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Interstate variation in trends of psychotropic medication use among Medicaid-enrolled children in foster care☆,☆☆

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ABSTRACT

Background: High rates of treating children in foster care with second-generation antipsychotics, both singly and in combination with other psychotropics, have focused public interest on the use of these medications, and motivated some states to implement programs to curtail usage.
Objective: To estimate any antipsychotic use and psychotropic polypharmacy among children in foster care during the last decade and to characterize interstate variation in these trends.
Design/methods: Centers for Medicare and Medicaid Services Medicaid Analytic Extract data files for 47 states and the District of Columbia for years 2002–2007. The study sample included an average of 686,080 children annually aged 3–18 years of age with foster care Medicaid eligibility. Repeated cross-sectional design conducted with multilevel logistic regression, clustered at the state level and controlling for patient demographics. Main outcome measures were rates of filled prescriptions for any antipsychotic medication and for psychotropic polypharmacy (defined as concurrent use of 3 or more psychotropic medication classes for at least 30 days during the year). State-level rate trajectories over time were classified as increased (≥5% relative increase over interval), decreased (≥5% relative decrease over the interval), or stable.
Results: The rate of any antipsychotic use increased from 8.9% in 2002 to 11.8% in 2007 ($P<.001$ for temporal trend). In contrast, the rate of psychotropic polypharmacy was 5.2% in 2002, peaked in 2004 at 5.9%, and fell to 5.3% in 2007 ($P<.001$ for trend). State-specific rates of any antipsychotic use were significantly increased in 45 states over the period, while rates of psychotropic polypharmacy increased in only 18 states and declined in 19.
Conclusions: Although absolute rates of any antipsychotic use and psychotropic polypharmacy among children in foster care remained high, psychotropic polypharmacy began to abate during the last decade, as rates of antipsychotic use continued to rise.

1. Introduction

Children in foster care, beset by high prevalence of behavioral health concerns (Clausen et al., 1998; Garland et al., 2000; Glisson, 1994; Halfon et al., 1995; Landsverk et al., 2002; Pecora et al., 2005; Rubin et al., 2005; Trupin et al., 1993; Urquiza et al., 1994), disproportionately use behavioral health services to a much greater degree than other children in the community (dosReis et al., 2001; Zito et al., 2008). While representing less than 3% of all enrollees in the Medicaid program, children in foster care account for 25–41% of all mental health expenditures within the Medicaid program for children (Halfon et al., 1992; Harman et al., 2000; Takayama et al., 1994).

A large component of increased mental health expenditures among foster care children is their increased use of psychotropic medications, both singly and in combinations, compared to other children. Data from the beginning of the last decade revealed that 13.5% of children in the child welfare system were using psychotropic medications, 2–3 times the rate of other children in the community (Raghavan et al., 2005). Furthermore, children in foster care are often exposed to psychotropic polypharmacy: examination of Medicaid records from the state

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of Texas in 2004 revealed that 41% of children in foster care were using 3 or more classes of psychotropic medication within the same year, and 1 in 5 were duplicating medications within the same pharmacologic class (Zito et al., 2008).

Increased use of psychotropic medications by children in foster care occurs against a backdrop of rising use of such medications among all children over the last two decades (Mojtabai & Olfson, 2010; Olfson et al., 2002, 2006). Federal and state policymakers have begun to respond to the growing public debate on psychotropic use by children, particularly for children in foster care. In 2006, a Government Accountability Office (GAO) report on pending challenges for the child welfare system found that 1 in 3 states identified the use of psychotropic medication in their foster care populations as among their most pressing issues for the next five years (Ashby, 2006). More recently, a 2011 GAO report examined psychotropic oversight for children in child welfare in six states (Kutz, 2011). The report found variability in adoption of oversight policies across the states, but noted that each state had implemented at least one such policy, though none had thoroughly adopted guidelines set forth by a psychiatry professional board. On a national-level, by 2010, 26 states reported having a policy or guideline for use of psychotropic medication by foster care youth and 13 states were in the development stage of such policies or guidelines (Leslie et al., 2010).

Rates of use of the second-generation antipsychotic (SGA) medication class are of principal interest, particularly among children in foster care, as these drugs are prescribed to address disruptive behaviors in children despite limited efficacy data and emerging evidence of metabolic side effects that have questioned their use in pediatric populations (Correll, 2008; Correll et al., 2007, 2009; De Hert et al., 2011). Between 1993 and 2002, office visits involving the prescription of SGAs to children and youth increased five-fold (Cooper et al., 2006; Olfson et al., 2006). By 2003, greater than 1 in 10 foster youth were receiving an SGA, and of those, 1 in 5 were receiving duplication of this class (dosReis et al., 2011).

The impact of states' responses regarding psychotropic medication use, particularly of SGAs, among children in foster care is unknown. We therefore sought to estimate state-specific trajectories in psychotropic use in this high-risk population and to characterize interstate variation in these trajectories during the last decade.

2. Methods

2.1. Design and sample selection

The data source was Centers for Medicare and Medicaid Services Medicaid Analytic Extract (MAX) data files for 50 states and the District of Columbia for years 2002 through 2007. Child-level demographic, eligibility, encounter, and pharmacy data were extracted from the personal summary, outpatient, inpatient, and pharmacy MAX files. Medicaid eligibility category was used as the basis for classifying youth in foster care. Youth were classified as foster care in a given year if they had at least one month of a foster care Medicaid eligible category in the year. The sample was restricted to foster care children aged 3–18 years of age with continuous Medicaid eligibility, defined as 10 of 12 months in a given year. Although this restriction removed 31% of potential children in foster care from the analysis, separate sensitivity analyses of this non-continuously eligible population revealed similar levels of psychotropic medication use and trajectories of prescribing over the period (data not shown). Because of uncertainty around coverage and service receipt during periods of disenrollment, we have chosen to report trends on only continuously enrolled children.

The dependent variables were a) use of a second-generation antipsychotic (SGA) and b) psychotropic polypharmacy, defined as the concurrent use of ≥3 psychotropic medication classes during the year. Concurrent use was defined as overlapping use of ≥3 psychotropic classes 30 days or more. Psychotropic classes included stimulants, antidepressants, SGAs, sedative/hypnotics, anxiolytics, mood-stabilizers, and alpha agonists. Antidepressants included selective serotonin reuptake inhibitors (SSRI), tricyclic antidepressants (TCA), and other antidepressants. Mood-stabilizing agents included carbamazepine, valproic acid, gabapentin, lamotrigine, and oxcarbazepine anticonvulsants and lithium. Since alpha-agonists, such as clonidine and guanfacine, can also be prescribed for medical conditions, these agents were only included in the analysis if a youth also had a claim for a psychotropic medication in one of the above-mentioned classes. Sedatives/hypnotics excluded antihistamines, which in pediatric practice most often have a non-psychiatric indication for use.

Independent variables included demographic information (age, race/ethnicity, sex, state of residence), psychiatric diagnoses, and a count of mental health encounters. Age was categorized within calendar years as 3 to 5 years, 6 to 11 years, and 12 to 18 years. Race/ethnicity was coded as white, black or African American, Latino, or other. Children with race classified as unknown were excluded from the analysis (n = 313,493; 7%). Eight states (IA, MT, MN, OK, NY, RI, VT, WI) had >15% of the state eligible population excluded as race unknown; sensitivity analyses for these states showed equivalent trajectories of psychotropic use over the study period. In two states (NY, WI), the levels of use differed slightly depending on the outcome — the direction of the differences varied by state (data not shown). Psychiatric diagnoses were coded using the *International Classification of Diseases, Ninth Revision* classification. Diagnostic categories included schizophrenia (295), bipolar disorder (296.00–296.10, 296.36–296.89), depression (296.20–

Table 1
Age-specific demographic characteristics of Medicaid-enrolled foster care children in the United States[a].

	Age 3–5 (Annual average = 100,000)			Age 6–11 (Annual average = 237,000)			Age 12–18 (Annual average = 349,000)		
	Average population percentage	Across years 2002–2007 (percentage)		Overall population percentage	Across years 2002–2007 (percentage)		Overall population percentage	Across years 2002–2007 (percentage)	
		High, low	Percentage point change 2002 to 2007		High, low	Percentage point change 2002 to 2007		High, low	Percentage point change 2002 to 2007
Sex									
Male	51.7	51.8, 51.6	+0.1	51.7	51.8, 51.6	−0.1	51.9	52.1, 51.8	+0.1
Female	48.3	48.4, 48.2	−0.1	48.3	48.4, 48.2	+0.1	48.1	48.3, 48.0	−0.1
Race[b]									
White	49.7	50.5 47.9	+2.3	47.4	48.9, 46.0	+2.9	47.9	49.8, 46.6	−3.2
Black	32.5	36.5, 29.9	−6.6	37.1	40.5, 33.8	−6.7	39.2	39.5, 38.2	+1.3
Hispanic	13.5	15.5, 11.9	+4.6	11.6	13.2, 10.1	+3.1	9.6	10.6, 8.8	+1.8
Other	4.3	4.5, 3.7	+0.8	3.9	4.1, 3.4	+0.7	3.3	3.5, 3.2	+0.2
Chronic conditions									
Mental retardation	0.7	0.8, 0.6	−0.2	1.0	1.2, 0.9	−0.3	1.4	1.5, 1.3	−0.1
Seizure disorder	1.0	1.1, 1.0	−0.1	1.0	1.0, 0.9	0.0	0.8	0.9, 0.8	+0.1

[a] 3 U.S. states not represented (Connecticut, Massachusetts, Maine).
[b] Children with race classified as unknown excluded (7%).

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296.35, and 311), anxiety disorder (300.00–300.29 and 301.4), conduct disorder (312.00–313.89), autism (299), and attention-deficit disorder (314). Separate covariates were identified for children who received a diagnosis of mental retardation (317–319) or seizure disorder (345). Identifying seizure disorder was particularly important given the overlapping use of anticonvulsant agents for mood stabilization.

To ensure a level of comparability across states, state-level data quality reviews were conducted to identify states in which data files were incomplete or contained extreme outliers in: 1) trends of Medicaid eligibility groups over time; or 2) proportion of children with mental health diagnoses over time. Following review, three states were deemed ineligible for use in this study: Connecticut, Massachusetts, and Maine. Outpatient mental health claims were unavailable in CT MAX files; foster care eligibility was unidentifiable in the MA MAX files; and the 2005–2007 outpatient files were unavailable for ME.

2.2. Statistical analyses

Demographic, clinical, and medication use characteristics were summarized as frequencies across year and categories of age (3–18). Included in these descriptive analyses were the proportions of other major psychotropic medication classes as a means of comparison against the observed rates of SGA and polypharmacy use. Generalized linear models (logit link) with a state-year interaction were then used to estimate state-level variation in medication use among children over time. Results were standardized by child-level characteristics, including age group, gender, race, diagnosis of mental retardation, and diagnosis of seizure disorder. Results were transformed into probabilities within state using predictive margins (Graubard & Korn, 1999). The resulting standardized probabilities of SGA and polypharmacy receipt were then used to characterize change over time within state. An annual increase was defined as a relative increase of ≥5% from one year to the next; an annual decrease was defined as a relative decrease of ≥5%; annual relative change of <5%; was categorized as no change. The analysis for children with non-continuous coverage used analogous log-linear models but with an offset for the number of months of eligibility per year (data not shown).

Analyses were conducted using Stata version 12.0 (College Station, TX; 2011) and SAS v9.2 (SAS Institute, Cary NC; 2011). The Institutional Review Board at the Children's Hospital of Philadelphia approved this study.

3. Results

An average of 686,080 children were identified as continuously eligible foster care youth within any given year from 2002 to 2007. Of these children, 15% were aged 3–5 years, 34% 6–11 years, and 51% 12–18 years; 52% were male. Nearly half children were white (48%), with the remaining classified as Black (37%), Hispanic (11%) or other (4%). Mental retardation and/or seizure disorder were identified in 1% of the study population (Table 1).

Between 2002 and 2007, and across age groups, rates of major mental health diagnoses increased for most conditions (Table 2). Depression and schizophrenia were two exceptions to this trend; rates of depression diagnosis were stable from 2002 to 2005, but exhibited a decrease from 2006 to 2007, and rates of schizophrenia remained stable over the period. Age-specific prevalence rates were slightly variable. Among 3–5 year olds, the most prevalent diagnoses were ADHD and conduct disorder (2007 rates: 6.1% and 6.8%, respectively). In the population aged 6–11, the prevalence of ADHD diagnoses far exceeded that of six other mental health diagnoses and experienced the largest absolute increase over the period (18.0% to 21.4%). Among 12–18 year olds, conduct disorder was the most frequent diagnosis, peaking in 2007 at 18.1%. Rates of ADHD experienced the largest growth among this age group, rising from 13.1% to 17.7%.

Table 2
Age-specific annual frequencies in thousands (%) of mental health diagnoses among Medicaid-enrolled foster care children in the United States.

	3–5 years					
	2002	2003	2004	2005	2006	2007
	N = 91.4	N = 95.1	N = 98.1	N = 102.7	N = 106.0	N = 108.4
Diagnoses						
ADHD	5.1 (5.6)	5.8 (6.1)	6.2 (6.3)	6.3 (6.2)	6.7 (6.3)	6.7 (6.1)
Anxiety	0.7 (0.8)	0.9 (0.9)	1.0 (1.0)	1.3 (1.1)	1.3 (1.2)	1.5 (1.3)
Autism	0.6 (0.7)	0.7 (0.7)	0.8 (0.8)	0.9 (0.9)	1.0 (1.0)	1.1 (1.0)
Bipolar	0.2 (0.2)	0.3 (0.3)	0.3 (0.3)	0.6 (0.5)	0.4 (0.4)	0.4 (0.4)
Conduct	4.8 (5.3)	5.4 (5.7)	6.1 (6.2)	6.8 (6.6)	7.2 (6.8)	7.4 (6.8)
Depression	0.6 (0.7)	0.8 (0.9)	0.7 (0.7)	0.9 (0.9)	0.8 (0.7)	0.7 (0.7)
Schizophrenia	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)
	6–11 years					
	2002	2003	2004	2005	2006	2007
	N = 231.0	N = 230.4	N = 233.4	N = 237.8	N = 241.2	N = 245.5
Diagnoses						
ADHD	41.6 (18.0)	44.1 (19.1)	46.5 (19.9)	48.9 (20.6)	50.4 (20.9)	52.5 (21.4)
Anxiety	4.0 (1.8)	4.5 (1.8)	4.9 (2.0)	5.6 (2.2)	5.9 (2.3)	6.6 (2.5)
Autism	1.9 (0.8)	1.9 (0.8)	2.1 (0.9)	2.4 (1.0)	2.8 (1.2)	3.0 (1.2)
Bipolar	3.3 (1.4)	4.1 (1.6)	4.7 (1.9)	5.8 (2.3)	5.6 (2.2)	5.8 (2.2)
Conduct	22.9 (9.9)	23.5 (10.2)	24.1 (10.3)	25.1 (10.6)	25.8 (10.7)	26.8 (10.9)
Depression	10.0 (4.3)	10.0 (4.3)	9.8 (4.2)	10.1 (4.3)	9.1 (3.8)	8.8 (3.6)
Schizophrenia	0.4 (0.2)	0.3 (0.1)	0.3 (0.1)	0.6 (0.3)	0.3 (0.1)	0.3 (0.1)
	12–18 years					
	2002	2003	2004	2005	2006	2007
	N = 311.4	N = 330.4	N = 348.8	N = 362.6	N = 369.3	N = 372.6
Diagnoses						
ADHD	40.7 (13.1)	47.4 (14.4)	54.0 (15.5)	60.1 (16.6)	63.6 (17.2)	65.9 (17.7)
Anxiety	7.0 (2.3)	8.6 (2.4)	9.5 (2.5)	10.5 (2.7)	11.3 (2.8)	12.1 (3.0)
Autism	1.9 (0.6)	2.2 (0.7)	2.6 (0.7)	3.0 (0.8)	3.4 (0.9)	3.8 (1.0)
Bipolar	12.5 (4.0)	15.6 (4.3)	18.5 (4.9)	22.0 (5.6)	23.7 (5.9)	25.1 (6.3)
Conduct	56.0 (18.0)	59.5 (18.0)	63.1 (18.1)	67.1 (18.5)	68.5 (18.5)	67.3 (18.1)
Depression	38.5 (12.4)	42.0 (12.7)	44.7 (12.8)	46.8 (12.9)	46.1 (12.5)	44.4 (11.9)
Schizophrenia	2.1 (0.7)	2.2 (0.7)	2.3 (0.7)	2.7 (0.8)	2.4 (0.6)	2.3 (0.6)

The unadjusted rates of medication use appear in Table 3. Across age groups, rates of any psychotropic use experienced a rise-and-fall trajectory, such that rates increased through 2004, but declined thereafter through 2007. Polypharmacy use followed a similar trajectory. Among individual medication classes, most classes (inclusive of stimulants, antidepressants, and mood stabilizers) followed a similar rise-and-fall trajectory. SGAs and alpha agonists, however, were the only classes to experience a continuous increase over the period for children aged 6–11 years and 12–18 years. Although trajectories were consistently up for both of these classes, the absolute increases

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Table 3
Age-specific annual frequencies in thousands (%) of psychotropic medication use among Medicaid-enrolled foster care children in the United States.

	3–5 years					
	2002	2003	2004	2005	2006	2007
	N = 91.4	N = 95.1	N = 98.1	N = 102.7	N = 106.0	N = 108.4
Medication class						
Alpha agonist[a]	1.6 (1.8)	1.8 (1.9)	2.1 (2.1)	2.2 (2.1)	2.2 (2.1)	2.1 (2.0)
Antidepressant	1.5 (1.7)	1.5 (1.6)	1.2 (1.3)	1.1 (1.1)	1.1 (1.0)	0.9 (0.8)
Second-generation antipsychotic	1.6 (1.7)	2.1 (2.2)	2.4 (2.4)	2.5 (2.4)	2.6 (2.4)	2.4 (2.2)
Mood stabilizer	1.3 (1.4)	1.3 (1.4)	1.3 (1.3)	1.3 (1.3)	1.3 (1.2)	1.1 (1.0)
Stimulant	4.2 (4.6)	4.9 (5.2)	5.1 (5.2)	5.0 (4.9)	5.0 (4.7)	4.6 (4.2)
Psychotropic medication[b]	6.7 (7.4)	7.4 (7.8)	7.7 (7.8)	7.6 (7.4)	7.7 (7.3)	7.1 (6.5)
Polypharmacy	0.6 (0.7)	0.7 (0.7)	0.7 (0.8)	0.7 (0.7)	0.7 (0.7)	0.7 (0.6)
	6–11 years					
	2002	2003	2004	2005	2006	2007
	N = 231.0	N = 230.4	N = 233.4	N = 237.8	N = 241.2	N = 245.5
Medication class						
Alpha agonist	13.8 (6.0)	14.0 (6.1)	14.3 (6.1)	15.2 (6.4)	16.3 (6.8)	17.4 (7.1)
Antidepressant	23.5 (10.2)	22.7 (9.9)	19.5 (8.3)	16.5 (6.9)	15.4 (6.4)	14.0 (5.7)
Second-generation antipsychotic	18.2 (7.9)	20.5 (8.9)	22.1 (9.5)	23.5 (9.9)	24.2 (10.0)	24.8 (10.1)
Mood stabilizer	10.6 (4.6)	10.9 (4.7)	10.7 (4.6)	10.6 (4.5)	10.3 (4.3)	9.8 (4.0)
Stimulant	48.3 (20.9)	52.5 (22.8)	54.9 (23.6)	56.5 (23.8)	56.4 (23.4)	55.2 (22.5)
Psychotropic medication	61.5 (26.6)	64.4 (28.0)	65.6 (28.1)	67.2 (28.2)	67.2 (27.8)	66.3 (27.0)
Polypharmacy	11.8 (5.1)	12.7 (5.5)	12.8 (5.5)	12.4 (5.2)	12.3 (5.1)	11.9 (4.9)
	12–18 years					
	2002	2003	2004	2005	2006	2007
	N = 311.4	N = 330.4	N = 348.8	N = 362.6	N = 369.3	N = 372.6
Medication class						
Alpha agonist	12.5 (4.0)	13.6 (4.1)	14.6 (4.2)	15.8 (4.4)	16.8 (4.6)	17.8 (4.8)
Antidepressant	61.9 (19.9)	66.6 (20.2)	65.0 (18.6)	59.7 (16.5)	57.1 (15.5)	53.7 (14.4)
Second-generation antipsychotic	36.3 (11.7)	43.5 (13.2)	49.8 (14.3)	54.1 (14.9)	56.5 (15.3)	58.3 (15.6)
Mood stabilizer	27.5 (8.8)	30.3 (9.2)	32.0 (9.2)	33.2 (9.2)	33.0 (8.9)	32.1 (8.6)
Stimulant	48.0 (15.4)	58.3 (17.6)	66.8 (19.2)	72.5 (20.0)	74.4 (20.2)	72.8 (19.5)
Psychotropic medication	99.4 (31.9)	110.7 (33.5)	118.2 (33.9)	122.7 (33.9)	124.3 (33.7)	123.1 (33.0)
Polypharmacy	20.5 (6.6)	24.4 (7.4)	26.6 (7.6)	27.0 (7.5)	27.0 (7.3)	26.1 (7.0)

[a] Alpha agonist use was coded only when an additional claim for psychotropic medication use was present within the year for a given child.
[b] Psychotropic medication includes any claim for alpha agonists, antidepressants, antipsychotics, anxiolytics, mood stabilizers, second-generation antipsychotics, sedative/hypnotics, or stimulants.

in SGA use (from 7.9% to 10.1% among 6–11 year olds, and from 11.7% to 15.6% among 12–18 year olds) eclipsed the absolute increase in alpha-agonist use (from 6.0% to 7.1% among 6–11 year olds, and from 4.0% to 4.8% among 12–18 year olds). Rates among 3–5 year olds for SGAs and alpha-agonists rose slightly early in the period, but had leveled off or declined slightly in later years (2005–2007).

At a state-level (Table 4), 45 states experienced a relative increase in rates of SGA use over the 6-year period. Two states experienced a relative decrease, and one state experienced no change over the period. Relative increases among states varied widely, ranging from 72.0% to 6.4%. Furthermore, absolute levels of antipsychotic use in 2007 were variable and ranged from 21.7% to 2.8%, with a median rate of 12.8%. Examining year-to-year change, some state-level rates increased consistently from year to the next, while others did not change or declined (Fig. 1). In any given year (compared to the prior year), the number of states experiencing an increase in SGA use declined from 42 in 2003 to 13 in 2007, while the number of states experiencing a decrease in SGA use rose from 3 to 9 over the period.

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Table 4
Trajectories[a] of second-generation antipsychotic (SGA) use among Medicaid-enrolled foster care children in the United States between 2002 and 2007; by state.

2002–2007 increase

State	2002 population	2002 rate[b]	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
AR	4191	0.105	+	+	.	+	+	0.181	5439	71.9%
SD	1995	0.079	+	+	+	+	+	0.136	2656	71.0%
RI	3740	0.054	+	+	+	.	+	0.090	2983	68.0%
WA	12,095	0.042	+	+	+	.	+	0.071	14,579	67.9%
AZ	6573	0.077	−	+	.	+	.	0.126	11,109	64.1%
MN	7568	0.076	+	+	+	.	.	0.118	6729	55.9%
TN	11,773	0.070	+	+	+	.	.	0.109	15,553	54.9%
MT	3132	0.083	+	+	+	.	.	0.128	3437	54.3%
AL	4631	0.091	+	+	+	.	.	0.139	6227	52.2%
MI	29,789	0.075	+	+	+	.	.	0.112	32,266	48.9%
CA	130,765	0.055	+	+	+	.	.	0.081	126,171	48.4%
OK	12,481	0.100	+	+	.	.	+	0.148	11,685	48.3%
DE	1431	0.122	+	+	+	+	.	0.178	1796	45.9%
VT	1470	0.085	+	+	+	.	−	0.123	1576	45.1%
IL	57,707	0.069	+	−	+	+	+	0.099	49,332	44.6%
WY	1449	0.087	−	+	+	+	.	0.126	2169	44.1%
SC	7067	0.057	+	+	+	+	.	0.081	9841	41.3%
WI	8663	0.086	+	+	.	.	.	0.121	8228	41.3%
OR	10622	0.065	+	.	.	.	+	0.091	12,540	40.8%
VA	8356	0.129	+	+	.	.	+	0.180	12,038	39.4%
AK	1633	0.089	+	−	+	.	+	0.122	2754	36.6%
ID	1735	0.104	+	+	+	.	.	0.141	2545	36.5%
NC	13,291	0.094	+	+	.	.	+	0.127	16,952	35.6%
NE	8425	0.127	+	+	.	.	.	0.172	10,666	35.6%
WV	5106	0.073	+	+	+	−	+	0.099	6325	35.1%
NM	3060	0.077	+	+	+	+	.	0.103	4489	34.9%
MD	13,319	0.122	.	+	+	+	.	0.164	13,525	33.8%
DC	3554	0.106	+	+	.	+	−	0.139	3094	31.5%
NV	3436	0.105	+	.	.	.	+	0.137	5609	31.1%
NY	13,327	0.085	+	+	.	.	.	0.109	17,833	28.1%
GA	15,904	0.109	+	+	.	.	.	0.140	25,770	28.0%
KS	9369	0.152	+	+	.	.	.	0.193	11,382	27.1%
UT	4341	0.102	+	.	.	+	.	0.129	6150	26.1%
FL	32,246	0.072	+	+	+	.	.	0.089	35,781	25.0%
LA	7845	0.116	+	+	.	−	.	0.144	10,003	23.7%
IN	11,476	0.124	+	+	.	−	.	0.153	15,346	23.4%
KY	7876	0.153	+	+	−	.	.	0.182	11,150	18.7%
OH	21,828	0.105	+	.	+	.	.	0.124	26,769	18.2%
PA	38,860	0.060	−	+	.	+	+	0.070	44,841	17.1%
ND	1353	0.114	+	.	.	.	−	0.133	1513	16.2%
NH	2216	0.114	+	+	.	.	−	0.129	2297	13.0%
NJ	15,395	0.097	.	−	+	.	.	0.106	20,028	9.8%
CO	10,723	0.117	+	+	−	−	−	0.128	13,201	9.6%
IA	7270	0.142	+	.	.	.	.	0.154	6558	8.5%
MO	21,973	0.148	+	.	.	.	.	0.157	24,063	6.4%

2002–2007 no change

State	2002 population	2002 rate	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
MS	2642	0.123	.	−	.	−	.	0.120	4006	−2.8

2002–2007 decrease

State	2002 population	2002 rate	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
TX	26,131	0.237	+	.	−	.	−	0.217	41,711	−8.4
HI	3961	0.032	+	+	.	.	−	0.028	5897	−11.7

[a] Annual increase defined as relative change of ≥5% increase; annual decrease defined as relative change of ≥5% decrease; annual no change defined as relative change <5%.
[b] Annual rate expressed as a proportion of Medicaid-enrolled foster care children aged 3–18 with at least one filled claim for SGA in the year, standardized on patient characteristics of sex, age group, race, and chronic conditions (seizure disorder and mental retardation).

In contrast to state-level antipsychotic trajectories, fewer states demonstrated an increase in polypharmacy use between 2002 and 2007. While 18 states experienced an increase in polypharmacy use, 19 experienced a decrease, and 11 experienced no change (Table 5). Relative increases ranged from 34.48% to 6.7%, while relative decreases ranged from −5.3% to −66.7%. Similar to antipsychotics, wide variability existed in states' absolute levels of polypharmacy in 2007 (13.6% to 0.5%) (Table 5). Year-to-year changes in polypharmacy use for each state were also considerably different than for SGA use (Fig. 1). The number of states with an annual increases in polypharmacy use declined from 32 in 2003 to 2 in 2007. Conversely, the number of states with decreased polypharmacy use from the previous year rose from 4 in 2003 to 19 in 2007.

4. Discussion

This national study revealed significant state variation in both polypharmacy and SGA use by children in foster care, and detected a changing trend in their use in this population. Although overall rates of psychotropic medication use remained high, many states

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Table 5
Trajectories[a] of polypharmacy use among Medicaid-enrolled foster care children in the United States between 2002 and 2007; by state.

2002–2007 increase

State	2002 population	2002 rate[b]	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
WA	12,095	0.029	+	.	.	.	.	0.039	14,579	34.48%
NM	3060	0.037	.	.	+	+	.	0.046	4489	24.32%
OK	12,481	0.05	+	.	−	.	+	0.062	11,685	24.00%
MN	7568	0.053	+	.	+	.	+	0.065	6729	22.64%
MI	29,789	0.042	+	+	+	.	.	0.05	32,266	19.05%
AR	4191	0.07	.	+	.	+	.	0.083	5439	18.57%
AL	4631	0.062	+	+	+	.	.	0.072	6227	16.13%
NY	13,327	0.019	+	+	.	−	−	0.022	17,833	15.79%
GA	15,904	0.065	+	+	−	−	.	0.074	25,770	13.85%
NC	13,291	0.052	+	+	−	.	.	0.059	16,952	13.46%
UT	4341	0.058	+	+	−	.	−	0.065	6150	12.07%
MT	3132	0.042	.	.	+	.	.	0.047	3437	11.90%
AZ	6573	0.059	−	+	−	.	.	0.065	11,109	10.17%
SD	1995	0.042	+	+	−	.	.	0.046	2656	9.52%
ID	1735	0.057	+	+	−	.	.	0.062	2545	8.77%
WI	8663	0.057	+	.	.	.	−	0.062	8228	8.77%
RI	3740	0.036	+	.	−	.	−	0.039	2983	8.33%
VA	8356	0.09	.	+	.	.	.	0.096	12,038	6.67%

2002–2007 no change

State	2002 population	2002 rate	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
CA	130,765	0.023	+	.	.	.	.	0.024	126,171	4.35%
OR	10,622	0.027	+	.	.	−	.	0.028	12,540	3.70%
DE	1431	0.079	+	−	.	+	−	0.081	1796	2.53%
IL	57,707	0.041	+	−	+	.	.	0.042	49,332	2.44%
IA	7270	0.087	+	.	−	.	−	0.089	6558	2.30%
WV	5106	0.051	.	.	−	.	.	0.052	6325	1.96%
OH	21,828	0.064	+	.	.	.	−	0.065	26,769	1.56%
KY	7876	0.085	+	.	−	.	.	0.086	11,150	1.18%
VT	1470	0.055	.	.	+	.	−	0.053	1576	−3.64%
NE	8425	0.082	+	.	−	.	−	0.078	10,666	−4.88%
MD	13,319	0.081	+	.	.	.	−	0.077	13,525	−4.94%

2002–2007 decrease

State	2002 population	2002 rate	2003	2004	2005	2006	2007	2007 rate	2007 population	Percent change 2007–2002
KS	9369	0.095	+	+	.	−	.	0.09	11,382	−5.26%
AK	1633	0.057	.	+	−	−	.	0.053	2754	−7.02%
TN[c]	11,773	n/a	n/a	+	−	−	−	0.049	15,553	−8.07%
DC	3554	0.062	+	−	−	.	−	0.056	3094	−9.68%
CO	10,723	0.061	+	.	−	−	.	0.055	13,201	−9.84%
NH	2216	0.071	.	.	−	.	.	0.063	2297	−11.27%
IN	11,476	0.081	+	+	−	.	.	0.071	15,346	−12.35%
MO	21,973	0.098	+	.	−	.	.	0.085	24,063	−13.27%
WY	1449	0.057	−	+	.	−	−	0.049	2169	−14.04%
LA	7845	0.084	+	.	−	−	.	0.072	10,003	−14.29%
SC	7067	0.052	.	.	.	.	−	0.044	9841	−15.38%
ND	1353	0.087	+	−	−	.	−	0.073	1513	−16.09%
PA	38,860	0.03	−	.	−	.	.	0.025	44,841	−16.67%
FL	32,246	0.042	+	−	−	−	−	0.033	35,781	−21.43%
NJ	15,395	0.049	.	−	.	−	.	0.038	20,028	−22.45%
NV	3436	0.06	+	.	.	−	−	0.046	5609	−23.33%
TX	26,131	0.181	+	.	−	.	−	0.136	41,711	−24.86%
MS	2634	0.061	.	−	−	−	.	0.041	3931	−32.79%
HI	3961	0.015	−	+	−	+	−	0.005	5897	−66.67%

[a] Annual increase defined as relative change of ≥5% increase; annual decrease defined as relative change of ≥5% decrease; annual no change defined as relative change <5%.
[b] Annual rate expressed as a proportion of Medicaid-enrolled foster care children aged 3–18 with filled claims for ≥3 psychotropic medication classes overlapping for at least 30 days in the year, standardized on patient characteristics of sex, age group, race, and chronic conditions (seizure disorder and mental retardation).
[c] Data projected from 2003 to 2007 due to limited availability of data on stimulants in 2002.

were experiencing a decline in polypharmacy for foster care children by 2007, in contrast to reports from prior years that had suggested consistent increases (Bhatara et al., 2004; Mojtabai & Olfson, 2010; Safer & Zito, 2003). Despite the decrease in polypharmacy prescribing, SGA use continued to increase over this time period, albeit with a reduced trajectory of growth by 2007. Notably, 2005 seems to have been a pivotal year. Not only did polypharmacy use in most states ebb significantly starting in 2005, but also, the increase in SGA use flattened, with many states showing no interval increases in SGA use across years beyond 2005.

The change in psychotropic use among children in foster care that was observed during the last decade should be interpreted cautiously. The waning of polypharmacy use beyond 2005, for example, was quite variable across states, and overall rates for many states remained quite high—1 in 14 adolescents were receiving polypharmacy by 2007. Nevertheless, why such rates began to decline in many states will likely invite speculation. Whether increased public dialogue, epidemiologic changes in the spectrum of illness, changing provider practice, availability of alternative therapies, or state-specific policy responses effected these changes might be difficult to disaggregate. Similarly,

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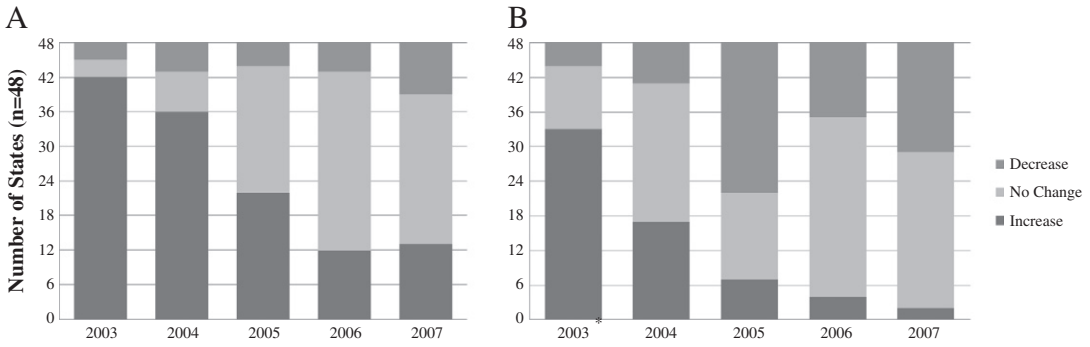

Annual increase defined as relative change of ≥5%; annual decrease defined as relative change of ≤5%; annual no change defined as relative change <5%

*Tennessee excluded from 2003 change bar due to limited availability of data on stimulants in 2002; the number of states in the 2003 change bar is 47

Fig. 1. State-level annual changes in rates of second-generation antipsychotic (A) and polypharmacy (B) among Medicaid-enrolled foster care children aged 3–18 years.

the decelerating trajectory of SGA use (although still increasing), should be also be interpreted with caution, particularly given the dynamic nature of the SGA market in later half of the past decade. Specifically, broadened approval of quetiapine (Seroquel) and aripiprazole (Abilify) for indications other than schizophrenia during the study period could potentially have influenced trends beyond 2007. Although the increasing trajectory of SGA use was beginning to slow in most states, it is certainly possible that the introduction of newer agents within this class might have led to state increases in SGA use – or perhaps even polypharmacy – beyond 2007.

This study has other limitations that also should be considered. First, while the study characterizes the state-specific trends in the use of psychotropic medications by children in foster care, it cannot describe at a case-level whether the treatment decisions were appropriate or inappropriate; nor can it describe the pattern of medications used by individual children. Second, it is possible that the children identified as foster care youth were misclassified among the state populations in this study, since administrative Medicaid-eligibility codes might misclassify children. A prior report, for example, suggested that eligibility codes for children in foster might over-count children receiving services (Rubin et al., 2009). However, the average of 686,000 children who were identified as foster care youth in any given year is reassuring, given that it is represents nearly 90% of known numbers of children traversing the system (U.S. Children's Bureau, Administration for Children, Youth and Families, 2011). Furthermore, to the degree that within state and across time any potential biases are consistent, they would be unlikely to change the observed trajectories even if they might bias the point estimates. The latter concern would caution against use of these data as a point-in-time report cards for states, but would not impact the interpretation of their trajectories.

Although the trajectories estimated in this study might refocus concern about psychotropic medication utilization, interpreting these findings is complex. Even a modest decline in the use of polypharmacy, for example, does not negate the reality that 5.3% of foster care children across the country were using a combination of three or more psychotropic medications, and 11.8% were using SGAs in 2007: these facts should remain a significant source of continued scrutiny. Furthermore, the substantial variation detected across states suggests that children's location within the systems of public health and child welfare might matter more than their underlying health issues in determining the likelihood of receiving psychotropics. Finally, even as polypharmacy has begun to decline, the relative increase in antipsychotic use might represent the substitution of single-drug treatment strategy with SGAs for disruptive behaviors in lieu of previous psychotropic polypharmacy patterns of using SGAs as an adjuvant with other psychotropic medications.

Nevertheless, characterizing the use of psychotropic medication by foster youth as increasing, particularly regarding psychotropic polypharmacy, might no longer be correct. Years of public dialogue, and potentially state responses, might be influencing provider behavior in the use of psychotropic medications. Examining trends beyond 2007 will be important, as will characterizing which combinations of medications (or single-use regimens) are becoming the most prevalently prescribed for foster care youth over time. Furthermore, while this study reveals that trends might be changing in many states, whether the outcomes for children are changing remains unknown. States will need to monitor child-level outcomes, as well as the alternative services provided by behavioral health systems, as they increasingly investigate and refine policies on the use of psychotropic medications.

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