with high reliability (r = 0.71–0.89) and well-established validity[3]	Total score ≥19 (90th percenttile)
Probable anxiety	C0 C1 C2	RCMAS	A 37-item true/false self-report measure of anxiety with high reliability (coefficient α = 0.82) and validity[4]	Total score ≥63 (90th percenttile)
Functional impairment	P0 P1 P2	CIS	A 13-item parent-report measure using a 0–4 rating scale (0 = not a problem, 4 = very bad problem) with high internal consistency (Cronbach's α = 0.85) and test–retest reliability (r = 0.89) in an ethnically and economically diverse child sample[5]	Total score ≥15
Academic				
Achievement	School record	English and Math grades recorded during semester before the corresponding parent interview	Not established. Grades were standardized using a 0–100 scale, with 50 corresponding to a letter grade of C (i.e., average).	Total score >50 (i.e., above average)
Suspension/expulsion	P0	NIMH DISC-4.0 (Module E, CD items 36, 37)		Any suspension/lifetime Any expulsion/lifetime
Parental perceptions				
Distress	P0 P1 P2	MHI-5	A well-established screening instrument of poor mental health in large, general, and depressed adult samples[6]; total score <56 corresponds to poor mental health[7]	MHI-5 <56

TABLE S2 Continued

Domain	Data Source	Measure	Psychometric Properties	Variable
Treatment satisfaction, perceived benefit	P0 P1 P2	CASA	Treatment satisfaction and perceived benefit were rated on 1–5 scale (1 = very satisfied or tremendous benefit, 5 = very dissatisfied or made things worse). A standardized measure of child mental health service use, care processes, and outcomes with good to excellent reliability[8-10]	Satisfied = very satisfied or satisfied Perceived benefit = tremendous or some benefit
Family relationships improved	P0 P1 P2	CASA	Improvement in family functioning was rated as yes, no, never a problem. Indicators of improved family relationships were less fighting, more positive interactions, or feeling better about each other.	Improved=yes

Note: ADHD = attention deficit/hyperactivity disorder; CASA = Child and Adolescent Services Assessment; CD = conduct disorder; CDI = Children's Depression Inventory; CIS = Columbia Impairment Scale; C0 = child first home interview; C1 = child 6-month telephone survey; C2 = child 12-month telephone survey; MHI-5 = Mental Health Inventory; NIMH DISC-4.0 = National Institute of Mental Health Diagnostic Interview Schedule for Children–4th version; ODD = oppositional defiant disorder; PC = primary care; P0 = parent/caregiver first home interview; P1 = parent/caregiver 6-month telephone survey; P2 = parent/caregiver 12-month telephone survey; RCMAS = Revised Children's Manifest Anxiety Scale; SMH = specialty mental health.

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TABLE S3 Data Summary: Medicaid Claims Data

Domain	Time Period[a]	Data Source	Variable
Care Process			
Care sector contact for mental health services	T1 T2 T3	Medicaid service encounter, pharmacy claims data	PC or SMH only = ≥1visit for any mental or nervous disorder or ≥1 prescription filled for any psychotropic medication; Dual contact = ≥1 contact in both care sectors if child met either visit or medication prescription criteria in PC or SMH care
Mental health service use	T1 T2 T3	Medicaid service encounter data	For PC: ≥1 visit for any mental health problem (ICD-9 diagnoses for mental disorders 290–319 or V codes related to child mental health problem); For SMH: ≥1 visit
No care	T1 T2 T3	Medicaid service encounter, pharmacy claims data	If continuously enrolled + no mental health service use or any psychotropic medication prescription filled
Unmet need for mental health services	T1 T2 T3	Parent, Medicaid service encounter, pharmacy claims data	NIMH DISC-4.0; CIS; ADHD diagnosis/year + impairment + no mental health service use
Psychosocial treatment[b]	T1 T2 T3	Medicaid service encounter data	For SMH: any psychosocial = ≥1 visit for individual, group, or family therapy, therapeutic behavioral services, day treatment, crisis intervention, psychological testing; any supportive = ≥1 visit for case management or activity or collateral information
Psychotropic medication prescription	T1 T2 T3	Medicaid pharmacy claims data	≥1 Psychotropic medication prescription filled for atomoxetine or any stimulant, α-agonist, typical or atypical antipsychotic, mood stabilizer, antidepressant, or anti-anxiety agent
Mental health service use intensity		Medicaid service encounter data	Mean number of mental health visits/month
Stimulant medication refill persistence		Medicaid pharmacy claims data	Total number of days any stimulant supplied/number of days during the study time period. Acceptable medication availability ≥67%, corresponding to taking medication ≥ 5 days/week[1]

Note: ADHD = attention-deficit/hyperactivity disorder; CIS = Columbia Impairment Scale; ICD = International Statistical Classification of Diseases and Related Health Problems; NIMH DISC-4.0 = National Institute of Mental Health Diagnostic Interview Schedule for Children–4th version; PC = primary care; SMH = specialty mental health.

[a]T1 = 6 months before baseline; T2 = baseline to 6 months; T3 = 6–12 months.

[b]Type of psychosocial treatment delivered in PC could not be determined because not specified in Medicaid service encounter data. The majority of procedures reported were outpatient visit or use of an examination room.

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TABLE S4 Baseline Characteristics by Follow-up Response Status and Weighting Procedures for Attrition Weights[a]

	6-Month Telephone Survey			12-Month Telephone Survey		
	Nonrespondents (N = 173) n (%)	Respondents (N = 373) n (%)	*p*	Nonrespondents (N = 203) n (%)	Respondents (N = 343) n (%)	*p*
Child						
Male	127 (73.4)	243 (65.1)	.05	142 (70.0)	228 (66.5)	.40
Race/Ethnicity			.37			.76
African American	40 (23.1)	85 (22.8)		50 (24.6)	75 (21.9)	
Nonwhite Hispanic	98 (56.6)	195 (52.3)		110 (54.2)	183 (53.4)	
White	23 (13.3)	49 (13.1)		24 (11.8)	48 (14.0)	
Biracial, multiracial, or other	12 (6.9)	44 (11.8)		19 (9.4)	37 (10.8)	
Care sector contact at sampling			.28			.35
PC	65 (37.6)	167 (44.8)		83 (40.9)	149 (43.4)	
SMH	68 (39.3)	132 (35.4)		71 (35.0)	129 (37.6)	
Dual	40 (23.1)	74 (19.8)		49 (24.1)	65 (19.0)	
Parent/caregiver						
Education			.48			.31
<12 years	72 (41.6)	146 (39.4)		76 (37.4)	142 (41.6)	
High school graduate	61 (35.3)	121 (32.6)		76 (37.4)	106 (31.1)	
≥13 Years	40 (23.1)	104 (28.0)		51 (25.1)	93 (27.3)	
Marital status			.26			.40
Married	73 (42.2)	143 (38.3)		75 (36.9)	141 (41.1)	
Widowed/separated/divorced	48 (27.7)	91 (24.4)		58 (28.6)	81 (23.6)	
Never married	52 (30.1)	139 (37.3)		70 (34.5)	121 (35.3)	
Primary language English	113 (65.3)	251 (67.3)	.65	137 (67.5)	227 (66.2)	.75
Caregiver born in US	91 (52.6)	205 (55.0)	.61	106 (52.2)	190 (55.4)	.47
Nonbiologic parent	18 (10.4)	43 (11.5)	.70	24 (11.8)	37 (10.8)	.71
Foster parent	9 (5.2)	12 (3.2)	.26	11 (5.4)	10 (2.9)	.14
High psychological distress (MHI-5 <56)	48 (27.7)	93 (24.9)	.48	57 (28.1)	84 (24.5)	.35
Child clinical variable						
ADHD/past year						
Inattentive type	34 (19.8)	63 (17.0)	.43	35 (17.3)	62 (18.2)	.80
Hyperactive/impulsive type	19 (11.0)	31 (8.4)	.32	21 (10.4)	29 (8.5)	.45
Combined type	79 (45.7)	185 (49.7)	.38	96 (47.3)	168 (49.1)	.68
Any type	132 (76.7)	279 (75.6)	.77	152 (75.6)	259 (76.2)	.88
ODD	80 (46.5)	192 (51.5)	.28	97 (47.8)	175 (51.2)	.44
CD	19 (11.0)	41 (11.0)	.99	24 (11.8)	36 (10.6)	.65
ODD or CD	81 (47.1)	195 (52.3)	.26	98 (48.3)	178 (52.0)	.39
Depression (CDI ≥19)	25 (14.5)	54 (14.9)	.91	33 (16.7)	46 (13.7)	.35
High anxiety (RCMAS ≥63)	20 (11.6)	48 (13.2)	.61	30 (15.1)	38 (11.3)	.20
Depression or high anxiety	41 (23.8)	87 (24.1)	.95	55 (27.8)	73 (21.8)	.12
Any common disorder	143 (82.7)	303 (81.2)	.69	166 (81.8)	280 (81.6)	.97
Impairment (CIS ≥15)	65 (37.6)	178 (47.8)	.02	81 (39.9)	162 (47.4)	.09
Ever suspended	69 (40.1)	138 (37.3)	.53	79 (39.1)	128 (37.6)	.73

TABLE S4 Continued

	6-Month Telephone Survey			12-Month Telephone Survey		
	Nonrespondents (N = 173) n (%)	Respondents (N = 373) n (%)	*p*	Nonrespondents (N = 203) n (%)	Respondents (N = 343) n (%)	*p*
Ever expelled	13 (7.6)	29 (7.8)	.93	13 (6.4)	29 (8.5)	.39
Any suspension or expulsion	70 (40.7)	144 (38.9)	.69	82 (40.6)	132 (38.8)	.68

Note: CD = conduct disorder; CIS = Columbia Impairment Scale; Dual = one or more contact for attention-deficit/hyperactivity disorder (ADHD) or stimulant medication filled in both sectors; MHI = Mental Health Inventory; PC = primary care; RCMAS = Revised Children's Manifest Anxiety Scale; SMH = specialty mental health care.

[a]*To control for potential nonresponse bias, attrition weights were constructed by fitting logistic regression models to predict follow-up status from baseline predictors. These models were fitted separately for the three care sectors at sampling. The fitted logistic regression models were used to derive the predicted probability for each individual respondent to remain in the follow-up. The reciprocal of the predicted probability was then used as the attrition weight for each participant. For 6-month data, predictors were child age, most time that child has one adult caregiver available, oppositional defiant disorder (ODD), impairment, type of ADHD care when selected (visit only, stimulant prescription filled, both), parent age, marital status, had barriers defined as number of barriers ≥2, and ADHD Knowledge and Opinions Survey-Revised (AKOS) Score (mean o1–o15). For 12-month data, predictors were child age, race/ethnicity, Children's Depression Inventory (CDI) score, impairment, type of ADHD care when selected (visit only, stimulant prescription filled, both), parent marital status, ADHD total criteria count, past year.*

TABLE S5 Baseline Sample Characteristics by Care Sector Contact at Sampling (January 2003 to June 2004)

	Analytic N	Overall (N = 546) *n* (%)	PC Only (N = 232) *n* (%)	SMH Only (N = 200) *n* (%)	Dual (N = 114) *n* (%)	Test Across Sector†		
						χ^2	*df*	*p*
Child								
Male	546	370 (67.8)	119 (51.3)	153 (76.5)	98 (86.0)[a,b]	53.1	2	<.01
Race/ethnicity						3.3	6	.77
African American	546	125 (22.9)	49 (21.1)	52 (26.0)	24 (21.1)			
Nonwhite Hispanic	546	293 (53.7)	123 (53.0)	108 (54.0)	62 (54.4)			
White	546	72 (13.2)	35 (15.1)	21 (10.5)	16 (14.0)			
Biracial, multiracial, or other	546	56 (10.3)	25 (10.8)	19 (9.5)	12 (10.5)			
Among nonwhite Hispanics, first US-born generation (N = 277)[d]	277	208 (75.1)	91 (76.5)	72 (72.7)	45 (76.3)	0.5	2	.79
Parent/caregiver								
Education						2.3	4	.68
<12 Years	544	218 (40.1)	95 (40.9)	80 (40.4)	43 (37.7)			
High school graduate	544	182 (33.5)	77 (33.2)	61 (30.8)	44 (38.6)			
≥13 Years	544	144 (26.5)	60 (25.9)	57 (28.8)	27 (23.7)			
Marital status						2.9	4	.57
Married	546	216 (39.6)	95 (40.9)	78 (39.0)	43 (37.7)			
Widowed/separated/divorced	546	139 (25.5)	60 (25.9)	45 (22.5)	34 (29.8)			
Never married	546	191 (35.0)	77 (33.2)	77 (38.5)	37 (32.5)			
Nonbiologic parent	546	61 (11.2)	17 (7.3)	32 (16.0)	12 (10.5)[a]	8.2	2	.02
Foster parent	546	21 (3.8)	4 (1.7)	13 (6.5)	4 (3.5)[a]	6.7	2	.04
High psychological distress (MHI-5 <56)	546	141 (25.8)	53 (22.8)	54 (27.0)	34 (29.8)	2.2	2	.34
Clinical								
Diagnosis								
ADHD/past year								
Inattentive type	543	97 (17.9)	47 (20.4)	34 (17.1)	16 (14.0)	2.3	2	.32
Hyperactive/impulsive type	544	50 (9.2)	19 (8.3)	21 (10.5)	10 (8.8)	0.7	2	.71
Combined type	545	264 (48.4)	107 (46.3)	97 (48.5)	60 (52.6)	1.2	2	.54
Any type	541	411 (76.0)	173 (75.9)	152 (76.4)	86 (75.4)	0.0	2	.98
ODD	545	272 (49.9)	108 (46.6)	103 (51.8)	61 (53.5)	1.9	2	.38
CD	544	60 (11.0)	22 (9.5)	19 (9.5)	19 (16.8)	4.9	2	.09
ODD or CD	545	276 (50.6)	109 (47.0)	105 (52.8)	62 (54.4)	2.2	2	.33
Depression (CDI ≥19)	534	79 (14.8)	32 (14.0)	26 (13.4)	21 (18.9)	1.9	2	.38
High anxiety (RCMAS ≥63)	536	68 (12.7)	29 (12.7)	20 (10.3)	19 (17.0)	2.9	2	.24
Depression or high anxiety	533	128 (24.0)	51 (22.3)	43 (22.3)	34 (30.6)	3.4	2	.19
Any common disorder	546	446 (81.7)	186 (80.2)	165 (82.5)	95 (83.3)	0.7	2	.72
ADHD comorbidity								
None (ADHD only)	411	125 (30.4)	57 (32.9)	47 (30.9)	21 (24.4)	2.0	2	.37
ADHD + ODD						2.9	2	.24
ADHD + CD	409	57 (13.9)	21 (12.1)	18 (11.9)	18 (21.2)	4.7	2	.10
ADHD + (ODD or CD)	410	258 (62.9)	100 (57.8)	100 (66.2)	58 (67.4)	3.4	2	.18
ADHD + (depression or high anxiety)	401	106 (26.4)	46 (26.7)	33 (22.6)	27 (32.5)	2.7	2	.26
Functioning								
Impairment (CIS ≥15)	545	243 (44.6)	97 (41.8)	82 (41.2)	64 (56.1)[b,c]	7.8	2	.02
ADHD/past year + impairment								
Inattentive type	542	30 (5.5)	14 (6.1)	11 (5.6)	5 (4.4)	0.4	2	.81
Hyperactive/impulsive type	543	19 (3.5)	7 (3.0)	6 (3.0)	6 (5.3)	1.3	2	.51
Combined type	544	171 (31.4)	68 (29.4)	57 (28.6)	46 (40.4)	5.4	2	.07
Any type	540	220 (40.7)	89 (39.0)	74 (37.4)	57 (50.0)	5.3	2	.07

TABLE S5 Continued

	Analytic N	Overall (N = 546) *n* (%)	PC Only (N = 232) *n* (%)	SMH Only (N = 200) *n* (%)	Dual (N = 114) *n* (%)	Test Across Sector†		
						χ^2	*df*	*p*
ODD + impairment	544	189 (34.7)	75 (32.3)	65 (32.8)	49 (43.0)	4.3	2	.11
CD + impairment	543	52 (9.6)	22 (9.5)	15 (7.6)	15 (13.3)	2.7	2	.26
(ODD or CD) + impairment	544	191 (35.1)	76 (32.8)	66 (33.3)	49 (43.0)	3.9	2	.14
Depression + impairment	533	56 (10.5)	21 (9.2)	19 (9.8)	16 (14.4)	2.3	2	.31
Anxiety + impairment	535	44 (8.2)	19 (8.3)	10 (5.2)	15 (13.4)[c]	6.4	2	.04
Depression/or high anxiety + impairment	532	85 (16.0)	33 (14.4)	27 (14.1)	25 (22.5)	4.5	2	.11
ADHD comorbidity[e]								
None (ADHD only) + impairment	411	26 (6.3)	14 (8.1)	6 (3.9)	6 (7.0)	2.4	2	.30
ADHD + (ODD or CD) + impairment	410	183 (44.6)	71 (41.0)	65 (43.0)	47 (54.7)	4.6	2	.10
ADHD + depression/or anxiety + impairment	401	77 (19.2)	30 (17.4)	25 (17.1)	22 (26.5)	3.6	2	.16
Any common disorder + impairment	545	234 (42.9)	96 (41.4)	77 (38.7)	61 (53.5)[c]	6.9	2	.03
Academic								
English C equivalent grade or better	308	153 (49.7)	77 (54.6)	46 (46.0)	30 (44.8)	2.6	2	.28
Math C equivalent grade or better	314	128 (40.8)	64 (44.4)	35 (34.3)	29 (42.6)	2.7	2	.26
Ever suspended	542	207 (38.2)	72 (31.3)	79 (39.9)	56 (49.1)[b]	10.6	2	.00
Ever expelled	545	42 (7.7)	14 (6.1)	17 (8.5)	11 (9.6)	1.7	2	.44
Any suspension or expulsion	542	214 (39.5)	76 (33.0)	81 (40.9)	57 (50.0)[b]	9.4	2	.01

Note: ADHD = attention-deficit/hyperactivity disorder; CD = conduct disorder; CDI = Children's Depression Inventory; CIS = Columbia Impairment Scale; Dual = one or more contact for ADHD or stimulant medication filled in both sectors; MHI-5 = Mental Health Inventory (short form); ODD = oppositional defiant disorder; PC = primary care; RCMAS = Revised Child Manifest Anxiety Scale; SMH = specialty mental health care.

†Comparing difference across care sector categories. Superscript letters indicate pairwise comparisons with significant level at .05 using Bonferroni correction (i.e., p < .017): [a]PC vs SMH, [b]PC vs Dual, [c]SMH vs Dual.

[d]Among 293 Latino, 16 did not answer this question; hence the analytic sample size is 277.

[e]Data are limited to children who had any type of ADHD based on first parent interview.

TABLE S6 Care Sector Contact for Mental Health Services at Three Time Intervals by Care Sector at Sampling

	Overall (N = 530) *N* (%)	PC Only (N = 228) *N* (%)	SMH Only (N = 192) *N* (%)	Dual (N = 110) *N* (%)	Test Across Sector[a]		
					χ^2	df	*p*
6 Months before baseline interview					401.7	6	<.001
No care	167 (31.5)	95 (41.7)	57 (29.7)	15 (13.6)			
PC	139 (26.2)	133 (58.3)	0 (0.0)	6 (5.5)			
SMH	206 (38.9)	0 (0.0)	135 (70.3)	71 (64.5)			
Both	18 (3.4)	0 (0.0)	0 (0.0)	18 (16.4)			
Any contact from PC or SMH or both (vs. no care)	363 (68.5)	133 (58.3)	135 (70.3)	95 (86.4)	27.5	2	<.001
Baseline to 6-month follow-up					370.0	6	<.001
No care	190 (35.8)	109 (47.8)	67 (34.9)	14 (12.7)			
PC	127 (24.0)	119 (52.2)	0 (0.0)	8 (7.3)			
SMH	197 (37.2)	0 (0.0)	125 (65.1)	72 (65.5)			
Both	16 (3.0)	0 (0.0)	0 (0.0)	16 (14.5)			
Any contact from PC or SMH or both (vs. no care)	340 (64.2)	119 (52.2)	125 (65.1)	96 (87.3)	39.8	2	<.001
6 - to 12-Month follow-up					304.0	6	<.001
No care	219 (41.3)	114 (50.0)	78 (40.6)	27 (24.5)			
PC	124 (23.4)	114 (50.0)	0 (0.0)	10 (9.1)			
SMH	178 (33.6)	0 (0.0)	114 (59.4)	64 (58.2)			
Both	9 (1.7)	0 (0.0)	0 (0.0)	9 (8.2)			
Any contact from PC or SMH or both (vs. no care)	311 (58.7)	114 (50.0)	114 (59.4)	83 (75.5)	19.9	2	<.001
6 Months before baseline to 12-month follow-up							
Any contact from PC or SMH or both (vs. no care)	358 (67.5)	134 (58.8)	128 (66.7)	96 (87.3)	27.6	2	<.001

Note: Dual = one or more contact for attention-deficit/hyperactivity disorder or stimulant medication filled in both sectors; PC = primary care, SMH = specialty mental health care.

[a]*Comparing difference across care-sector categories.*

TABLE S7 Treatment Types, Stimulant Medication Refill Persistence, and Service Use Intensity Among Children Receiving Care From Only Primary Care (PC) or Specialty Mental Health (SMH), Restricted to Children with Attention-Deficit/Hyperactivity Disorder (ADHD) and Comorbid Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD)

	6 Months Before Baseline		Baseline to 6 Months		6–12 Months	
	PC (N = 66)	SMH (N = 109)	PC (N = 60)	SMH (N = 106)	PC (N = 64)	SMH (N = 100)
Any psychosocial						
Any mental health visit	19 (28.8)	109 (100)	19 (31.7)	106 (100)	16 (25)	100 (100)
Any medication						
Any psychotropic medication	63 (95.5)	52 (47.7)***	58 (96.7)	51 (48.1)***	61 (95.3)	38 (38)***
Only psychotropic medication	47 (71.2)	0 (0)	41 (68.3)	0 (0)	48 (75)	0 (0)
Any stimulant medication	54 (81.8)	37 (33.9)***	47 (78.3)	35 (33)***	48 (75)	30 (30)***
Only stimulant medication	36 (54.5)	22 (20.2)***	31 (51.7)	19 (17.9)***	32 (50)	16 (16)
Stimulant medication + other psychotropic medication	18 (27.3)	15 (13.8)*	16 (26.7)	16 (15.1)*	16 (25)	14 (14)*
Only other psychotropic medication	9 (13.6)	15 (13.8)	11 (18.3)	16 (15.1)	13 (20.3)	8 (8)
Stimulant medication refill persistence[a]	16 (29.6)	12 (32.4)	19 (40.4)	14 (40)	20 (41.7)	15 (50)
Combined						
Mental health visit + psychotropic medication	16 (24.2)	52 (47.7)*	17 (28.3)	51 (48.1)*	13 (20.3)	38 (38)**
Service use intensity						
Average no. of visits per month, mean (SD)	0.1 (0.2)	5.2 (4.9)***	0.1 (0.3)	5.9 (5.9)***	0.1 (0.5)	5 (5.1)***

Note: Data are presented as n (%) unless otherwise indicated. Data are limited to those for children who had service contact from PC or SMH. Unweighted frequencies are reported, but percentages are weighted by sampling weights. The χ^2 test was used for comparisons of PC vs. SMH (see p values below).

[a]*Stimulant medication available for more than 67% of total day supply. Sample sizes for at three time intervals are 54, 47, and 48 for PC and 37, 35, and 30 for SMH.*

*$p < .05$, **$p < .01$, ***$p < .001$.

TABLE S8 Psychotherapy Visits and Supportive Care Contacts Among Children Receiving Care From Only Specialty Mental Health (SMH)

	6 Months Before Baseline (N = 206)	Baseline to 6 Months (N = 197)	6–12 Months (N = 178)
Treatment type			
Psychosocial			
Any supportive care	191 (92.7)	183 (92.9)	162 (91.0)
Supportive care only + no medication	108 (52.4)	102 (51.8)	102 (57.3)
Any psychotherapy visit	157 (76.2)	158 (80.2)	148 (83.1)
Psychotherapy visit only + no medication	91 (44.2)	92 (46.7)	96 (53.9)
Combined			
Psychotherapy + psychotropic Medication	66 (32.0)	66 (33.5)	52 (29.2)
Supportive care + psychotropic medication	83 (40.3)	81 (41.1)	60 (33.7)
Service use intensity			
Supportive care			
Average no. of services per month, mean (SD)	2.3 ± 2.8	2.2 ± 2.3	1.8 ± 2.3
Psychotherapy visit			
Average no. of visits per month, mean (SD)	2.3 ± 3.6	2.6 ± 4.6	2.5 ± 4.0

Note: Data are presented as n (%) for categorical variables and as mean ± SD for continuously scaled variables.