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Trends in Psychotropic Polypharmacy Among Youths Enrolled in Ohio Medicaid, 2002—2008

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Abstract

Objective—This study examined polypharmacy patterns and rates over time among Medicaid-enrolled youths by comparing three enrollment groups (youths in foster care, with a disability, or from a family with low income).

Methods—Serial cross-sectional trend analyses of Medicaid claims data were conducted for youths age 17 and younger who were continuously enrolled in Ohio Medicaid for a one-year period and prescribed one or more psychotropic medications during fiscal years 2002 (N=26,252) through 2008 (N=50,311). Outcome measures were any polypharmacy (three or more psychotropic medications from any drug class) and multiclass polypharmacy (three or more psychotropic medications from different drug classes).

Results—Both types of polypharmacy increased across all three eligibility groups. Any polypharmacy increased from 8.8% to 11.5% for low-income youths (adjusted odds ratio [AOR]=1.12, 99% confidence interval [CI]=1.10–1.13), from 18.0% to 24.9% for youths with a disability (AOR=1.11, CI=1.09–1.13), and from 19.8% to 27.3% for youths in foster care (AOR=1.09, CI=1.07–1.11). Combinations associated with positive increases were two or more antipsychotics, two or more stimulants, and antipsychotics with stimulants.

Conclusions—Polypharmacy increased across all enrollment groups, with the highest absolute rates for youths in foster care. Both the overall prevalence and increases in prescriptions for drug

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combinations with limited evidence of safety and efficacy, such as the prescription of two or more antipsychotics, underscore the need for targeted quality improvement efforts. System oversight and monitoring of psychotropic medication use appears to be warranted, especially for higher-risk groups, such as youths in foster care and those from low-income households who were prescribed multiple antipsychotics.

Psychotropic polypharmacy (the concurrent use of multiple medications) is a common practice in the treatment of psychiatric disorders of children and adolescents. It is estimated that between 27.2% and 52.0% of children in outpatient settings and up to 85% in inpatient and residential settings are prescribed two or more psychotropic medications (1–6). Across payer groups, rates are generally higher for publicly rather than privately insured children and for children in foster care compared with the general population (2,7).

Polypharmacy is concerning because of a lack of data on the efficacy of drug combinations when used with children and adolescents (8). Prescribing practices for children are largely based on extrapolation from studies of adults, with limited guidelines for dosing, tolerability, and drug-drug interactions (9). Also of concern are safety risks associated with polypharmacy, including increased risk of adverse events and drug-drug interactions, the potential for cumulative drug-induced behavioral toxicities, the greater potential for side effects requiring additional medications, and nonadherence because of drug regimen complexity (8–11). Given these issues, the American Academy of Child and Adolescent Psychiatry recommends the “judicious use of combined medications, keeping such use to clearly justifiable circumstances” (12). Such circumstances might include individuals with multiple comorbidities and complex symptom profiles, difficult-to-treat cases (failures of monotherapy, for example), and specific diagnoses that may warrant a particular combination of medication (bipolar illness, for example) (13).

Despite these concerns, polypharmacy appears to be increasing (2,14). In addition, cross-sectional studies of Medicaid populations indicate that there are different rates of polypharmacy by eligibility group (foster care, disability, and other aid categories) (15,16). Longitudinal studies of polypharmacy trends by eligibility status are needed given a growing body of research documenting disparities in mental health service use and quality of care across Medicaid eligibility groups, including lower quality of care for children in foster care (17–19). Children in foster care compared with other aid groups have poorer health and mental health outcomes, higher rates of unmet need, and greater barriers in accessing services (20).

To our knowledge, this is the first study to examine trends in pediatric polypharmacy over time and investigate variations across Medicaid eligibility groups. Using Medicaid data from a large Midwestern state, we examined rates and patterns of pediatric psychotropic polypharmacy from 2002 to 2008 to answer three main questions. First, among youths prescribed any medication, what are the rates of multiple medication use for each eligibility group, and have they increased over time? To facilitate comparisons with other studies, often difficult to reconcile because of variations in how polypharmacy is defined (1,21), estimates are presented for several operationalizations of polypharmacy. Second, with controls for demographic and clinical characteristics, have polypharmacy rates increased

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differentially across eligibility groups? In these adjusted models, polypharmacy was measured as coprescription of three or more medications from any drug class and as coprescription of three or more medications from different drug classes. We used this definition because of the lack of empirical evidence for the effectiveness of three or more medications. Moreover, this definition also has been adopted by several state Medicaid programs as an indicator of quality of care (22,23). Third, what are the most common medication combinations for each eligibility group, and have they changed over time?

Answering these questions within a single state may assist other states in better understanding patterns of polypharmacy and improving their mental health service delivery systems for youths in Medicaid.

Methods

Study design

This serial, cross-sectional study used Medicaid claims data to examine trends in psychotropic polypharmacy over a seven-year period (2002–2008) for youths 17 years and younger. October was randomly chosen to represent the cross-sectional period for each year. All procedures were approved by the Ohio State University Institutional Review Board.

Data source

Medicaid eligibility, fee-for-service claims, and managed care encounter data were obtained from the Ohio Department of Jobs and Family Services. Eligibility files included information on monthly enrollment, eligibility category, and demographic characteristics of enrollees. Pharmacy files provided information on prescriptions filled by outpatient pharmacies, including generic name and code, national drug code, and dispense dates. The institutional and professional files provided information on service claims with up to seven *ICD-9-CM* diagnoses.

Study population and procedures

The study population included all children and adolescents 17 years and younger who had at least one prescription claim for a psychotropic medication and were continuously enrolled in the Medicaid program for a one-year period during fiscal years 2002 (N=26,252) through 2008 (N=50,311). The Medicaid population included three eligibility groups: low-income children who have a family income at or below 200% of the federal poverty level, children with a disability who have a family income at or below 64% of the federal poverty level, and children in foster care who receive adoption assistance or who are in institutional placements. In Ohio, which has systems similar to those of other states, youths with disabilities and children in foster care are covered under a fee-for-service system, whereas children from low-income families are covered by managed care.

During the study period, the number of children enrolled in Medicaid rose 35.7%, from 545,958 to 740,593. However, the proportion within each eligibility group has remained stable, with most youths in the low-income group (93%). The percentage of youths prescribed any psychotropic medication also increased from 4.8% in 2002 to 6.9% in 2008.

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The largest increase in youths prescribed any psychotropic (64.4%) occurred in the low-income group (from 3.2% to 5.3%), followed by roughly equal increases of 17% among those in the disability and foster care groups (from 31.9% to 37.3% and 19.3% to 22.6%, respectively).

Outcome measures

Psychotropic medications were identified from pharmacy files by using generic name codes and dispense dates during the same randomly selected month in each of the study years. Medications were grouped into six major drug classes according to the American Hospital Formulary Service Pharmacologic Therapeutic Classification System: antidepressants (serotonin reuptake inhibitors, tricyclics, monoamine oxidase inhibitors, and other antidepressants, including trazodone hydrochloride, bupropion, and mirtazapine); antipsychotics (first generation, including chlorpromazine hydrochloride, fluphenazine hydrochloride, and mesoridazine, and second generation, including risperidone, olanzapine, and quetiapine); mood stabilizers, including anticonvulsants (such as carbamazepine, valproate sodium, and gabapentin) and lithium; anxiolytics, including benzodiazepines (such as clonazepam) and nonbenzodiazepines (such as buspirone); stimulants (such as methylphenidate, amphetamine, and pemoline) and other attention-deficit hyperactivity disorder (ADHD) medications (such as atomoxetine); and alpha-adrenergic agonists (such as clonidine hydrochloride and guanfacine hydrochloride). In order not to overestimate rates of polypharmacy, we excluded certain drug classes. Antihistamines, anticholinergic-antiparkinson agents, and beta blockers were excluded because they may be used to treat general medical conditions, such as hypertension. Sleep agents, classified as hypnotics, were excluded because these are commonly prescribed on an as-needed basis.

Polypharmacy was defined in two ways: “any” involved three or more medications from the same or different drug classes, and “multiclass” involved three or more medications from different drug classes. Stimulant polypharmacy did not include the combination of long-acting and immediate-release agents from the same drug class.

Statistical analysis

Medication rates were compared across all study years with a chi square test for linear trend, but for ease of interpretation, only the frequencies and percentages for the first (2002) and last (2008) year of the study period are presented. Because of the structure of the database, in which individuals could have between one and seven observations, generalized estimating equation (GEE) logistic regression models featuring the binomial distribution and the logit link function were used to estimate polypharmacy odds ratios for each one-year increase in time. Eligibility group was entered into the model along with its interaction with time because we expected polypharmacy odds ratios to differ over these groups.

Odds ratios were adjusted for demographic characteristics (age, race-ethnicity, sex, and area of residence, which was classified as urban or rural based on the Office of Management and Budget Metropolitan Statistical Area Designation) and clinical characteristics (primary psychiatric diagnosis, number of comorbid psychiatric disorders, presence of a chronic general medical condition, number of annual outpatient mental health visits, and number of

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annual psychiatric hospitalizations) that may indicate illness severity and be associated with the use of psychotropic medication.

Primary diagnosis was defined as the one associated with the majority of mental health services during the year and grouped into nine *ICD-9-CM* diagnostic categories: ADHD, adjustment disorders, anxiety disorders, autism spectrum disorders, disruptive behavior disorders, mood disorders, developmental disabilities, schizophrenia, and other mental disorders. Youths were classified as having a general medical or psychiatric disorder if they had two or more claims associated with the disorder during the year. [A table showing the distribution of control variables by eligibility group is available online as a data supplement to this report.]

For all multivariable analyses, conservative 99% confidence intervals were generated for the odds ratios because the number of observations was so large. All analyses were run with Stata 12.01 software (24).

Results

Trends in psychotropic polypharmacy

Among youths prescribed any psychotropic medication, the mean number of medications increased for each group, with the largest increase among youths in the disability group (9.2%), followed by youths in foster care (7.8%) and from low-income households (5.2%) (Table 1). Although most youths were prescribed only one medication, the proportion with one medication significantly decreased over time for all groups. For the disability and foster care groups, by 2008 less than half of youths prescribed medication were prescribed only one. Among youths prescribed any medication, there was a significant increase in each group in the coprescription of three, four, and five medications. Table 1 shows steady increases over time in “any” and multiclass polypharmacy, with the highest rates among foster care youths. By 2008, approximately one-quarter of the foster care (27.3%) and disability (24.9%) groups and one-tenth of the low-income group (11.5%) were prescribed three or more medications; approximately one-fifth of foster care (22.3%) and disability (19.5%) groups and slightly less than one tenth (9.0%) of the low-income group were prescribed medications from three or more drug classes.

Table 1 also shows the distributions and changes in rates of specific drug classes among youths prescribed any psychotropic medication. Rates of three of the seven specific medication classes (stimulants, antipsychotics, and alpha-agonists) increased across all eligibility groups. Stimulants were the most commonly prescribed medications across all years for all eligibility groups: by 2008, approximately three-quarters of the low-income and foster care groups were prescribed a stimulant, as was 57.3% of the disability group. Antipsychotics were the second most frequently prescribed medication class by 2008, with the largest percentage among youths in foster care (39.7%), followed by those with disability (36.1%), and those from low-income households (19.3%). Antidepressant prescriptions significantly decreased between 2002 and 2008 for all eligibility groups. Mood stabilizers and anxiolytics remained among the least frequently prescribed classes of medication among all three eligibility groups.

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Adjusted GEE logistic regression model results are shown in Table 2. The interaction term between eligibility category and year for each of the medication measures indicated that the medication odds ratios differed for each group. With analyses controlling for demographic and clinical characteristics, the odds of any polypharmacy increased annually by 12% for youths from low-income households, 11% for youths with disabilities, and 9% for foster care youths. The odds of multiclass polypharmacy likewise increased (10% for low-income, 9% for disability, and 6% for foster care groups). Odds ratios did not significantly differ between the low-income and disability groups for either measure of polypharmacy, but the ratio was significantly greater for the youths from low-income families compared with youths in the foster care group ($p=.006$ "any"; $p<.001$ multiclass). The likelihood that youths would be prescribed medications significantly increased between 2002 and 2008 for each class and for each eligibility group (all tests $p<.001$). The exception was the likelihood of prescription of antidepressants, which significantly decreased for each group (all tests $p<.001$).

Polypharmacy combinations by Medicaid eligibility category

Detailed information about the change in and prevalence of medication combinations among youths with a multiclass polypharmacy regimen is presented in Table 3. Because youths prescribed medication from different classes might also be prescribed multiple medications from one class, within-class medication combinations are presented for these youths as well. Prescription of two or more stimulants increased significantly for all eligibility groups, and these increases remained significant in adjusted models. As of 2008, of youths with a polypharmacy regimen, 6.9% from low-income households, 5.8% with a disability, and 7.9% in foster care were prescribed two or more stimulants. Prescription of two or more antipsychotics significantly increased for all eligibility groups in both the unadjusted and adjusted models ($p<.001$). The foster care group had the highest rate of being prescribed multiple antipsychotics (9.9%). Prescription of two or more antidepressants significantly decreased over time for all eligibility groups. The prescription of two or more mood stabilizers also decreased for each group but not significantly.

Table 3 also shows the prevalence and time trends for the ten most commonly prescribed multiclass combinations. Overall, the patterns were similar across the eligibility groups. For the combinations that included a stimulant, an antipsychotic, and a medication from any class except antidepressants, the rates increased over time. Moreover, these increases were statistically significant in all models, with the exception of stimulants/antipsychotics/anticonvulsants among the youths with a disability. Two combinations significantly decreased over time for all eligibility groups: stimulants/alpha-agonists/antidepressants and antipsychotics/anticonvulsants/antidepressants. Prescription of the other five combinations did not significantly change over time, with one exception: the combination stimulants/anticonvulsants/antidepressants among the youths from low-income families was prescribed significantly less frequently. By 2008, the most prevalent between-class combinations among youths with a polypharmacy regimen were stimulants/antipsychotics/alpha-agonists among the youths from low-income families (17.4%) and with disability status (15.1%) and stimulants/antipsychotics/antidepressants among the youths in foster care (16.8%).

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Discussion

In the large statewide Medicaid program of Ohio, psychotropic polypharmacy rates significantly increased across all eligibility groups between 2002 and 2008, with substantial changes in the specific drugs and drug combinations prescribed. Polypharmacy regimens increasingly included stimulants and antipsychotics, whereas concomitant antidepressant use decreased, most likely a result of the 2004 black box warning (25). Consistent with results of other Medicaid studies (26,27), polypharmacy rates were higher for children in foster care than for those eligible for Medicaid because of disability or low income. By the end of the study period, over a quarter of the foster care group with any psychotropic medication received three or more medications from any drug class and over one-fifth received three or more medications from different drug classes. Although overall rates were highest among the foster care group, the trends and prevalent combinations were strikingly similar across eligibility groups, regardless of payment system.

Possible explanations for overall increases in polypharmacy include a growing trend toward symptom-based prescribing and a greater cultural acceptance of psychopharmacology in general; a growing awareness of the problem of psychiatric comorbidity; a reluctance to discontinue medications that are already in place; pressures from parents, teachers, or clinicians to add medications to existing regimens in times of crisis or when new symptoms present themselves; limitations in access to psychotherapeutic treatments; and aggressive marketing by pharmaceutical companies (8,9,28,29).

Other factors may explain why polypharmacy rates are highest for children in foster care. First, they have multiple biological, psychological, and social risk factors that predispose them to emotional and behavioral problems (26) and to disproportionate mental health service use (18–20). This explanation is supported by the results that show differences in absolute rates of polypharmacy across groups but similar odds of polypharmacy when models adjust for client characteristics. Second, inadequate coordination across general health, mental health, and child welfare systems may contribute to prescribing multiple medications (27,30,31), especially if children experience multiple placements that disrupt continuity of care (32,33).

The increase in specific combinations of within- and between-class medications requires further research, both to determine whether the trends are continuing and whether the combinations' benefits outweigh the risks. The trend toward multiple antipsychotics raises questions about quality of care for all youths prescribed any medication (34), but particularly for children in foster care. Studies on the effectiveness of this practice for children and adolescents are lacking (35–37), but safety issues, including drug-drug interactions and adverse metabolic effects, have been well documented (11,38–42).

The observed increase in the prescription of multiple stimulants (such as a methylphenidate-based stimulant with an amphetamine-based stimulant) is also occurring absent clinical guidelines and raises special concerns. Although the practice might simply be an example of "irrational" polypharmacy based on the belief that two medications are more effective than one (43), it may be a marker for stimulant misuse (that is, taking a stimulant not in

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accordance with physician guidance, such as for recreational purposes) or diversion to another individual, both of which have been reported as increasing among youths (44–46).

The significant increase in multiclass combinations involving an antipsychotic and stimulant is consistent with prior studies (47–49). It can be argued that the combination of antipsychotics and stimulants lacks pharmacologic rationality, with stimulants augmenting and antipsychotics blocking dopamine activity in the central nervous system. Physicians often combine these medications to treat comorbid ADHD and conduct disorder, as well as bipolar disorder (13). Addition of a second-generation antipsychotic to a stimulant regimen has also been recommended to treat ADHD occurring with aggression after behavioral interventions have been unsuccessful and ADHD symptoms have been treated (50), and an antipsychotic may be added to a stimulant regimen to augment its effects or address side effects (13). Nevertheless, as with the use of multiple antipsychotics, evidence of the effectiveness and safety of combined antipsychotics and stimulants is limited, whereas evidence of adverse events, most notably extrapyramidal symptoms, is growing (51–54).

Several limitations of this study need to be acknowledged. First, findings may not generalize to states with different Medicaid income eligibility requirements, policies related to prescription formularies, or demographic characteristics. Second, although a 30-day window is commonly used to measure polypharmacy, it captures different types of polypharmacy that may require further investigation. For example, it may capture cross-tapering or switching which would be of relatively short duration and possibly of less concern related to interactions. Third, prescription claims data, although reliable and valid, may overestimate polypharmacy because they are based on prescription fills, not actual medication consumption (55). On the other hand, pharmacy claims do not capture medications provided as samples by physicians or during hospitalization. Finally, absent more reliable diagnostic information than is available in claims data, as well as information about treatment plans and outcomes, it is not possible to gauge the appropriateness of polypharmacy regimens.

Conclusions

Despite these limitations, the study had several strengths, including the use of statewide Medicaid data and a detailed examination of patterns of polypharmacy over time and across eligibility groups, with controls for medication correlates. Our findings suggest that polypharmacy is not only prevalent but increasing across all Medicaid eligibility groups, with the highest rates for children in foster care. The higher rate of multiple medications for youths in foster care does not necessarily mean inappropriate use; however, it raises questions about quality of care. The increased use of two or more antipsychotics is especially worrisome given the lack of evidence of efficacy and the serious safety risks. To the extent that these high and increasing rates are occurring in other states, our findings make a powerful case for systemwide oversight and monitoring of psychotropic prescribing practices in the Medicaid population, especially for children in foster care, as well as for the implementation of quality improvement initiatives targeting prescription of multiple antipsychotics.

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The issue of pediatric pharmacotherapy is complex; children prescribed polypharmacy often have multiple, chronic, and comorbid psychiatric conditions that present major challenges for clinicians. Further research is clearly needed, preferably randomized controlled trial and naturalistic studies, not only to examine the reasons for polypharmacy but also to determine its association with outcomes. As Medicaid access changes, especially in light of the transformations stemming from the Affordable Care Act, multistate studies will be needed to identify the extent to which federal guidelines or state-level implementation decisions and prescribing practices influence polypharmacy rates among different eligibility groups.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Psychotropic medication patterns among Ohio Medicaid-enrolled youths prescribed any psychotropic medication, by eligibility category, 2002 and 2008

	Low-income household						Disability						Foster care					
	2002 (N= 16,362)		2008 (N=36,813)				2002 (N=6,061)		2008 (N=8,592)				2002 (N=3,829)		2008 (N=4,906)			
Characteristic	**N**	**%**	**N**	**%**	**Change (%)**	**p[a]**	**N**	**%**	**N**	**%**	**Change (%)**	**p[a]**	**N**	**%**	**N**	**%**	**Change (%)**	**p[a]**
Number of medications per child (M±SD)	1.4±.7		1.4±.7		5.2	<.001	1.6±.8		1.8±.9		9.2	<.001	1.7±.9		1.8±.9		7.8	<.001
Number of medications																		
1	11,568	70.7	23,864	64.8	–8.3	<.001	3,227	53.2	3,987	46.4	–12.8	<.001	2,056	53.7	2,261	46.1	–14.2	<.001
2	3,355	20.5	8,732	23.7	15.7	<.001	1,744	28.8	2,464	28.7	–.3	.538	1,015	26.5	1,308	26.7	.6	.853
3	1,074	6.6	3,052	8.3	26.4	<.001	746	12.3	1,364	15.9	29.0	<.001	536	14.0	849	17.3	23.6	<.001
4	293	1.8	904	2.5	37.4	<.001	245	4.0	562	6.5	61.9	<.001	165	4.3	363	7.4	71.7	<.001
≥5	72	.4	261	.7	61.4	.006	99	1.6	215	2.5	53.4	<.001	57	1.5	125	2.5	71.1	<.001
Polypharmacy																		
Any (≥3 medications)	1,439	8.8	4,217	11.5	30.8	<.001	1,090	18.0	2,141	24.9	38.3	<.001	758	19.8	1,337	27.3	37.9	<.001
Multiclass (≥3 medication classes)	1,199	7.3	3,327	9.0	23.3	<.001	865	14.3	1,679	19.5	36.4	<.001	660	17.2	1,096	22.3	29.7	<.001
Medication class																		
Stimulant	11,255	68.8	28,231	76.7	11.5	<.001	3,205	52.9	4,921	57.3	8.3	<.001	2,562	66.9	3,687	75.2	12.3	<.001
Antipsychotic	2,024	12.4	7,102	19.3	56.0	<.001	1,457	24.0	3,102	36.1	50.2	<.001	1,054	27.5	1,949	39.7	44.3	<.001
Antidepressant	4,076	24.9	6,081	16.5	–33.7	<.001	1,337	22.1	1,530	17.8	–19.3	<.001	1,205	31.5	1,177	24.0	–23.8	<.001
Alpha-agonist	1,987	12.1	5,957	16.2	33.2	<.001	1,047	17.3	2,006	23.4	35.2	<.001	666	17.4	910	18.6	6.6	.043
Mood stabilizer	2,473	15.1	4,601	12.5	–17.2	<.001	2,204	36.4	2,801	32.6	–10.4	<.001	782	20.4	967	19.7	–2.6	.721
Anxiolytic	419	2.6	666	1.8	–29.4	<.001	483	8.0	723	8.4	5.6	.038	90	2.4	84	1.7	–27.2	.703

[a] All p values are based on chi square linear trend tests for all 7 years and were adjusted with the Holm's procedure in order to conserve the type I error at .05.

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Table 2

Likelihood of time trends in polypharmacy and medication classes among youths prescribed any psychotropic medication, by Ohio Medicaid eligibility group[a]

Variable[c]	Low income		Disability		Foster care		OR comparison (p)[b]	
	AOR	99% CI	AOR	99% CI	AOR	99% CI	Low income vs. disability[d]	Low income vs. foster care[e]
≥3 medications	1.12	1.10–1.13	1.11	1.09–1.13	1.09	1.07–1.11	.323	.006
≥3 medication classes	1.10	1.09–1.12	1.09	1.07–1.11	1.06	1.03–1.08	.240	<.001
Medication class								
Stimulant	1.06	1.05–1.07	1.04	1.03–1.06	1.08	1.06–1.11	.001	.060
Antipsychotic	1.16	1.15–1.17	1.14	1.12–1.15	1.11	1.09–1.13	.003	.002
Antidepressant	.87	.86–.88	.89	.88–.91	.87	.86–.89	<.001	.057
Alpha-agonist	1.13	1.12–1.14	1.13	1.11–1.14	1.07	1.05–1.09	.486	<.001
Mood stabilizer	1.05	1.04–1.06	1.02	1.01–1.03	1.05	1.03–1.07	<.001	.961

[a] Each outcome measure came from a separate generalized estimating equation model and was adjusted for age, race-ethnicity, sex, area of residence, primary psychiatric diagnosis, number of other psychiatric disorders, presence of a chronic medical condition, number of annual outpatient mental health visits, and number of annual inpatient psychiatric hospitalizations.

[b] All p values were adjusted with the Holm's procedure to conserve the overall type I error at .05 per outcome as a result of multiple testing. All adjusted odds ratios are significant between groups (p<.001).

[c] Dummy variables. The reference group equals “no” for each variable listed.

[d] Tested whether the odds ratio for youths with a disability was significantly different from the odds ratio for youths from low-income families

[e] Tested whether the odds ratio for youths in foster care was significantly different from the odds ratio for youths from low-income families

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Table 3

Medication combinations among youths with multiclass polypharmacy regimens, by Ohio Medicaid eligibility group, 2002–2008[a]

	2002		2008						
Medicaid eligibility group	**N**	**%**	**N**	**%**	**Change**	**p[b]**	**AOR**	**99% CI**	**p**
Low income[c]									
Within–medication class combinations									
≥2 stimulants	31	2.6	229	6.9	165.6	<.001	1.17	1.10–1.25	<.001
≥2 antipsychotics	39	3.3	177	5.3	63.7	<.001	1.17	1.09–1.26	<.001
≥2 antidepressants	70	5.8	137	4.1	–29.5	<.001	.87	.82–.93	<.001
≥2 mood stabilizers	65	5.4	170	5.1	–5.7	.650	1.01	.95–1.07	>.99
Between–medication class combinations									
Stimulant/antipsychotic/alpha-agonist	110	9.2	579	17.4	89.1	<.001	1.24	1.18–1.29	<.001
Stimulant/antipsychotic/antidepressant	195	16.3	506	15.2	–6.7	.272	.99	.95–1.02	>.99
Stimulant/antipsychotic/anticonvulsant	115	9.6	469	14.1	46.9	<.001	1.10	1.06–1.15	<.001
Stimulant/alpha-agonist/antidepressant	161	13.4	306	9.2	–31.3	<.001	.84	.80–.88	<.001
Stimulant/alpha-agonist/anticonvulsant	84	4.5	153	4.6	2.2	.695	.99	.92–1.06	>.99
Stimulant/anticonvulsant/antidepressant	88	7.3	136)	4.1	–43.8	<.001	.85	.81–.90	<.001
Antipsychotic/anticonvulsant/antidepressant	125	10.4	260	7.8	–25.0	<.001	.93	.89–.97	<.001
Antipsychotic/alpha-agonist/anticonvulsant	54	4.5	230	6.9	53.3	<.001	1.14	1.07–1.22	<.001
Antipsychotic/alpha-agonist/antidepressant	58	4.8	200	6.0	25.0	<.001	1.09	1.02–1.17	.001
Anticonvulsant/alpha-agonist/antidepressant	68	5.7	120	3.6	–36.8	<.001	.92	.86–1.00	.024
Disability[d]									
Within–medication class combinations									
≥2 stimulants	13	1.5	97	5.8	284.7	<.001	1.23	1.13–1.35	<.001
≥2 antipsychotics	53	6.1	148	8.8	43.7	<.001	1.17	1.09–1.25	<.001
≥2 antidepressants	63	7.3	74	4.4	–39.6	<.001	.87	.80–.95	<.001
≥2 mood stabilizers	87	10.1	136	2.9	–19.5	.375	1.03	.97–1.10	.840
Between-medication class combinations									
Stimulant/antipsychotic/alpha-agonist	175	8.7	254	15.1	73.6	<.001	1.17	1.10–1.24	<.001
Stimulant/antipsychotic/antidepressant	101	11.7	171	10.2	–12.8	.165	.96	.91–1.01	.174
Stimulant/antipsychotic/anticonvulsant	93	10.8	210	12.5	15.7	.282	1.04	.99–1.10	.076
Stimulant/alpha-agonist/antidepressant	66	7.6	76	4.5	–40.8	<.001	.84	.77–.91	<.001
Stimulant/alpha-agonist/anticonvulsant	35	4.1	65	3.9	–4.9	>.99	.97	.88–1.06	>.99
Stimulant/anticonvulsant/antidepressant	36	4.2	45	2.7	–35.7	.084	.93	.84–1.02	.072
Antipsychotic/anticonvulsant/antidepressant	119	13.8	148	8.8	–36.2	<.001	.88	.83–.93	<.001
Antipsychotic/alpha-agonist/anticonvulsant	60	6.9	198	11.8	71.0	<.001	1.14	1.07–1.22	<.001
Antipsychotic/alpha-agonist/antidepressant	56	6.5	138	8.2	26.2	.132	1.02	.95–1.10	.428
Anticonvulsant/alpha-agonist/antidepressant	65	7.5	104	6.2	–17.3	.588	.97	.89–1.05	.295
Foster care[e]									
Within–medication class combinations									

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Medicaid eligibility group	2002 N	2002 %	2008 N	2008 %	Change	p *b*	AOR	99% CI	p
≥2 stimulants	10	1.5	87	7.9	426.6	<.001	1.30	1.18–1.44	<.001
≥2 antipsychotics	31	4.7	108	9.9	110.6	<.001	1.17	1.08–1.27	<.001
≥2 antidepressants	33	5.0	53	4.8	–4.0	.037	.92	.84–1.00	.028
≥2 mood stabilizers	42	6.4	80	7.3	14.1	>.99	1.00	.91–1.10	.952
Between–medication class combinations									
Stimulant/antipsychotic/alpha-agonist	55	8.3	160	14.6	75.9	<.001	1.16	1.08–1.24	<.001
Stimulant/antipsychotic/antidepressant	85	12.9	184	16.8	30.2	.754	.99	.94–1.05	>.99
Stimulant/antipsychotic/anticonvulsant	75	11.4	154	14.0	22.8	<.001	1.08	1.01–1.14	.006
Stimulant/alpha-agonist/antidepressant	51	7.7	60	5.5	–28.6	<.001	.88	.81–.96	<.001
Stimulant/alpha-agonist/anticonvulsant	27	4.1	20	1.8	–56.1	>.99	1.03	.90–1.17	>.99
Stimulant/anticonvulsant/antidepressant	35	5.3	36	3.3	–37.7	.084	.90	.81–.99	.028
Antipsychotic/anticonvulsant/antidepressant	107	16.2	134	12.2	–24.7	<.001	.89	.83–.94	<.001
Antipsychotic/alpha-agonist/anticonvulsant	37	5.6	93	8.5	51.8	.002	1.15	1.05–1.25	<.001
Antipsychotic/alpha-agonist/antidepressant	51	7.7	88	8.0	3.9	.782	1.03	.95–1.12	>.99
Anticonvulsant/alpha-agonist/antidepressant	42	6.4	45	4.1	–35.9	<.001	.94	.85–1.03	.219

a Each outcome measure came from a separate generalized estimating equation model and was adjusted for age, race-ethnicity, sex, area of residence, primary psychiatric diagnosis, number of other psychiatric disorders, presence of a chronic medical condition, number of annual outpatient mental health visits, and number of annual inpatient psychiatric hospitalizations. All p values were adjusted with the Holm's procedure to conserve the overall type I error at .05 per outcome as a result of multiple testing.

b Based on chi square linear trend test for all 7 years

c 2002, N=1,199; 2008, N=3,327

d 2002, N=865; 2008, N=1,679

e 2002, N=660; 2008, N=1,097