

Psychotropic Polypharmacy Among Youths With Serious Emotional and Behavioral Disorders Receiving Coordinated Care Services

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Objective: The study examined differences in psychotropic polypharmacy among youths with serious emotional and behavioral disorders who received coordinated care services (CCS) that used a wraparound model and a matched sample of youths who received traditional services.

Methods: A quasi-experimental design compared psychotropic polypharmacy one year before and one year after discharge from CCS. The cohort was youths with serious emotional and behavioral disorders who were enrolled in CCS from December 2009 through May 2014. The comparison group was youths with serious emotional and behavioral disorders who received outpatient mental health services during the same time. Administrative data from Medicaid, child welfare, and juvenile justice services were used. A difference-in-difference analysis with propensity score matching evaluated the CCS intervention by time effect on psychotropic polypharmacy.

Results: In both groups, most youths were male, black, and 10–18 years old, with attention-deficit hyperactivity disorder (54%–55%), mood disorder (39%–42%), depression (26%–27%), and bipolar disorder (25%–26%). About half of each group was taking an antipsychotic. The percentage reduction in polypharmacy from one year before CCS enrollment to one year after discharge was 28% for the CCS group and 29% for the non-CCS group, a nonsignificant difference. CCS youths excluded from the analysis had more complex mental health needs and a greater change in polypharmacy than the CCS youths who were included in the analytic sample.

Conclusions: Mental health care coordination had limited impact in reducing psychotropic polypharmacy for youths with less complex mental health needs. Further research is needed to evaluate the effect on psychotropic polypharmacy among youths with the greatest mental health needs.

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Psychotropic use among youths has been highly scrutinized because of recent sharp increases in prescribing, both singly and in combination (1,2), and concerns regarding safety of concomitant use of more than one therapeutic class (polypharmacy), including convincing evidence of harmful cardiometabolic effects with antipsychotic medications (3–7). These concerns have been further heightened by research showing that psychotropic polypharmacy is initiated at very young ages (8–10) and that compared with youths treated with a single psychotropic medication, youths who receive psychotropic polypharmacy that includes an antipsychotic medication are more likely to be exposed for longer periods of time (11). Despite evidence of the importance of combining psychosocial interventions with psychotropic medication to optimize positive effects (12–14), research suggests that rates of such multimodal treatment are low (15,16).

Psychotropic polypharmacy is highest among Medicaid-enrolled youths (15,17,18) and those who experience serious emotional and behavioral disorders (19). These disorders are

defined as one or more diagnosable emotional or behavioral disorders with impairment that interferes with functioning in home, school, or community (20). Medicaid-enrolled youths with serious emotional and behavioral disorders typically have multiple needs across life domains (emotional, behavioral, and educational), and their primary caregivers often experience multiple stressors borne of poverty, resulting in a need for multiple services and supports that are often unavailable or uncoordinated (21,22). When access to other mental health services is limited, this can contribute to psychotropic polypharmacy.

System-level interventions that address financial and service barriers and enhance multisystem coordination and multimodal therapies have been found to reduce reliance on out-of-home placement of youths with serious emotional and behavioral disorders (23,24). The most common community-based care coordination model for youths with these disorders is the team-based wraparound model (25–28). Wraparound is an intensive, family-driven care

coordination process, facilitated by a care manager who individualizes treatment to the needs of the youth and family and coordinates multisystem services (21).

The effectiveness of wraparound is documented across multiple outcome domains, including reduced out-of-home placement, fewer criminal reoffenses (29), improved clinical outcomes (24,30,31), improved academic performance (32), and reduced overall health care expenditures (33). To date, very little is known about the impact of integrated mental health services on psychotropic prescribing for youths. The active ingredients of wraparound and care coordination initiatives, such as engaging caregivers and youths in plans of care that match community-based services to clinical and other needs, incorporating medication and medication management into the care process, and integrating progress monitoring and plan adjustment, could facilitate provision of more effective community-based psychosocial services and decrease the need for psychotropic polypharmacy.

Our objective was to evaluate the association between receipt of coordinated care services (CCS) and psychotropic polypharmacy among youths with serious emotional and behavioral disorders. The specific aims were to measure psychotropic use overall and polypharmacy before entry, during, and after discharge from CCS relative to a comparison group during a comparable index period; and to examine changes in polypharmacy from one year before entry to one year after discharge from CCS. We hypothesized that CCS that uses a wraparound practice model providing a comprehensive, individualized care management plan that incorporates nonpharmacologic interventions would reduce the use of psychotropic polypharmacy, compared with traditional outpatient mental health services.

METHODS

Study Design

In a quasi-experimental design, we compared psychotropic polypharmacy between youths with serious emotional and behavioral disorders who were enrolled in CCS and youths with serious emotional and behavioral disorders who received traditional mental health services (non-CCS) from December 2009 through May 2014. We identified three distinct observation periods: 12 months before CCS enrollment (pre-CCS), 12 months after CCS enrollment (during CCS), and 12 months after CCS discharge (post-CCS).

CCS for youths with serious emotional and behavioral disorders was available in Maryland from 2009 to 2015 via a statewide care management entity (34). Youths referred to CCS were required to be age 16 or younger at enrollment; in a home- and community-based setting that was not a therapeutic group home, a psychiatric respite care facility for the purpose of placement in a psychiatric institution, or a residential program for individuals with serious mental illness; and not enrolled in a medical home. The family or medical guardian was required to provide consent. A provider not associated with the CCS program was required to determine

that the youth had a *DSM IV* diagnosis and was amenable to active clinical treatment. Needs-based eligibility was determined every 12 months or more frequently if needed.

The University of Maryland Baltimore School of Social Work Institute for Innovation and Implementation served as a training and technical assistance provider. Partnering with the National Wraparound Implementation Center, the institute offered a Wraparound Practitioner Certificate Program (see www.nwic.org for more details). Coaching across child and family team meetings and team or community engagement meetings focused on building core skills to support high-quality practice. Care coordinators worked with the family and youth to facilitate care, organize the team, and follow up on action steps.

The study was approved by the University of Maryland Baltimore Institutional Review Board and the research oversight committees of the Centers for Medicare and Medicaid Services, the Maryland Behavioral Health Administration, the Maryland Department of Human Services, and the Maryland Juvenile Services Divisions.

Study Cohorts

CCS cohort. The study sample was selected from all youths served in the CCS from December 2009 through May 2014 who had continuous Medicaid eligibility one year before and one year after enrollment in CCS and who were enrolled for 90 days or more in CCS. [A figure illustrating the sample selection process is included in an online supplement to this article.] Medicaid enrollment was considered continuous if there had been no lapse in coverage lasting longer than 30 days. Although length of wraparound enrollment is typically six to 18 months, we required at least a 90-day exposure to the intervention in order to observe potential effects of CCS. In an individualized need-based service, there is no defined measure of “adequate exposure” to observe an effect. The 90-day window allowed for at least three monthly visits with the CCS team to assess treatment effectiveness. Furthermore, management with psychotropic medications often requires eight to 12 weeks to observe an effect, with the exception of stimulants. Of the 1,215 youths served in CCS during the study period, 814 (67%) met all eligibility criteria.

Non-CCS cohort. To ensure a comparison group with significant mental health impairment, we oversampled from youths who received traditional outpatient mental health services for the management of a severe mental illness (schizophrenia, bipolar disorder, or major depressive disorder) and who were in foster care or disabled. The comparison group included 3,962 youths. Because the comparison cohort did not have enrollment and discharge dates, we considered five methods for index date assignment. Simple grouping of treated versus not treated can overestimate the treatment effect. A specified prescription time (for example, receipt of medication within a 90-day window) is less efficient or precise because of data excluded in the time window used to define the group. Random

TABLE 1. Characteristics one year before the index date of youths with serious emotional and behavioral disorders who received coordinated care services (CCS) and a comparison group (non-CCS)

Characteristic	CCS (N=496)		Non-CCS (N=993)		Standardized mean difference	p
	N	%	N	%		
Gender					.090	.103
Male	312	63	581	59		
Female	184	37	412	41		
Race					.061	.543
White	147	30	273	27		
Black	316	64	661	67		
Other	33	6	59	6		
Age					.171	.030
3–9	58	12	115	12		
10–14	187	38	398	40		
15–18	236	47	419	42		
19–21	15	3	61	6		
Mental health services						
Any residential treatment	52	10	83	8	.073	.178
Any psychiatric hospitalization	132	27	260	26	.010	.859
Any psychiatric emergency visits	180	36	355	36	.011	.838
Psychiatric diagnosis						
ADHD	271	55	535	54	.015	.782
Anxiety disorder	64	13	123	12	.015	.777
Bipolar disorder	128	26	247	25	.022	.696
Conduct disorder	82	17	165	17	.002	.967
Depression	132	27	260	26	.010	.859
Mood disorder	195	39	418	42	.057	.304
Oppositional disorder	83	17	173	17	.018	.740
Substance use disorder	53	11	123	12	.053	.338
Schizophrenia	48	10	98	10	.006	.907
Psychotropic medication						
ADHD medication ^a	238	48	484	49	.015	.783
Antidepressant	184	37	383	39	.030	.581
Antipsychotic	265	53	534	54	.007	.899
Mood stabilizer	128	26	249	25	.017	.760
Child welfare services						
Out-of-home placement	229	46	473	48	.029	.594
Nonfamily out-of-home placement	145	29	289	29	.003	.959
Juvenile justice services						
Any involvement	216	44	400	40	.066	.228
Felony	89	18	163	16	.041	.458

^a Stimulants, alpha-agonists, and atomoxetine

assignment may bias the effect toward the null but provides a uniform distribution of a time window (35). Identifying youths with similar cost peaks and assigning the non-CCS index date on the basis of a CCS youth with the same date of cost peak precluded use of psychotropic polypharmacy as an outcome because psychotropic medications are primary drivers of mental health expenditures. Matching on the start date for the longest period of continuous Medicaid enrollment introduced temporal bias, because the longest period of Medicaid enrollment could have been more than a year before CCS enrollment and therefore would not represent mental health needs at enrollment.

Because none of these approaches is perfect, we chose the strongest available approach and assigned index dates

randomly from the CCS cohort to permit a comparable evaluation of polypharmacy in three observation periods (pre-CCS, during CCS, and post-CCS), accounting for active Medicaid enrollment without introducing time period bias and preserving efficiency and precision. After assigning index dates, we applied the aforementioned eligibility criteria to the non-CCS cohort. Of the 3,962 non-CCS youths, 2,439 (62%) youths met all eligibility criteria. The CCS and non-CCS youths who satisfied the study inclusion criteria did not differ from those who did not meet the study inclusion criteria on demographic characteristics, diagnoses, psychotropic use, or service settings (data available upon request).

Data Sources

Data included Medicaid (services, pharmacy, and enrollment), CCS entry and exit data, child welfare, and juvenile justice services administrative records. A unique identifier preserved anonymity and permitted data linkages. Medicaid claims data were obtained from two years preenrollment through five years after CCS became available in the state (2009–2014). Data on child welfare and juvenile justice services involvement were obtained for one year preenrollment.

Medicaid administrative claims. General medical and mental health encounter claims associated with a psychiatric diagnosis, psychotherapy visit, or other mental health-related care provided in inpatient and outpatient settings at any point during the study period identified all mental health-related visits. ICD-9 codes 290 through 319 were used to categorize major diagnostic groups: attention-deficit hyperactivity disorder (ADHD), conduct disorder, oppositional defiant disorder, anxiety, depression, posttraumatic stress disorder, mood/bipolar disorder, pervasive developmental disorder, mental retardation, and all other developmental disorders. Procedure codes identified individual (90804–90808, 90816, 90817, 90819, 90821, 90824, and 90827), family (90832–920834, 90836, 90837, 90846–90847, and 90849), and group (90853) psychotherapy; home visit (99323–99325, 99331, 99334–99336, 99343, 99348, and 99349); medical intervention for mental health (00104, 36415, 90782, 90870, and 96372), and neuropsychiatric test (96115–96119).

Medicaid pharmacy claims identified youths who received at least one psychotropic medication during the entire study period. The psychotropic medications included in this analysis were the major therapeutic classes prescribed

for the chronic management of child and adolescent psychiatric disorders. These included ADHD medications (for example, methylphenidate, amphetamine salts, and atomoxetine), antidepressants (for example, selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors, and tricyclic antidepressants), antipsychotics (for example, first- and second-generation agents), and mood stabilizers (for example, lithium, carbamazepine, valproic acid, gabapentin, lamotrigine, and oxcarbazepine).

Child welfare administrative records. The electronic database used by child welfare caseworkers statewide identifies youths who have an out-of-home placement (removed from biological parents or other normative community setting). Binary indicators were created for any involvement in child welfare and an out-of-home placement.

Juvenile justice services records. Automated data for youths referred and processed (that is, detention, delinquency intake, predisposition investigation, probation, correctional, and aftercare services) through the Maryland Department of Juvenile Services were used to identify any criminal offenses. Binary indicators for any juvenile justice service involvement and any felony characterized the youth's experience one year prior to the index date.

Measure of Psychotropic Polypharmacy

Psychotropic class use and polypharmacy were assessed in each 12-month observation period (pre-CCS, during CCS, and post-CCS). To rule out "as needed" use, any single therapeutic class use for more than seven days in a 30-day period defined active treatment. Fifteen or more days of overlap of medications from three or more therapeutic classes defined concomitant use.

Analytic Plan

Demographic and clinical factors and child welfare and juvenile services involvement were characterized in the one-year pre-CCS period. Bivariate chi-square analyses assessed statistically significant differences between CCS and non-CCS youths on baseline characteristics as well as psychotropic class and polypharmacy use for the pre-CCS, during-CCS, and post-CCS periods.

Propensity score matching was used to balance the observed covariates between the CCS and non-CCS cohorts. The propensity score, estimated by using logistic regression, assessed the likelihood of CCS enrollment as a function of the observed covariates in the 12 months preceding CCS enrollment or index date. The variables entered into the model included age, gender, race, Medicaid eligibility category, psychiatric diagnoses, single psychotropic class use, residential treatment center placement, hospitalizations,

TABLE 2. Use of psychotropic medications and polypharmacy among youths with serious emotional and behavioral disorders who received coordinated care services (CCS) and a comparison group (non-CCS), by observation period^a

Psychotropic class	Pre-CCS				During CCS				Post-CCS			
	CCS (N=496)		Non-CCS (N=993)		CCS (N=496)		Non-CCS (N=993)		CCS (N=496)		Non-CCS (N=993)	
	N	%	N	%	N	%	N	%	N	%	N	%
ADHD medication	238	48	484	49	234	47	417	42	181	36	352	35
Antidepressant	184	37	383	39	187	38	366	37	155	31	313	32
Antipsychotic	265	53	534	54	256	52	473	48	191	39	366	37
Mood stabilizer	128	26	249	25	137	28	245	25	118	24	204	21
Polypharmacy ^b	144	29	279	28	153	31	253	25	104	21	198	20

^a No significant differences were noted between groups, with the exception of polypharmacy during CCS ($\chi^2=4.8$, $df=1$, $p<.03$).

^b Defined as three or more psychotropic classes used concomitantly

emergency department visits, out-of-home placement, and juvenile service involvement. Nonoverlapping propensity score distributions were trimmed before matching. Calipers of .2, .05, .02, and .01 produced similar standardized mean differences and covariate balance; therefore, we proceeded with .2 to preserve sample size without sacrificing performance (36,37). After a 1:2 propensity score match was applied, 496 (61%) of the 814 CCS youths and 993 (41%) of 2,439 of the non-CCS youths constituted the final analytic sample. [Tables presenting data on the characteristics of the matched and unmatched CCS and non-CCS cohorts are included in the online supplement].

A difference-in-difference (DID) model assessed psychotropic polypharmacy use one year before entry and one year after discharge from CCS. This was estimated by using a logit model in which the outcome (polypharmacy) was a function of CCS, time, and the DID estimator, which is the interaction of CCS \times time. The DID estimator reflected the difference between CCS and non-CCS polypharmacy use at two time periods (pre-CCS and post-CCS). Because the dependent variable (polypharmacy) was not a rare event ($>10\%$) and a logit model would overestimate the relative risk, a modified Poisson regression model with a log link function was used (38,39). Generalized estimating equation models were used because of the nonindependent measures within individuals. Sensitivity analyses were conducted with more liberal inclusion criteria by allowing CCS exposure windows of 30 and 60 days. Analyses were performed with PROC GENMOD in SAS version 9.4, and significance was assessed at the 5% level.

RESULTS

Sample Characteristics

The characteristics of the 496 CCS and the 993 non-CCS youths were balanced after propensity score matching (Table 1). The most common psychiatric diagnoses across both cohorts were ADHD (54%–55%), mood disorder (39%–42%), depression (26%–27%), and bipolar disorder (25%–26%). Approximately one-half of each cohort received an antipsychotic and a medication for ADHD. The mean \pm SD

TABLE 3. Relative risk of polypharmacy before and after receipt of coordinated care services (CCS) among youths with serious emotional and behavioral disorders

Variable	Relative risk	95% CI	p
CCS (reference: non-CCS)	1.03	.87 to 1.22	.705
Post-CCS period (reference: pre-CCS period)	.71	.63 to .80	<.001
CCS × post-CCS period	.73	−1.57 to 3.04	.873

intervention duration was 378±198 days for CCS youths, which was not significantly different from the mean of 376±200 days for non-CCS youths.

Psychotropic Polypharmacy

Data on psychotropic medication use by the two groups in each observation period are presented in Table 2. No significant differences were noted between the propensity score-matched groups, with the exception of polypharmacy during CCS (31% for CCS youths versus 25% for non-CCS youths, p<.03). The proportion of youths with any psychotropic use was lower in the post-CCS discharge period for all therapeutic classes, including polypharmacy. The percentage decrease from pre-CCS to post-CCS periods was nearly equal for CCS and non-CCS youths: antipsychotics, 26% and 31%, respectively; ADHD medication, 25% and 29%; antidepressants, 16% and 18%; and polypharmacy, 28% and 29%. For both groups, use of mood stabilizers differed the least from pre- to post-CCS.

Multivariate DID

Table 3 shows the results of the DID analysis for the propensity score-matched youths. Because the matched groups were balanced on the pre-CCS covariates, this simplified the regression model to the two main effects and the interactive effects of CCS and time. The CCS and non-CCS youths did not differ in their risk of polypharmacy. A 3% higher risk of polypharmacy among CCS youths was noted, as well as a 27% lower risk of the CCS × time interaction, but these differences were not significant. The 29% lower risk of polypharmacy from pre-CCS to post-CCS was statistically significant (relative risk=.71, p<.001). The findings were unchanged in the sensitivity analyses that used a cohort inclusion criteria of a 30-day and a 60-day CCS exposure.

DISCUSSION

This quasi-experimental, naturalistic study demonstrated a 28% overall reduction in polypharmacy use from pre-CCS enrollment to post-CCS discharge. The analysis of propensity score-matched groups indicated that the difference in psychotropic polypharmacy from the pre-enrollment period to the postdischarge period was not significantly different between CCS and non-CCS youths.

This study contributes to the ongoing dialogue regarding psychotropic oversight in pediatric populations. In response to a federal psychotropic monitoring mandate (18,40), many

states implemented prior authorization programs (41), mainly focused on antipsychotic use among publicly insured youths. However, these programs typically are not integrated with other system interventions, such as CCS (41). Research has found that behavioral and psychosocial interventions complement the therapeutic effects of psychotropic medication (12,13) and that health system changes have increased access to psychotropic medication among low- and middle-income countries (42). Prior research has also shown that CCS significantly reduced concomitant antipsychotic use (43). This should motivate further investigation to explore whether other practice and policy changes—such as delivering behavioral and psychosocial interventions in a coordinated care system—contribute to decreases in psychotropic polypharmacy regimens and better oversight and monitoring among youths. Investigating the specific mechanisms of effect (for example, youth and family engagement, tailoring treatment to the youth’s needs, managing implementation of the care plan, and providing continuous monitoring) will also be important to informing future practice and policy directions.

Although careful attention to the imbalance of confounders in nonrandomized studies is of paramount importance, it also is critical that system interventions target the population or populations that have the greatest need for such care. In this study, the propensity score-matched analysis excluded youths with the highest use of mental health inpatient and residential services and psychotropic treatment—that is, those whom the system interventions are intended to serve. Compared with CCS youths included in the propensity score analysis, a larger proportion of CCS youths excluded from the analysis had inpatient and residential services and psychotropic use [see table in online supplement]. For CCS youths excluded from the propensity score-matched analysis, polypharmacy decreased from 57% pre-CCS to 36% post-CCS, compared with 29% pre-CCS to 21% post-CCS among CCS youths included in the analysis [see table in online supplement]. Replicating this work to include youths with greater mental health needs is necessary to determine whether there is an effect among the youth subgroup for whom CCS was intended. Such knowledge could be used to guide resource allocation and would help states determine the population or populations for which interventions such as CCS are most cost-effective. This study is motivation for further evaluation of the effect of coordinated care models in reducing complex psychotropic regimens in youth with the greatest mental health needs.

The study had several limitations. Propensity score matching balanced measured confounders; however, there may have been other pertinent unmeasured covariates that influenced CCS enrollment and polypharmacy (44). We used multiple data sources for confounder adjustment to mitigate the possibility of an omitted variable. Selection bias into CCS cannot be ruled out. The study was based on one state, and the results may not generalize to other state systems. Finally, the significant effect of time may be indicative

of prescribing changes secondary to state-level efforts to enhance psychotropic monitoring and oversight in public programs.

CONCLUSIONS

Although state-level reform that emphasizes psychotropic oversight is a positive development, integration within a coordinated mental health system may also hold promise for improving mental health outcomes. Care coordination had a limited effect on psychotropic polypharmacy among youths with less complex needs or multiagency involvement. Future research should include multiagency data to identify youths with the most severe mental health needs in order to better assess the effect of mental health care coordination in optimizing psychotropic management for this youth subgroup.

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