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# Patterns of Early Mental Health Diagnosis and Medication Treatment in a Medicaid-Insured Birth Cohort

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**IMPORTANCE** The increased use of psychiatric services in the US pediatric population raises concerns about the appropriate use of psychotropic medications for very young children.

**OBJECTIVE** To assess the longitudinal patterns of psychotropic medication use in association with diagnosis and duration of use in a Medicaid-insured birth cohort.

**DESIGN, SETTING, AND PARTICIPANTS** A cohort design was applied to computerized Medicaid administrative claims data for 35 244 children born in a mid-Atlantic state in 2007 and followed up for up to 96 months through December 31, 2014. Children were included in the birth cohort if they had an enrollment record at birth or within 3 months of birth and at least 6 months of continuous enrollment from birth. The cohort represents 92.2% of 38 225 Medicaid-insured newborns in 2007.

**EXPOSURES** Mental health treatments from birth through age 7 years.

**MAIN OUTCOMES AND MEASURES** Cumulative incidence of first psychiatric diagnosis and psychotropic medication use (monotherapy or concomitant use of psychotropic medications) from birth through age 7 years, total and by sex, and the cumulative incidence of the use of psychosocial services (age, 0-7 years) as well as the annual duration of medication use (ie, number of days of psychotropic medication use among children 3-7 years of age).

**RESULTS** Of the 35 244 children in the cohort, 17 267 were girls and 17 977 were boys. By age 8 years, 4550 children in the birth cohort (19.7% [percentage adjusted for right censoring]) had received a psychiatric diagnosis (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 290-319); 2624 of these diagnoses (57.7%) were behavioral (codes 312, 313, or 314). Girls were more likely than boys to receive an incident psychiatric diagnosis of adjustment disorder (355 of 1598 [22.2%] vs 427 of 2952 [14.5%]; $P < .001$) or anxiety disorder (114 of 1598 [7.1%] vs 120 of 2952 [4.1%]; $P < .001$). By age 8 years, 2196 children in the cohort (10.2% [percentage adjusted for right censoring]) had received a psychotropic medication. Among medication users, 1763 of 2196 (80.5% [percentage adjusted for right censoring]) received monotherapy, 343 of 2196 (16.4% [percentage adjusted for right censoring]) received 2 medication classes concomitantly, and 90 of 2196 (4.3% [percentage adjusted for right censoring]) received 3 or more medication classes concomitantly for 60 days or more (range, 78-180 days). The annual median number of days of psychotropic medication use among medicated children increased with age, reaching 210 of 365 days for children 7 years of age. Among children 7 years of age, the median number of days of use of an antipsychotic (193 days [interquartile range, 60-266 days]), stimulant (183 days [interquartile range, 86-295 days]), or α-agonist (199 days [interquartile range, 85-305 days]) exceeded half of the year.

**CONCLUSIONS AND RELEVANCE** Medicaid-insured children received substantial mental health services and had prolonged exposure to psychotropic medications in the early years of life. These findings highlight the need for outcomes research in pediatric populations.

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Author Audio Interview

Supplemental content

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The increase in the prevalence of treated psychiatric diagnoses and the use of psychotropic medications in pediatric populations in the United States[1-5] has generated public health concerns,[6-8] particularly regarding the expanded use of antipsychotics for the behavioral management of children.[9] Most pediatric psychotropic medication use (67%)[10] is not approved by the US Food and Drug Administration and is therefore prescribed off-label, whereby the evidence for the benefits is not available to balance the risk of potential harm.[10-12] The differential use of psychotropic medications among poor, near-poor, and foster care children, who are more likely than privately insured youth to receive psychotropic medications,[13-15] raises social and ethical concerns. Although there is evidence to support the efficacy of stimulants in the management of attention-deficit /hyperactivity disorder (ADHD)[16] and antipsychotics for aggression in autism spectrum disorders (ASD),[17] concerns continue unabated about off-label use and the short- and long-term neurobiological effects of early exposure to complex combinations of medications in community populations.[18,19]

During the past 20 years, cross-sectional studies have assessed the trends in psychiatric diagnosis and treatment in pediatric populations.[20-25] However, little is known about the longitudinal patterns of pediatric use of psychiatric services.[26,27] To our knowledge, there has been no assessment of the cumulative use of mental health services from birth in a Medicaid-insured cohort. In addition, although there is evidence to support sex differences in the prevalence of psychiatric diagnosis and treatment,[3,28,29] sex differences in the patterns of initiation of psychiatric services among children are largely unknown.

Furthermore, little research has been devoted to developmental psychopharmacology despite concerns that early exposure to such medications in utero or in the preschool years could potentially alter physical, cognitive, and emotional development.[30-33] This knowledge gap and the controversies surrounding the safety of pediatric psychotropic medication use highlight the need to understand the extent of pediatric mental health services in a longitudinal framework.

We assessed the cumulative incidence of a first psychiatric diagnosis and first use of psychotropic medication class use in a Medicaid-insured population of the same children across 8 years. To appreciate the context of service use, we assessed the cumulative incidence of psychosocial service use and the duration of psychotropic class use among medication users.

### Key Points

**Question** What is the cumulative incidence of psychiatric diagnosis and use of psychotropic medications in a Medicaid-insured birth cohort by age 8 years?

**Findings** In this cohort study of 35 244 newborns, 19.7% received a psychiatric diagnosis and 10.2% received a psychotropic medication by age 8 years; 20% of medication users received 2 or more medication classes concurrently for 60 days or more. At age 7 years, half or more of the medicated children had more than 200 days of drug exposure.

**Meaning** Early exposure to psychotropic medications has implications for long-term safety and highlights the need for outcomes research in young children.

## Methods

### Study Design

The cohort was selected from computerized Medicaid claims data for newborns in a mid-Atlantic state in 2007 (eFigure in the Supplement) and followed up for 96 months or less through December 31, 2014. Enrollees included in the birth cohort had an enrollment record within 3 months of birth and 6 months or more of contiguous enrollment. Enrollees were lost to follow-up if they were missing 6 or more contiguous months. This study was reviewed and approved by the University of Maryland, Baltimore, institutional review board. Because deidentified, secondary administrative claims data were used, parental consent or waiver was not required.

We linked enrollment files to outpatient and physician files and dispensed prescription drug files to assess *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnosis codes, procedure codes, and date of service. The prescription drug files comprise prescription drug names and dispensing dates.

### Outcome Measures

The outcome measures were the cumulative incidence of psychiatric diagnoses and psychotropic medication class use, both total and by enrollee characteristics; the cumulative incidence of the use of psychosocial services; and the annual duration of psychotropic medication class use (ages, 3-7 years). In addition, we assessed sex-specific differences in incident psychiatric diagnosis and psychotropic medication class use.

#### Psychiatric Diagnoses

Using *ICD-9-CM* codes, we identified the annual cumulative percentage of children who received a clinician-reported diagnosis from birth through age 7 years, in total and stratified by race/ethnicity, Medicaid eligibility group, and residential locale. To improve the validity of clinician-reported diagnoses, we required 2 or more diagnosis claims on separate days.[34] Eight diagnostic groups were examined in the following categories: ADHD, disruptive disorders, learning disorder (LD), adjustment disorder, anxiety disorders, depression, ASD, and other psychiatric diagnoses (eTable 1 in the Supplement).

#### Psychotropic Medication Classes

We assessed the annual cumulative percentage of first psychotropic medication dispensing from birth through age 7 years, in total and stratified by race/ethnicity, Medicaid eligibility, and residential locale. Medications were grouped into 6 classes: stimulants, α-agonists, antidepressants, antipsychotics, anxiolytic and hypnotics, and other (ie, atomoxetine hydrochloride and anticonvulsant-mood stabilizers). Enrollees with *ICD-9-CM* codes for seizure disorder were excluded if they had no codes for psychiatric or developmental disorder diagnoses. Among medica-

tion users, we defined concomitant regimens as 2 or 3 or more concurrent dispensings from different medication classes for 60 days or more.

#### Additional Outcomes

Using *Current Procedural Terminology* codes, we assessed the annual cumulative percentage of the cohort who received a psychosocial service (ie, individual, family, or group psychotherapy). Medication use was minimal by age 2 years. Consequently, we estimated the annual duration of use among continuously enrolled children 3 to 7 years of age (n = 15 207). Finally, across 8 years, we assessed the distribution of any psychiatric diagnosis among medication users according to medication class.

### Covariates

Study covariates included sex, race/ethnicity (white, African American, Hispanic, and other or missing), enrollees' residential locale (urban, suburban, or rural county) and Medicaid eligibility group (children in foster care, recipients of Supplemental Security Income [SSI], and youths eligible by family income at or below the federal poverty level [Temporary Assistance for Needy Families] or family income ≥200%-300% above the federal poverty level [State Children's Health Insurance Plan]).

### Statistical Analysis

Using survival analysis, we estimated the 8-year cumulative incidence of psychiatric diagnosis and psychotropic medication class use, total and by covariates. In addition, we estimated the sex-specific incidence of first psychiatric diagnosis and first psychotropic medication class use. We used Kaplan-Meier estimators to address loss to follow-up owing to administrative censoring. For each 1-year interval, we calculated the cumulative incidence as the number of children with the event of interest divided by the number of children at risk. Children who were lost to administrative censoring were not counted as at risk. Cox proportional hazards regression models were used to assess statistical differences in the cumulative incidence of psychiatric diagnosis and psychotropic medication use while adjusting for covariates.

We estimated the cumulative incidence of the use of psychosocial services using Kaplan-Meier estimators. Among continuously enrolled children 3 to 7 years of age, we calculated annual unadjusted median number of days of psychotropic medication class use by total and for selected medication classes among medicated children. Using quantile regression models, we estimated the adjusted median number of days of medication class use according to eligibility group. Models were adjusted for study covariates. With $\chi^2$ analyses, we compared the sex-specific proportions of incident psychiatric diagnoses and psychotropic medication class across 8 years. Statistical analyses were performed with SAS, version 9.4 (SAS Institute Inc), and statistical graphics were plotted with R, version 3.4.2 (R Foundation for Statistical Computing). $P < .05$ (2-sided) was considered significant.

## Results

### Birth Cohort Characteristics

The cohort (N = 35 244) represents 92.2% of 38 225 Medicaid enrollees who were born and enrolled in 2007 in this mid-Atlantic state. Although the cohort did not differ by sex (17 267 girls vs 17 977 boys), it was predominantly African American (15 105 [42.9%]), with a similar distribution of white (8330 [23.6%]) and Hispanic (7254 [20.6%]) children (eTable 2 in the Supplement).

### Main Outcomes

#### First Psychiatric Diagnosis

The cumulative incidence of psychiatric diagnosis linearly increased from 0.3% (n=107 [percentage adjusted for right censoring]) by age 1 year to 19.7% (n=4550 [percentage adjusted for right censoring]) by age 8 years (**Figure 1**A). Across 8 years, 57.7% (2624 of 4550) of the diagnoses were behavioral. Attention-deficit/hyperactivity disorder and LD accounted for 43.9% (1999 of 4550) and 31.6% (1438 of 4550) of the psychiatric diagnoses, respectively (eTable 3 in the Supplement).

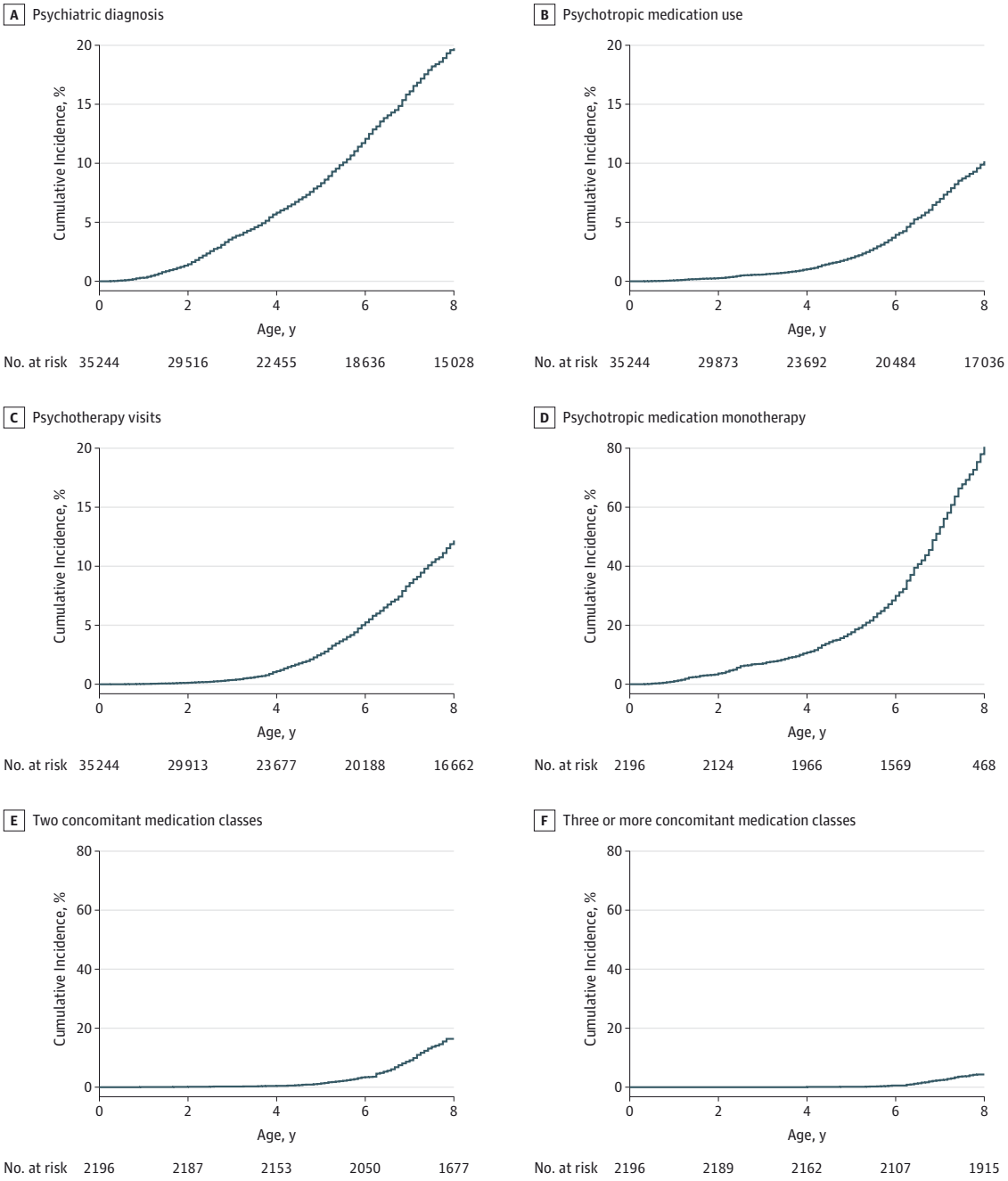
By age 8 years, the cumulative incidence of diagnosis was greater among white children (27.6% [1372 of 8330; percentage adjusted for right censoring]) compared with African American children (21.4% [2206 of 15105; percentage adjusted for right censoring]; hazard ratio [HR], 0.72; 95% CI, 0.67-0.77) and Hispanic children (10.2% [528 of 7254; percentage adjusted for right censoring]; HR, 0.54; 95% CI, 0.48-0.60) (eTable 4 in the Supplement). Furthermore, more than half of the children receiving foster care (58.8% [413 of 948; percentage adjusted for right censoring]; HR, 4.45; 95% CI, 4.01-4.93) and those eligible for SSI (62.7% [680 of 1266; percentage adjusted for right censoring]; HR, 6.32; 95% CI, 5.82-6.87) received a diagnosis in contrast to 16.6% (3457 of 33030 [percentage adjusted for right censoring]) of income-eligible children. Compared with residents of suburban counties (10.6% [785 of 12152; percentage adjusted for right censoring]), residents of urban counties (24.3% [2706 of 16297; percentage adjusted for right censoring]; HR, 1.95; 95% CI, 1.79-2.12) or rural counties (23.7% [1059 of 6795; percentage adjusted for right censoring]; HR, 1.75; 95% CI, 1.58-1.94) were twice as likely to receive a diagnosis (eTable 5 in the Supplement).

Boys were more likely than girls to receive a diagnosis of ADHD at their first psychiatric visit (30.0% [885 of 2952] vs 22.4% [358 of 1598]; $P < .001$). Compared with boys, girls were more likely to receive a diagnosis of adjustment disorder (22.2% [355 of 1598] vs 14.5% [427 of 2952]; $P < .001$) or anxiety disorder (7.1% [114 of 1598] vs 4.1% [120 of 2952]; $P < .001$). Regardless of sex, nearly one-third of diagnosed children received a diagnosis of LD; small proportions of children received a diagnosis of depression, ASD, or other psychiatric disorder (**Figure 2**).

#### First Psychotropic Medication Use

The 8-year cumulative incidence of psychotropic medication class use was 10.2% (2196 of 35 244 [percentage adjusted for right censoring]) (Figure 1B). By age 8 years, 74.9% (1645 of

Figure 1. Cumulative Incidence of Psychiatric Service Use in a Medicaid-Insured Birth Cohort

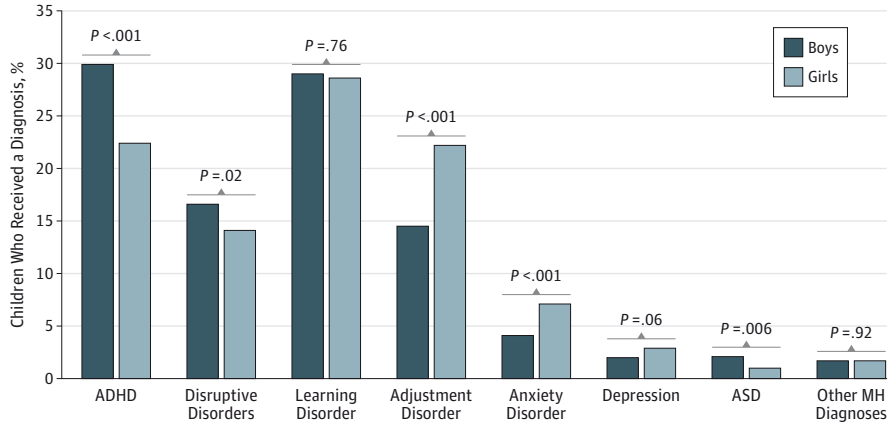



A total of 35 244 children were in the cohort. A, Psychiatric diagnosis. B, Psychotropic medication use. C, Psychotherapy visits. D, Psychotropic medication monotherapy. E, Patients taking 2 concomitant medication classes. F, Patients taking 3 or more concomitant medication classes. A, B, and C show patterns of time to service across 8 years. D, E, and F show patterns according to medication regimen.

2196) of medication users had received a stimulant, 32.1% (706 of 2196) had received an α-agonist, and 19.5% (429 of 2196) had received an anxiolytic or hypnotic medication (eTable 6 in the Supplement).

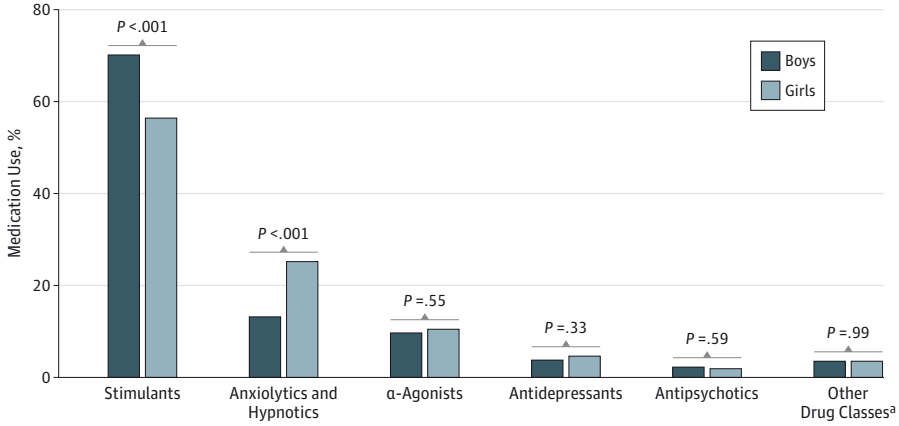
eTable 7 in the Supplement presents the cumulative incidence of psychotropic class use by total and by enrollee characteristics. White children (17.0% [781 of 8330; percentage adjusted for right censoring]; HR, 3.39; 95% CI, 2.83-4.07) and African American children (10.3% [1006 of 15 105; percentage adjusted for right censoring]; HR, 2.08; 95% CI, 1.74-2.48) were significantly more likely to receive a psychotropic medication by age 8 years compared with their Hispanic counterparts (3.2% [163 of 7254; percentage adjusted for right censoring]). Furthermore, we observed differences in cumulative psychotropic use according to eligibility group (children receiving foster care, 29.1% [175 of 948; percentage adjusted for

Figure 2. Seven Diagnostic Subgroups of Incident (First) Psychiatric Diagnosis by Sex




By the age of 8 years, 22.4% of girls (358 of 1598) had a diagnosis of attention-deficit/hyperactivity disorder (ADHD) as their incident psychiatric disorder compared with 30.0% of boys (885 of 2952) ($P < .001$). ASD indicates autism spectrum disorder; MH, mental health.

Figure 3. Six Medication Classes of First Psychotropic Medication Use by Sex




Boys were significantly more likely than girls to receive a stimulant (70.1% [1059 of 1510] vs 56.4% [387 of 686]; $P < .001$), whereas girls were significantly more likely than boys to receive an anxiolytic and hypnotic as their first psychotropic medication (25.2% [173 of 686] vs 13.2% [199 of 1510]; $P < .001$).

[a] Atomoxetine and anticonvulsant-mood stabilizers.

right censoring]; HR, 3.24; 95% CI, 2.77-3.79; those eligible for SSI, 37.1% [382 of 1266; percentage adjusted for right censoring]; HR, 5.20; 95% CI, 4.64-5.82; and income-eligible children, 8.3% [1637 of 33 030; percentage adjusted for right censoring]) and residential locale (rural, 16.4% [692 of 6789; percentage adjusted for right censoring]; HR, 2.13; 95% CI, 1.85-2.45; suburban, 4.8% [345 of 12 144; percentage adjusted for right censoring]; or urban counties, 11.2% [1159 of 16 311; percentage adjusted for right censoring]; HR, 1.51; 95% CI, 1.33-1.72) (eTable 8 in the Supplement).

**Figure 3** presents sex-specific data on first use of a psychotropic medication. Boys were more likely than girls to initiate psychotropic treatment with stimulants (70.1% [1059 of 1510] vs 56.4% [387 of 686]; $P < .001$), whereas girls were twice as likely as boys to initiate treatment with anxiolytics and hypnotics (25.2% [173 of 686] vs 13.2% [199 of 1510]; $P < .001$). This finding is particularly concerning because there is insufficient evidence to support the use of anxiolytics and hypnotics as first-line treatment for pediatric mental health conditions.[35] In addition, 11.5% of children who initiated treatment with psychotropic medication received chloral hydrate, 2.2% received a nonbenzodiazepine medication, and 86% received a benzodiazepine, a highly potent subclass of anxiolytics with a high potential for addiction and dependence in both pediatric and adult populations.[36]

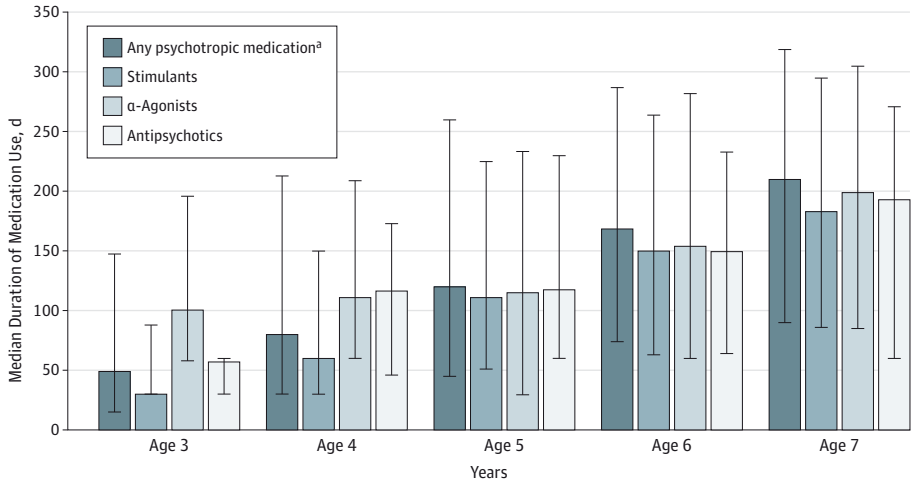
By age 8 years, 1763 of 2196 children (80.5%) using psychotropic medication had received monotherapy, whereas concomitant psychotropic use for 60 days or more (range, 78-180 days) was observed among 343 of 2196 children (16.4%; percentage adjusted for right censoring) with 2 concurrent psychotropic classes and 90 of 2196 children (4.3%; percentage adjusted for right censoring) with 3 or more concurrent psychotropic classes (Figure 1D-F). The concurrent use of 3 or more medications was 3 to 4 times more common among children receiving foster care (11.6%; HR, 4.26; 95% CI, 2.29-7.89) and those eligible for SSI (18.4%; HR, 6.37; 95% CI, 4.01-10.13) than among income-eligible children (3.6%) (eTable 9 in the Supplement).

## Other Outcomes

### Use of Psychosocial Services

The cumulative incidence of use of psychosocial services reached 12.2% (2612 of 35244 [percentage adjusted for right censoring]) by age 8 years; these services were predominantly family therapy

Figure 4. Annual Psychotropic Medication Class Use According to Duration




Age-specific annual duration of psychotropic medication use among children 3 to 7 years of age (n = 15 207). Error bars indicate interquartile range.

[a] Includes 7 psychotropic medication classes: stimulants, α-agonists, antipsychotics, atomoxetine, anxiolytics and hypnotics, antidepressants, and anticonvulsant-mood stabilizers.

(75.1% [1962 of 2612]), followed by individual therapy (23.0% [602 of 2612]) and group therapy (1.8% [48 of 2612]). Boys were more likely than girls to receive psychosocial services (14.8% [1626 of 17 977; percentage adjusted for right censoring] vs 9.4% [986 of 17 267; percentage adjusted for right censoring]; HR, 1.56; 95% CI, 1.44-1.69). Children receiving foster care (45.2% [282 of 948; percentage adjusted for right censoring]; HR, 4.78; 95% CI, 4.21-5.42) and those eligible for SSI (24.6% [250 of 1266; percentage adjusted for right censoring]; HR, 2.28; 95% CI, 1.99-2.60) were more likely than their income-eligible counterparts (10.6% [2080 of 33 030; percentage adjusted for right censoring]) to receive psychosocial services.

### Duration of Medication Use

From ages 3 to 7 years among children using psychotropic medication, the annual unadjusted median number of days of any use of psychotropic medication ranged from 49 days (interquartile range [IQR], 15.0-147.5 days) for 112 children to 210 days (IQR, 90-319 days) for 1401 children. Among those receiving antipsychotics, medication use ranged from 57 days (IQR, 30-60 days) for 9 children to 193 days (IQR, 60-266 days) for 87 children. Among those receiving stimulants, medication use ranged from 30 days (IQR, 30-88 days) for 25 children to 183 days (IQR, 86-295 days) for 1213 children. Among those receiving α-agonists, medication use ranged from 101 days (IQR, 58-196) for 18 children to 199 days (IQR, 85-305 days) for 481 children (**Figure 4**). Compared with income-eligible children, children receiving foster care had 153 (95% CI, 76.4-231.5) additional days of psychotropic medication exposure from ages 3 through 7 years, and children eligible for SSI had 193 (95% CI, 117.2-270.3) additional days of psychotropic medication exposure from ages 3 through 7 years (eTable 10 in the Supplement).

## Discussion

Our findings reveal substantial early use of mental health services from birth through age 7 years. A diagnosis of ADHD and the use of stimulants in girls were only modestly lower than for boys. Compared with boys, girls were more likely to initiate psychotropic use with an anxiolytic or hypnotic medication. Overall, approximately 20% of medicated children (433 of 2196 [percentage adjusted for right censoring]) received 2 or more classes concomitantly for 60 days or more. At age 7 years, half or more of the children taking psychotropic medications had more than 200 days of drug exposure. Our findings capture the occurrence of a first psychiatric diagnosis in the same children across 8 years. Characterizing the first psychiatric diagnosis provides insight into how and when children enter mental health service treatment, critical information for understanding how best to address pediatric mental health needs and future research priorities.

### Diagnostic Patterns

Our assessment of the incidence of ADHD, the leading clinician-reported psychiatric diagnosis, showed that 9.4% (1999 of 35 244 [percentage adjusted for right censoring]) of the cohort (13.2% of boys [1444 of 17 977; percentage adjusted for right censoring] vs 5.4% of girls [555 of 17 267; percentage adjusted for right censoring]) had an ADHD diagnosis by age 8 years. This finding is consistent with national estimates from a parent-reported telephone survey of clinician-diagnosed ADHD.[37] In comparison with a 1990 estimate of the cumulative incidence of research-identified ADHD in a largely white regional birth cohort in Minnesota,[38] our findings suggest a 2-fold greater cumulative incidence of ADHD by 2014. Furthermore, we report a 2.4:1 ratio of male to female cumulative incidence of ADHD by age 8 years, with a male to female ratio of first psychiatric diagnosis that suggests that an increasing proportion of girls (1.3:1) are recipients of an initial mental health service with an ADHD diagnosis. This narrowing margin underscores the need to explore and understand the reported elevated risk for comorbid psychopathologic conditions among girls with ADHD.[39]

Learning disorder was the second most common psychiatric diagnosis in the cohort (5.3% [1438 of 35 244; percentage adjusted for right censoring] by age 8 years). Our cumu-

lative assessment shows that 81.6% of LD cases (1173 of 1438) in the cohort were identified by age 3 years. This finding is particularly interesting because early detection and management (eg, special educational services or speech-language therapy) is key to controlling long-range consequences of LD.[40] Only 17.5% of the children with LD (252 of 1438) received psychotherapy during the 8-year study period, which suggests a need to promote nonmedication therapy and to educate parents and caregivers on the role of nonmedication therapy in LD management, particularly in Medicaid populations.

### Medication Use

Cumulatively, 10.2% of the cohort (2196 of 35 244 [percentage adjusted for right censoring]) received a psychotropic medication by the age of 8 years. Of these medication users (n = 2196), 74.9% (n = 1645) received a stimulant, most of whom (89.7% [n = 1475]) initiated use during school years (ages 5-7 years). Our cumulative findings suggest that most psychotropic medication use in the cohort was for behavioral management, with a lower male to female ratio (1.2:1) of stimulant use compared with a 1998 statewide survey of elementary school students in this state (3.5:1).[41] These findings emphasize a narrowing of the stimulant medication to sex ratio among young children.

An 8-year assessment of psychiatric diagnostic groups among children using psychotropic medication shows that approximately 90% of those who received stimulants (1440 of 1645 [87.5%]), atomoxetine (102 of 114 [89.5%]), or α-agonists (616 of 706 [87.3%]) had a behavioral diagnosis. This finding is consistent with the recommendations for the pharmacologic management of behavioral disorders.[42,43] However, while there is clinical evidence to support the use of antipsychotics for children with schizophrenia and bipolar disorder and for some children with ASD, only 15.1% of children (24 of 159) in the birth cohort using antipsychotics had a diagnosis of ASD, 1.9% (3 of 159) had a diagnosis of schizophrenia, and 6.3% (10 of 159) had a diagnosis of bipolar disorder (eTable 11 in the Supplement). This finding suggests that antipsychotics are largely used for off-label behavioral management in the birth cohort, highlighting the need for a delicate benefit-risk balance.

Overall, given the considerable incidence of trauma and physical abuse among very young Medicaid enrollees,[44] the expanded use of psychotropic medications in this birth cohort is not surprising. Our cumulative estimates highlight the extent of early exposure to psychotropic medication and support the need for drug safety monitoring and outcomes research to provide evidence for the benefit-risk balance, particularly in the early years of life.[45]

### Concomitant Medication Use

Cumulatively, 19.7% of our birth cohort (433 of 2196) received 2 or more psychotropic medications concomitantly for 60 days or more, with most concomitant use beginning after 5 years of age. Our estimate of concomitant medication use is conservative, requiring 60 or more days of overlap. Among children using 2 concomitant medications, the leading pair included stimulants and α-agonists, commonly used for behavioral management.[43] In light of the recent findings associating pediatric use of antipsychotics with serious metabolic adverse effects,[46,47] the greater use of antipsychotic medication in combination with other psychotropics among Medicaid enrollees suggests, at a minimum, the need for improving antipsychotic-related laboratory assay monitoring[48] at baseline and at regular follow-ups to guard against treatment-emergent conditions such as type 2 diabetes,[46,47] particularly for behavioral disorder management.[45]

### Duration of Medication Use

Psychotropic exposure in young Medicaid enrollees can be lengthy, particularly among children receiving foster care.[49] Our assessment shows a linear increase in the median duration of psychotropic use from ages 3 to 7 years. Although antipsychotic use was initiated in a modest number of children at the age of 7 years (n = 87), 50.6% of them (n=44) received antipsychotics for 6 months or more in 2014. These findings are particularly notable in light of emerging safety research. Longitudinal exposures to antipsychotics alone[46,47] or antipsychotics with antidepressants[47] increased the risk of type 2 diabetes with increasing duration of use.

### Limitations and Strengths

Several limitations of our study should be noted. First, this study uses Medicaid data from a mid-Atlantic state and may not generalize to other Medicaid populations or privately insured populations. Second, we analyzed clinician-reported diagnoses that are less reliable than research-identified diagnoses. However, to improve validity, each diagnosis was confirmed by more than 1 claim on different days.[34] Third, we captured dispensed medications and not medication consumption. Fourth, while a comparison of multiple cohorts from overlapping years could reveal temporal changes in use patterns, we assessed a single cohort across 8 years because the literature suggests minimal temporal changes in the study population and age range across 8 years.[50]

Finally, in the absence of data on death or migration, we could not account for loss to follow-up. However, more than half of the cohort was insured by Medicaid across 8 years. Much greater population retention is recorded in previous community-based cohort studies that have contributed to our understanding of early-onset psychiatric disorders.[31,51-53] In recent times, claims data have been enhanced with clinical research by Barbaresi and colleagues[38,54-56] for longitudinal studies. Our contribution is more modest because we captured services in a single-state Medicaid population without critically important data on clinical outcomes or academic performance. Nevertheless, an important strength of this longitudinal study is that it provides an 8-year cumulative incidence and duration of psychiatric service use in the same children and captures long-term exposures to medications prescribed largely off-label.

## Conclusions

Early exposure to psychotropic medications and prolonged duration of use have implications for long-term safety. The data

highlight the need for safety and outcomes research, particularly for health outcomes such as metabolic imbalance, weight gain, and sleep disturbances after initiation of psychotropic medication for very young children. Effectiveness research in observational cohorts should include functional improvements (eg, school performance and social relationships). The role of including parent training for medication monitoring is critical.

## ARTICLE INFORMATION

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**Author Contributions:** Ms Pennap had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
*Study concept and design:* Pennap, Zito, Santosh, Magder.
*Acquisition, analysis, or interpretation of data:* Pennap, Zito, Santosh, Tom, Onukwugha.
*Drafting of the manuscript:* Pennap, Zito.
*Critical revision of the manuscript for important intellectual content:* All authors.
*Statistical analysis:* Pennap.
*Administrative, technical, or material support:* Pennap.
*Study supervision:* Zito.

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