Published in final edited form as:
Pediatrics. 2008 March ; 121(3): e441–e448. doi:10.1542/peds.2007-0984.

Psychotropic Medication Use Among Medicaid-Enrolled Children With Autism Spectrum Disorders

David S. Mandell, ScD[a,b,c], **Knashawn H. Morales, ScD**[d], **Steven C. Marcus, PhD**[c,e], **Aubyn C. Stahmer, PhD**[f], **Jalpa Doshi, PhD**[c,g], and **Daniel E. Polsky, PhD**[c,g]

[a] Department of Psychiatry, University of Pennsylvania, Philadelphia, Pennsylvania

[b] Department of Pediatrics, University of Pennsylvania, Philadelphia, Pennsylvania

[d] Department of Biostatistics and Epidemiology, University of Pennsylvania, Philadelphia, Pennsylvania

[g] Division of General Internal Medicine, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania

[c] Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, Pennsylvania

[e] School of Social Policy and Practice, University of Pennsylvania, Philadelphia, Pennsylvania

[f] Child and Adolescent Services Research Center, Rady Children's Hospital, San Diego, California

Abstract

OBJECTIVE—The objective of this study was to provide national estimates of psychotropic medication use among Medicaid-enrolled children with autism spectrum disorders and to examine child and health system characteristics associated with psychotropic medication use.

METHODS—This cross-sectional study used Medicaid claims for calendar year 2001 from all 50 states and Washington, DC, to examine 60 641 children with an autism spectrum disorder diagnosis. Logistic regression with random effects was used to examine the child, county, and state factors associated with psychotropic medication use.

RESULTS—Of the sample, 56% used at least 1 psychotropic medication, 20% of whom were prescribed ≥3 medications concurrently. Use was common even in children aged 0 to 2 years (18%) and 3 to 5 years (32%). Neuroleptic drugs were the most common psychotropic class (31%), followed by antidepressants (25%) and stimulants (22%). In adjusted analyses, male, older, and white children; those who were in foster care or in the Medicaid disability category; those who received additional psychiatric diagnoses; and those who used more autism spectrum disorder services were more likely to have used psychotropic drugs. Children who had a diagnosis of autistic disorder or who lived in counties with a lower percentage of white residents or greater urban density were less likely to use such medications.

CONCLUSIONS—Psychotropic medication use is common among even very young children with autism spectrum disorders. Factors unrelated to clinical presentation seem highly associated with prescribing practices. Given the limited evidence base, there is an urgent need to assess the risks,

Address correspondence to David S. Mandell, ScD, University of Pennsylvania School of Medicine, Center for Mental Health Policy and Services Research, 3535 Market St, Third Floor, Philadelphia, PA 19104. mandelld@mail.med.upenn.edu.

Financial Disclosure: Dr Marcus has received grants from McNeil and has been a consultant to Eli Lilly and Company, Bristol Myers Squibb, Pfizer, and Astra Zeneca; the other authors have indicated they have no financial relationships relevant to this article to disclose.

benefits, and costs of medication use and understand the local and national policies that affect medication use.

Keywords

autistic disorder; Asperger disorder; psychotropic drugs; pharmacoepidemiology; physician practice patterns; Medicaid

---

The purpose of this study was to provide a national estimate of psychotropic medication use among children who have autism spectrum disorders (ASDs) and are served by the Medicaid system and to examine child and local area characteristics that are associated with their use. ASDs comprise a group of similar developmental disorders that manifest in the first 3 years of life and are characterized by impairments in reciprocal social interaction and communication and by the presence of restricted behaviors, interests, and activities.[1]

There is ongoing debate regarding the role of psychotropic agents in ASD management.[2,3] Although no medications are known to address the core symptoms of ASDs, they often are prescribed as adjunctive therapy to address symptoms such as aggression, self-injurious behaviors, stereotypies, and hyperactivity.[4–6] Many medications have been tested with varying levels of scientific rigor,[7] but only risperidone, an atypical neuroleptic that reduces aggression and irritability, has received Food and Drug Administration approval for the treatment of these symptoms in individuals with ASDs.[8]

Medication use is common among children with ASDs and seems to be increasing. A 1995 survey found that 30% of children with ASDs were using some psychotropic medication[9]; follow-up studies 6 years later found 46% using them.[10,11] Neuroleptic agents were most common in 2 of 3 studies,[9,11] with antidepressants the most common in the third.[10] In 2001, 21% were using >1 drug, compared with 8% in 1995. A 2005 international Internet survey found that 52% of parents reported that their children were using psychotropic drugs.[12] These studies provided important information regarding psychotropic medication use in children with ASDs, but all relied on parent report, the validity of which is unknown. With 1 exception,[12] they sampled relatively small geographic areas, and all except 1[13] had low response rates with high potential for selection bias.

We used the Medicaid administrative claims (rather than self-report) for all beneficiaries from all 50 states and the District of Columbia to derive national estimates of psychotropic medication use among Medicaid-enrolled children with ASDs overall and by class of medication. We then linked state- and county-level characteristics to the Medicaid records to explore variation in the use of these medications among children with ASDs as a function of area-level characteristics as well as children's demographic and clinical characteristics. Given that the rising numbers of children who receive a diagnosis of ASD[14,15] combined with the considerable expense associated with their care[16–18] has caused states and local jurisdictions to take varied approaches to addressing their needs,[19–21] understanding what may drive geographic variation in medication use is of great policy significance. What is known is that there is considerable county- and state-level variation in the identification of children with ASD, which has been associated with education-related spending, urbanicity, and health care resources.[19,22] Other studies also have found rural/urban[23] and ethnic differences in ASD identification.[24,25] Little is known, however, about how child characteristics and local resources influence medication treatment; therefore, in addition to estimating the prevalence of psychotropic medication use among children with ASDs, we explored the relative contributions of child, county, and state characteristics to its use.

METHODS

Data Sources

Child-level data from Medicaid demographic, eligibility, encounter, and pharmacy files were extracted from the 2001 Centers for Medicare and Medicaid Services Medicaid Analytic Extract data files of all Medicaid claims from all 50 states and the District of Columbia. County-level variables were obtained from the Area Resource File.[26] Data in the Area Resource File are obtained from the Bureau of the Census, the American Hospital Association, the American Medical Association, and the Centers for Disease Control and Prevention, among other agencies. The number of children in the autism category of special education by state in 2001 was obtained from the US Department of Education.[27]

Sample

The study sample included all 60 641 children who were younger than 21 years and received a primary or secondary diagnosis for autistic disorder (*International Classification of Diseases, Ninth Revision* [ICD-9] code 299.00) or Asperger disorder/pervasive developmental disorder, not otherwise specified (299.8 or 299.9) associated with a Medicaid reimbursed claim in 2001.[28] Children were classified as having autistic disorder or another spectrum disorder on the basis of the most commonly occurring diagnosis in their claims. This sample represents 0.26% of the 23.3 million Medicaid-enrolled children in 2001.

Variables

Psychotropic Medication Use—Our primary outcome measure was any psychotropic medication use. We also counted the number of psychotropic medications used concurrently and use by medication class. Concurrent use was coded when a child had prescriptions for ≥3 medications in different classes overlapping for at least 30 days. Medication class was categorized according to the American Hospital Formulary System[29] and included neuroleptic, antidepressant, stimulant, anticonvulsant, anxiolytic, and hypnotic agents.

Child Characteristics—Demographic characteristics, including age, race/ethnicity, gender, and county of residence, were abstracted from the Medicaid eligibility file. Age was coded using date of birth and categorized as a function of educational services for which children would be eligible (early intervention, elementary school, and high school). Race/ethnicity was coded according to Medicaid categories as white, black or African American, Asian, Latino, or other. Medicaid eligibility reason was coded from the Medicaid eligibility files and included poverty, disability, foster care, and other programs. Clinical characteristics included children's number of Medicaid-reimbursed claims other than pharmacy claims, which were categorized by quartile. We also identified other psychiatric diagnoses assigned in the Medicaid claims, which were coded using the ICD-9 and included schizophrenia (295), bipolar disorder (296.00–296.10 and 296.36–296.89), depression (296.20–296.35 and 311), anxiety disorder (300.00–300.29 and 301.4), conduct disorder (312.00–313.89), attention-deficit disorder (314), and mental retardation (317–319). Mental retardation was further classified as mild (317), moderate (318), or severe (319) on the basis of the most common ICD-9 code associated with each child's claims.

County and State Characteristics—ASD Medicaid service use penetration was calculated using the number of children in each county who were known to have received Medicaid services associated with ASD as the numerator and the number of children aged 0 to 19 years in the county from the 2000 census as the denominator. County health care resources included the number of primary care pediatricians and the number of pediatric specialists (child psychiatrists, neurologists, occupational therapists, audiologists, physical therapists, speech-language pathologists, speech therapists, and psychologists). County population information

included percentage living in urban areas, percentage of each racial and ethnic group, and median household income. ASD education penetration was measured at the state level. All county and state variables were categorized by quartile. We also coded census region to capture any geographic variation that was not accounted for by our county or state variables.

Analysis

Percentages of any psychotropic medication use, use ≥3 medications concurrently, and use of each class of medication were calculated for the total sample and stratified by each variable of interest. Bivariate statistical associations between any psychotropic medication use and each variable were estimated using random-effects logistic models that accounted for clustering of children within county and county within state. Corrections for multiple comparisons in the bivariate analyses were made using the Bonferroni method, resulting in $P < .002$ being considered statistically significant.[30] $P < .05$ was considered statistically significant for the adjusted model. The glimmix macro in SAS (SAS Institute, Inc, Cary, NC) was used to implement the random-effects models.[31]

RESULTS

A total of 60 641 children had at least 1 Medicaid claim associated with an ASD diagnosis during calendar year 2001. The sample was predominantly aged 6 to 11 years (45%) mostly male (78%) and white (50%), and most were eligible for Medicaid because of disability (71%).

Table 1 shows the use of psychotropic drugs as a function of each child-level variable. Of the sample, 56% used at least 1 medication during 2001; of those who received any medication, 20% used ≥3 concurrently. Neuroleptic drugs were most common (31%), followed by antidepressants (25%), stimulants (22%), mood stabilizers (21%), anxiolytic drugs (12%), and sedatives (3%).

Older children were more likely to use any psychotropic medication than younger children; however, use was quite common even in children aged 0 to 2 years (18%) and 3 to 5 years (32%). Younger children rarely used >1 medication. Among 0- to 2-year-olds, sedatives were most common; among 3- to 5- and 6- to 11-year-olds, both neuroleptic drugs and stimulants were most common; and in the oldest 2 age groups, neuroleptic drugs were most common.

White children were most likely (61%) and Asian children least likely (43%) to use any psychotropic drug, with neuroleptic drugs most common in each ethnic group. Among all Medicaid-eligibility categories, children who were eligible through foster care had the highest use of psychotropic drugs (71%). Children who had an inpatient stay or who used more nonpharmacy Medicaid-reimbursed services were more likely to use a psychotropic drug. Children who had a diagnosis of Asperger disorder or pervasive developmental disorder, not otherwise specified, were more likely to be prescribed psychotropic drugs (61%) than children who had a diagnosis of autistic disorder (53%). Children who received any psychiatric diagnosis in addition to an ASD were more likely than children without that diagnosis to use any psychotropic drug, with medication use most common among children who had a diagnosis of schizophrenia and bipolar disorder (94%); however, 39% of children with no diagnoses other than ASD still used a psychotropic medication. Among children who had a diagnosis of mental retardation, medication use was less common among those who had a diagnosis of mild retardation (63%) than among those who had a diagnosis of moderate (72%) or severe retardation (71%).

Table 2 shows medication use stratified by county- and state-level variables. Children living in predominantly urban counties were less likely to use psychotropic drugs than those in less urban counties. The relationship between the per capita number of pediatricians and medication

use was not linear; children in counties in the lowest 2 quartiles were most likely to use these medications, followed by those in the highest quartile. Forty-eight percent of children in counties in the highest quartile of Medicaid ASD penetration used a psychotropic medication, whereas those in the lower 3 quartiles were prescribed medication with a higher and similar frequency (58%–59%). Children in states with the greatest proportion of children in the autism special education category had the greatest psychotropic medication use, and those with the least penetration had the lowest.

Table 3 provides the results of the multivariate logistic regression model with random effects predicting psychotropic medication use. The bivariate associations between child demographic and clinical characteristics and use of psychotropic medications observed in Table 1 were confirmed in the multivariate analyses; however, the magnitude and statistical significance of county- and state-level associations with psychotropic medication use changed in the adjusted model. Specifically, children in more urban areas were less likely to use psychotropic medications; those in counties with a greater proportion of white residents were more likely.

DISCUSSION

We found that more than half of Medicaid-enrolled children with a diagnosis of ASD received a psychotropic medication in 2001, and >1 in 10 received ≥3 concurrently. These proportions are 5% to 10% higher than what has been reported previously in surveys of children with ASDs occurring in similar years.[10–12] Use among the Medicaid population may be higher than in the general ASD population because Medicaid typically has less restrictive formulary and copayments than private insurance.[32] Also, Medicaid-eligible children may be more severely affected than the general population of children with ASDs; that 70% of children in this study qualified for Medicaid because of their disability provides some evidence of this. The young children in this sample, however, had substantially higher psychotropic medication use than what has been previously reported among Medicaid-enrolled children. Zito et al[33] found that 1% of Medicaid-eligible 2- to 4-year-olds were prescribed psychotropic medication; our study found proportions of 18% for 0- to 2-year-olds and 32% for 3- to 5-year-olds. In addition, psychotropic medication use among this sample was ~5 times higher than what has been reported for Medicaid-eligible children in general[34] and 2.5 times higher than what has been reported for Medicaid-eligible children who use mental health services.[35]

White children were more likely than children in any other ethnic or racial group to use medications, similar to what previous studies have reported regarding psychotropic medication use in general.[34,36,37] Although this issue has not been examined in ASDs, studies of children with attention-deficit/hyperactivity disorder suggest that differences may be attributable to disparities in access to health care, beliefs about adverse effects of medication, and general trust of the health care system.[38,39]

The finding that children who were eligible for Medicaid because of disability were more likely to use medication than children who were eligible because of poverty is not surprising and is in line with previous research[40]; more concerning is the high prevalence of psychotropic medication and multiple medication use among children in foster care. Because difficult behavior is associated with placement changes in foster care, child welfare systems may attempt to reduce behavioral difficulties with medication to increase placement stability.[41] Because children with ASDs are often quite averse to changes in routine, foster placement may be even more disruptive to them than to other children. Alternatively, children in foster care may have less access to behavioral programs, resulting in greater psychotropic medication use to control behaviors.

Hospitalizations, high volume of ASD-related medical services, and the presence of other psychiatric diagnoses, all of which were associated with psychotropic medication use, may be indicators of clinical complexity, which would also explain the very high percentages of multiple medication use among children who had an inpatient stay or who were assigned 1 of these diagnoses, yet among those without any other psychiatric diagnosis, use was still nearly 40%.

The significant associations with county characteristics reveal that socioeconomics and local health system factors drive medication use as much as the needs of individual children. Children in counties with greater urban density had lower proportions of medication use. Similarly, Palmer et al[22] showed that greater urban density at the county level was associated with more identification of children with ASD. Urban areas, as well as areas with a higher proportion of white residents, may have access to academic health settings where there is greater familiarity with developmental delays. Alternatively, with greater access to health care resources, less severe cases may be more likely to be diagnosed, thereby resulting in a Medicaid-eligible group of children who are less in need of medication.

Interpretation of study findings is limited by a number of factors, primary among them that the autism diagnosis in Medicaid claims has not been validated. Although its accuracy has not been specifically examined, Fombonne et al42 found 97% positive predictive value for chart diagnoses and a diagnosis of autism administered by a trained research team, and Yeargin-Allsopp et al[43] found that 98% of children with a chart diagnosis met research criteria for ASD. Similarly, there were no measures of symptoms or severity, both of which are most likely associated with psychotropic medication use. A third limitation is that states have different coding strategies and incentives for providers to submit claims. Differences, for example, in whether psychotropic medications are covered under capitated or fee-for-service plans may affect claim submission. Although this may affect the observed overall proportions, it is unlikely to affect the odds ratios associated with the logistic regression, because clustering at the county and state levels was accounted for in the analysis. A fourth limitation is the absence of other variables at the child level (eg, age of diagnosis, use of behavioral interventions) and county level (eg, ASD-specific intervention resources) that may relate to medication use. Finally, the study was conducted with Medicaid-eligible children and may not be generalizable to other children, although children with ASDs are disproportionately Medicaid eligible relative to those with other disabilities.[44–46] In addition, Medicaid is the most important insurer of children in the United States, covering >1 in 4 children.47

Despite these limitations, these findings have important implications. The high levels of use of many different psychotropic agents, often in combination, is concerning, especially among young children, in whom the effects of these medications on development have not been well studied.[33,48] Especially worthy of additional study is sedative use among very young children, which may be associated with the sleep problems that often accompany autism[49] or may be associated with medical procedures.[50] There also is little systematic evidence for the use of psychotropic medications in combination.[51] These issues speak to the importance of scientific studies' keeping pace with practice. Although traditional randomized trials may not be feasible or ethical, careful naturalistic studies of the risks, benefits, and costs of psychotropic medication use in children with ASDs are warranted.[52]

The association of health care resources with psychotropic medication use suggests the potential of under-resourced communities and the need for more and well-trained pediatric primary care and specialist clinicians who can accurately diagnose ASDs and appropriately treat children with ASDs. Finally, the results suggest the potential importance of local and regional policies and practices. Variation in state and county approaches and resulting service use offers an important opportunity for study and the potential to develop local and national

models that maximize the safety, efficiency, and effectiveness of care that is delivered to children with ASDs.

Acknowledgments

This study was funded by a grant from the University of Pennsylvania Research Foundation.

Abbreviations

ASD	autism spectrum disorder
ICD-9	International Classification of Diseases, Ninth Revision

References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4. Washington, DC: American Psychiatric Association; 2000. Text revision
2. Bryson S, Rogers S, Fombonne E. Autism spectrum disorders: early detection, intervention, education, and psychopharmacological management. Can J Psychiatry 2003;48(8):506–516. [PubMed: 14574826]
3. Tsai L. Psychopharmacology in autism. Psychosom Med 1999;61(5):651–655. [PubMed: 10511014]
4. Hollander E, Phillips A, Yeh C. Targeted treatments for symptom domains in child and adolescent autism. Lancet 2003;362(9385):732–734. [PubMed: 12957098]
5. McDougle C, Scahill L, McCracken J, et al. Research Units on Pediatric Psychopharmacology (RUPP) Autism Network: background and rationale for an initial controlled study of risperidone. Child Adolesc Psychiatr Clin N Am 2000;9(1):201–224. [PubMed: 10674197]
6. Volkmar F, Lord C, Bailey A, Schultz R, Klin A. Autism and pervasive developmental disorders. J Child Psychol Psychiatry 2004;45(1):135–155. [PubMed: 14959806]
7. Findling R. Pharmacologic treatment of behavior symptoms in autism and pervasive developmental disorders. J Clin Psychiatry 2005;66(suppl 10):26–31. [PubMed: 16401147]
8. McCracken J, McGough J, Shah B, et al. Risperidone in children with autism and serious behavior problems. N Engl J Med 2002;347(5):314–321. [PubMed: 12151468]
9. Aman M, Van Bourgondien M, Wolford P, Sarphare G. Psychotropic and anticonvulsant drugs in subjects with autism: prevalence and patterns of use. J Am Acad Child Adolesc Psychiatry 1995;34 (12):1672–1681. [PubMed: 8543539]
10. Langworthy-Lam K, Aman M, Van Bourgondien M. Prevalence and patterns of use of psychoactive medicines in individuals with autism in the Autism Society of North Carolina. J Child Adolesc Psychopharmacol 2002;2(4):311–321. [PubMed: 12625991]
11. Aman M, Lam K, Collier-Crespin A. Prevalence and patterns of use of psychoactive medicines among individuals with autism in the Autism Society of America. J Autism Dev Disord 2003;33(5):527–533. [PubMed: 14594332]
12. Green V, Pituch K, Itchon J, Choi A, O'Reilly M, Sigafoos J. Internet survey of treatments used by parents of children with autism. Res Dev Disabil 2006;27(1):70–84. [PubMed: 15919178]
13. Martin A, Scahill L, Klin A, Volkmar F. Higher functioning pervasive developmental disorders: rates and patterns of psychotropic drug use. J Am Acad Child Adolesc Psychiatry 1999;38(7):923–931. [PubMed: 10405512]
14. Fombonne E. Epidemiological surveys of autism and other pervasive developmental disorders: an update. J Autism Dev Disord 2003;33(4):365–382. [PubMed: 12959416]
15. Fombonne E. Epidemiology of autistic disorder and other pervasive developmental disorders. J Clin Psychiatry 2005;66(suppl 10):3–8. [PubMed: 16401144]
16. Jacobson J, Mulick J, Green G. Cost-benefit estimates for early intensive behavioral intervention for young children with autism: general model and single state case. Behav Interv 1998;13:201–226.
17. Järbrink K, Knapp M. The economic impact of autism in Britain. Autism 2001;5(1):7–22. [PubMed: 11708392]

18. Mandell DS, Cao J, Ittenbach R, Pinto-Martin J. Medicaid expenditures for children with autistic spectrum disorders: 1994 to 1999. J Autism Dev Disord 2006;36(4):475–485. [PubMed: 16586155]
19. Mandell DS, Palmer R. Differences among states in the identification of autistic spectrum disorders. Arch Pediatr Adolesc Med 2005;159(3):266–269. [PubMed: 15753271]
20. Ruble L, Heflinger C, Renfrew J, Saunders R. Access and service use by children with autism spectrum disorders in Medicaid managed care. J Autism Dev Disord 2005;35(1):3–13. [PubMed: 15796117]
21. Stahmer AC, Mandell DS. State infant/toddler program policies for eligibility and services provision for young children with autism. Ment Health Serv Res. 2006 [epub ahead of print].
22. Palmer RF, Blanchard S, Jean CR, Mandell DS. School district resources and identification of children with autistic disorder. Am J Public Health 2005;95(1):125–130. [PubMed: 15623872]
23. Mandell DS, Novak M, Zubritsky C. Factors associated with the age of diagnosis among children with autism spectrum disorders. Pediatrics 2005;116(6):1480–1486. [PubMed: 16322174]
24. Mandell DS, Listerud J, Levy S, Pinto-Martin J. Race differences in the age at diagnosis among Medicaid-eligible children with autism. J Am Acad Child Adolesc Psychiatry 2002;41(12):1447–1453. [PubMed: 12447031]
25. Mandell DS, Walrath C, Manteuffel B, Sgro G, Pinto-Martin J. Characteristics of children with autistic spectrum disorders served in comprehensive community-based mental health settings. J Autism Dev Disord 2005;35(3):113–121.
26. Quality Resource Systems, Inc. Area Resource File. Fairfax, VA: Health Resources and Services Administration, US Department of Health and Human Services; 2004.
27. US Office of Special Education Programs. IDEAdata.org: Individuals With Disabilities Education Act (IDEA) data. [Accessed April 1, 2007]. Available at: www.ideadata.org
28. Medicode. International Classification of Diseases, Ninth Revision. Salt Lake City, UT: Med-Index Publications; 1987.
29. American Society of Health System Pharmacists. AHFS Drug Information. Bethesda, MD: American Society of Health-System Pharmacists; 1999.
30. Bonferroni C. The calculation for the protection against groups of tests. Studies in Honor of Professor Salvatore Ortu Carboni. [in Italian] Rome, Italy 1935:13–60.
31. Fitzmaurice, G.; Laird, N.; Ware, J. Applied Longitudinal Analysis. New York, NY: Wiley; 2004.
32. Safer D, Zito J, Gardner J. Comparative prevalence of psychotropic medications among youths enrolled in the SCHIP and privately insured youths. Psychiatr Serv 2004;55(9):1049–1051. [PubMed: 15345766]
33. Zito J, Safer D, dosReis S, Gardner J, Boles M, Lynch F. Trends in the prescribing of psychotropic medications to preschoolers. JAMA 2000;283(8):1025–1030. [PubMed: 10697062]
34. Zito J, Safer D, Zuckerman I, Gardner J, Soeken K. Effect of Medicaid eligibility category on racial disparities in the use of psychotropic medications among youths. Psychiatr Serv 2005;56(2):157–163. [PubMed: 15703342]
35. dosReis S, Zito J, Safer D, Gardner J, Puccia K, Owens P. Multiple psychotropic medication use for youths: a two-state comparison. J Child Adolesc Psychopharmacol 2005;15(1):68–77. [PubMed: 15741788]
36. Mandell DS, Davis J, Bevans K, Guevara JP. Disparities in special education placement among children with attention deficit/hyperactivity disorder. J Emotional Behav Disord. 2007 in press.
37. Zito J, Safer D, DosReis S, et al. Psychotropic practice patterns for youth: a 10-year perspective. Arch Pediatr Adolesc Med 2003;157(1):17–25. [PubMed: 12517190]
38. Bussing R, Schoenberg N, Perwien A. Knowledge and information about ADHD: evidence of cultural differences among African-American and white parents. Soc Sci Med 1998;46(7):919–928. [PubMed: 9541077]
39. dosReis S, Zito J, Safer D, Soeken K, Mitchell JJ, Ellwood L. Parental perceptions and satisfaction with stimulant medication for attention-deficit hyperactivity disorder. J Dev Behav Pediatr 2003;24(3):155–162. [PubMed: 12806227]
40. dosReis S, Zito J, Safer D, Soeken K. Mental health services for youths in foster care and disabled youths. Am J Public Health 2001;91(7):1094–1099. [PubMed: 11441737]

41. James S. Why do foster care placements disrupt? An investigation of reasons for placement change in foster care. Soc Serv Rev 2004;78:601–627.

42. Fombonne E, Heavey L, Smeeth L, et al. Validation of the diagnosis of autism in general practitioner records. BMC Public Health 2004;4:5. [PubMed: 15113435]

43. Yeargin-Allsopp M, Rice C, Karapurkar T, Doernberg N, Boyle C, Murphy C. Prevalence of autism in a US metropolitan area. JAMA 2003;289(1):49–55. [PubMed: 12503976]

44. Birenbaum A, Guyot D, Cohen H. Health care financing for severe developmental disabilities. Monogr Am Assoc Ment Retard 1990;14(14):1–150. [PubMed: 1703621]

45. Braddock, D. Disability at the Dawn of the 21st Century and the State of States. Washington, DC: American Association on Mental Retardation; 2002.

46. Krauss M, Gulley S, Sciegaj M, Wells N. Access to specialty medical care for children with mental retardation, autism and other special health care needs. Ment Retard 2003;41(5):329–339. [PubMed: 12962535]

47. Kaiser Commission of Medicaid and the Uninsured. Health Coverage for Low-Income Populations: A Comparison of Medicaid and SCHIP. Washington, DC: Kaiser Family Foundation; 2006.

48. Volkmar F. Pharmacological interventions in autism: theoretical and practical issues. J Clin Child Psychol 2001;30(1):80–87. [PubMed: 11294081]

49. Richdale A. Sleep problems in autism: prevalence, cause, and intervention. Dev Med Child Neurol 1999;41(1):60–66. [PubMed: 10068053]

50. Wheeler D, Vaux K, Ponaman M, Poss B. The safe and effective use of propofol sedation in children undergoing diagnostic and therapeutic procedures: experience in a pediatric ICU and a review of the literature. Pediatr Emerg Care 2003;19(6):385–392. [PubMed: 14676486]

51. Safer D, Zito J, DosReis S. Concomitant psychotropic medication for youths. Am J Psychiatry 2003;160(3):438–449. [PubMed: 12611822]

52. Greenhill L, Vitiello B, Abikoff H, et al. Developing methodologies for monitoring long-term safety of psychotropic medications in children: report on the NIMH conference, September 25, 2000. J Am Acad Child Adolesc Psychiatry 2003;42(6):651–655. [PubMed: 12921472]

TABLE 1

Medicaid-Reimbursed Psychotropic Medication Use Among Children With ASDs (*N* = 60 641)

Parameter	Any Psychotropic Medication, %	≥3 Concurrent Psychotropics, %	Psychotropic Medication Class, %					
			Antidepressant	Neuroleptic	Anxiolytic	Mood Stabilizer	Sedative	Stimulant
Total (*n* =60 641)	56	11	25	31	12	21	3	22
Gender								
Female (*n* =13 435)	55	10	25	28	14	24	4	17
Male (*n* =47 205)	56	11	25	32	11	20	3	24
Age, y[a]								
0–2 (*n* =1009)	18	0.1	2	2	6	5	8	1
3–5 (*n* =10 119)	32	2	9	12	7	8	3	13
6–11 (*n* =27 545)	56	9	23	29	10	18	2	28
12–17 (*n* =17 164)	67	17	34	42	15	29	3	23
18–21 (*n* =4804)	73	20	39	49	23	39	6	9
Ethnicity[a]								
Black (*n* =13 470)	48	7	16	27	8	16	3	20
Asian (*n* =642)	43	4	15	22	10	14	3	13
Latino (*n* =4075)	50	8	18	28	11	17	3	19
White (*n* =30 439)	61	13	31	34	13	25	3	25
Other (*n* =12 015)	55	9	21	30	11	20	4	20
Medicaid eligibility[a]								
Disabled (*n* =43 535)	58	11	25	32	13	23	4	21
Poverty (*n* =11 240)	44	7	20	20	7	13	2	23
Foster Care (*n* =4445)	71	20	36	45	13	31	3	35
Other (*n* =1421)	46	9	24	24	9	17	2	20
Had an inpatient stay[a]								
Yes (*n* =4232)	81	26	40	54	27	51	8	28
No (*n* =56 409)	54	9	24	29	11	19	3	22
No. of nonpharmacy ASD claims[a]								
1–30 claims (*n* =13 506)	43	5	18	21	6	11	1	19
31–60 claims (*n* =15 537)	54	9	24	29	10	17	2	23

Parameter	Any Psychotropic Medication, %	≥3 Concurrent Psychotropics, %	Psychotropic Medication Class, %					
			Antidepressant	Neuroleptic	Anxiolytic	Mood Stabilizer	Sedative	Stimulant
61–124 claims (*n* =15 773)	61	13	28	35	14	25	4	24
≥125 claims (*n* =15 825)	63	14	28	37	17	30	5	23
ASDs[a]								
Autism (*n* =37 576)	53	8	21	28	13	20	4	17
Asperger (*n* =23 065)	61	14	30	35	10	23	2	31
Other diagnoses[b]								
No other diagnosis (*n* =32 760)[a]	39	4	16	18	8	13	3	12
Schizophrenia (*n* =929)[a]	94	40	56	88	28	59	6	22
Bipolar (*n* =2149)[a]	94	48	59	83	24	77	4	40
Depression (*n* =2774)[a]	90	35	69	68	19	45	4	36
Attention deficit (*n* =12 445)[a]	87	22	40	49	14	30	3	62
Anxiety (*n* =1387)[a]	83	23	58	52	24	31	4	30
Conduct (*n* =8559)[a]	82	25	43	60	18	40	4	36
Mental retardation[a]								
Mild (*n* =3198)	63	15	30	39	14	27	3	25
Moderate (*n* =5748)	72	16	28	45	21	36	7	17
Severe (*n* =4082)	71	15	28	45	20	34	6	20

[a] Statistically significant at $P < .002$ based on random-effects model to account for clustering by county and state.

[b] Children with each diagnosis or who saw each type of specialist are compared with those without that diagnosis.

TABLE 2

Medicaid-Reimbursed Psychotropic Medication Use Among Children With ASDs According to County and State Characteristics (*N* =60 641)

Parameter	Any Psychotropic Medication, %	≥3 Concurrent Psychotropics, %	Psychotropic Medication Class, %					
			Antidepressant	Neuroleptic	Anxiolytic	Mood Stabilizer	Sedative	Stimulant
% of county living in urban areas[a]								
First quartile (0%–63%)	61	12	30	32	13	24	3	26
Second quartile (64%–87%)	60	12	29	33	14	23	3	25
Third quartile (88%–98%)	56	11	26	32	12	23	3	21
Fourth quartile (99%–100%)	46	7	15	26	8	16	3	18
Median county household income								
First quartile ($16 435–$35 574)	61	12	27	32	14	23	4	26
Second quartile ($35 575–$40 274)	52	9	23	27	10	18	3	23
Third quartile ($40 275–$44 360)	55	9	21	32	11	21	3	19
Fourth quartile ($44 394–$93 316)	56	11	27	31	12	22	3	21
Pediatricians per capita by county[a]								
First quartile (0.00–0.32 per 1000)	62	13	30	33	13	24	3	26
Second quartile (0.33–0.52 per 1000)	58	12	28	32	13	22	3	24
Third quartile (0.53–0.86 per 1000)	50	9	21	27	10	19	3	20
Fourth quartile (0.87–4.56 per 1000)	55	9	21	31	11	20	3	20
Pediatric specialists per capita by county[a]								
First quartile (0.00–0.02 per 1000)	61	12	30	33	14	24	4	25
Second quartile (0.03–0.12 per 1000)	60	12	28	33	13	23	3	24
Third quartile (0.13–0.23 per 1000)	48	9	20	27	9	18	3	20
Fourth quartile (0.24–4.32 per 1000)	55	9	22	32	11	21	3	20
% white by county								
First quartile (5%–56%)	46	6	15	25	8	15	3	18
Second quartile (57%–76%)	59	11	25	34	13	23	4	23
Third quartile (77%–90%)	59	12	28	33	13	24	4	24
Fourth quartile (91%–99%)	60	12	31	31	12	23	3	25
ASD Medicaid penetration by county[a]								
First quartile (0.04–0.58 per 1000)	58	12	27	35	13	24	4	21

Parameter	Any Psychotropic Medication, %	≥3 Concurrent Psychotropics, %	Psychotropic Medication Class, %					
			Antidepressant	Neuroleptic	Anxiolytic	Mood Stabilizer	Sedative	Stimulant
Second quartile (0.59–0.95 per 1000)	58	11	26	33	12	23	3	22
Third quartile (0.96–1.79 per 1000)	59	12	29	31	13	22	3	25
Fourth quartile (1.80–32.5 per 1000)	48	8	19	25	9	16	3	21
ASD education penetration by state[a]								
First quartile (0.002–0.011 per 1000)	46	9	20	25	9	17	2	19
Second quartile (0.012–0.030 per 1000)	56	9	22	32	11	21	3	21
Third quartile (0.031–0.107 per 1000)	60	11	28	33	13	23	4	24
Fourth quartile (0.108–15.400 per 1000)	62	12	30	34	13	24	4	26
Census region[a]								
Midwest (n =18 557)	53	10	26	28	9	21	2	24
Northeast (n =12 447)	55	9	22	32	11	20	4	20
South (n =18 735)	61	12	26	33	15	23	4	26
West (n =10 898)	52	10	25	30	11	21	3	16

[a]Statistically significant at P <.0002 based on random-effects model to account for clustering by county and state.

TABLE 3

Logistic Regression With Random Effects Predicting Medicaid-Reimbursed Psychotropic Medication Use Among Children With ASDs (*N* = 60 641)

Parameter	Adjusted OR (95% CI)	*P*
Female	0.94 (0.90–0.98)	.0093
Age (reference is 0- to 2-y-olds), y		
3–5	1.88 (1.56–2.28)	<.0001
6–11	4.88 (4.05–5.88)	
12–17	8.01 (6.63–9.68)	
18–21	9.77 (8.00–11.93)	
Race/ethnicity (reference is white)		
Black	0.78 (0.73–0.83)	<.0001
Hispanic	0.92 (0.84–1.00)	
Asian	0.76 (0.63–0.92)	
Other	0.92 (0.87–0.98)	
Medicaid eligibility reason (reference is poverty)		
Disability	1.48 (1.40–1.57)	<.0001
Foster care	2.18 (1.99–2.40)	
Other	0.86 (0.74–1.00)	
Had an inpatient stay	2.38 (2.16–2.62)	<.0001
No. of ASD-related Medicaid claims (reference is lowest quartile)		
Second quartile	1.36 (1.28–1.44)	<.0001
Third quartile	1.60 (1.51–1.70)	
Fourth quartile	1.83 (1.72–1.95)	
ASD diagnosis (reference is 299.8)		
Autistic disorder (299.0)	0.78 (0.74–0.82)	<.0001
Other diagnoses		
No other psychiatric diagnosis	0.71 (0.65–0.79)	<.0001
Schizophrenia	3.26 (2.44–4.37)	<.0001
Bipolar disorder	3.55 (2.90–4.33)	<.0001
Depression	2.14 (1.85–2.49)	<.0001
Attention-deficit disorder	4.62 (4.23–5.04)	<.0001
Anxiety disorder	1.73 (1.46–2.05)	<.0001
Conduct disorder	1.90 (1.75–2.07)	<.0001
Mental retardation		<.0001
Mild	0.93 (0.83–1.04)	
Moderate	1.33 (1.19–1.47)	
Severe	1.38 (1.23–1.54)	
% in county living in urban areas (reference is lowest quartile)		
Second quartile	1.09 (0.99–1.19)	.0374
Third quartile	0.97 (0.84–1.12)	
Fourth quartile	0.90 (0.74–1.11)	
Median county income (reference is lowest quartile)		

Parameter	Adjusted OR (95% CI)	*P*
Second quartile	1.03 (0.94–1.13)	.8376
Third quartile	1.04 (0.94–1.16)	
Fourth quartile	1.04 (0.93–1.17)	
Pediatricians per capita in county (reference is lowest quartile)		
Second quartile	0.94 (0.86–1.02)	.1347
Third quartile	0.91 (0.81–1.02)	
Fourth quartile	0.84 (0.72–0.98)	
Pediatric specialists per capita (reference is lowest quartile)		
Second quartile	1.03 (0.94–1.12)	.8811
Third quartile	0.99 (0.88–1.12)	
Fourth quartile	0.99 (0.85–1.16)	
% white within the county (reference is lowest quartile)		
Second quartile	1.23 (1.08–1.40)	.0047
Third quartile	1.23 (1.07–1.42)	
Fourth quartile	1.32 (1.12–1.54)	
County ASD Medicaid penetration (reference is lowest quartile)		
Second quartile	1.01 (0.93–1.11)	.8529
Third quartile	1.01 (0.91–1.11)	
Fourth quartile	0.96 (0.84–1.10)	
State ASD special education penetration (reference is lowest quartile)		
Second quartile	0.95 (0.83–1.10)	.8111
Third quartile	0.94 (0.82–1.09)	
Fourth quartile	0.96 (0.81–1.15)	
Census region (reference is Midwest)		
Northeast	0.84 (0.60–1.18)	.1152
South	1.02 (0.76–1.38)	
West	0.74 (0.54–1.01)	

OR indicates odds ratio; CI, confidence interval.