Specialty
Healthcare
Benefits Council
Defining Specialty Health

# The Appropriateness of Use of 3 Classes of Psychotropic Medications in Children and Adolescents

Michael R. Brown, MD, MPH; Marc L. Leib, MD, JD; Sylvia R. Brown, PhD;
Terri Warholak, PhD; and Daniel C. Malone, PhD

The prevalence of mental health disorders in children and adolescents has been estimated to be 12%.[1] Comorbid psychiatric conditions are common among this segment of the population.[2] Psychotropic medications play an increasingly important role in the treatment of these disorders in children. The prevalence of having at least 1 prescription for a psychotropic medication in Medicaid enrollees has been estimated to be as high as 6%.[3] Historically, few studies have been conducted on the efficacy and safety of the use in children of many of these medications commonly prescribed today. Only a few have been approved by the Food and Drug Administration (FDA) for use in patients younger than 18 years, often based on trials with a relatively small number of child subjects.[4] Concern by the public and from several clinical trials over a possible increase in suicidality in pediatric and adolescent users of antidepressants led to recent reviews by regulators in the United States and the United Kingdom. In the United Kingdom, these reviews resulted in a recommendation against the use of all but 1 drug (fluoxetine) in patients younger than 18 years[5] and, in the United States, in a Public Health Advisory and mandated "black box" warnings for the package inserts.[6,7] Journal articles, reviews, editorials, and lay press articles have also appeared in recent years expressing concerns regarding the use of psychotropic medications, particularly of stimulants, in the preschool age group.[8-15] Until late 2006, there were only small, short-term trials of 1 stimulant in the preschool age range, which included a total of only 246 subjects.[16]

The aim of this study was to compare the use of 3 groups of psychotropic medications by Medicaid and State Children's Health Insurance Program (SCHIP) enrollees younger than 18 years in Arizona with age-specific FDA approvals, published practice guidelines, meta-analyses, or review articles, an approach which has not been previously published.

**Objectives:** Concerns have been raised about the increasing use and potential adverse effects of psychotropic medications in children and adolescents. The objective of this study was to estimate the degree of appropriate use, and rates of use, of 3 groups of psychotropic medications (Attention Deficit Hyperactivity Disorder [ADHD)], atypical antipsychotic, selective serotonin receptor inhibitor [SSRI] antidepressant) among children in a Medicaid population.

**Methods:** The study population consisted of members of one state's Medicaid program and State Children's Health Insurance Program who were 17 years or younger and continuously enrolled during calendar year 2006. A retrospective analysis was conducted using pharmacy and medical claims databases. Age-specific appropriateness of care criteria were developed based on US Food and Drug Administration–approved package inserts, national guidelines, and the professional literature. Diagnoses were obtained from medical claims, using 3-digit *International Classification of Diseases, Ninth Revision, Clinical Modification* codes.

**Results:** Data were available for 274,569 children. Seventy-five percent of their use of any study medication was consistent with study criteria. Eighty-two percent of children had ADHD medication use, 67% had antipsychotic medication use, and 63% had antidepressant medication use that was consistent with criteria. The prevalence of having at least 1 prescription for any psychotropic medication was 52.7 per 1000, with rates of ADHD medication use of 39.2 per 1000, antipsychotic medication of 21.2 per 1000, and an antidepressant of 13.3 per 1000. The prevalence of use of any medication for whites was 1.5 times higher than for blacks, 4.1 times higher than for Hispanics, and 7.3 times higher than for Native Americans.

**Conclusions:** The majority of use of these medications was appropriate as determined by our evidence-based methodology. The prevalence of use was modest and consistent with previous literature. There was evidence of racial disparity in access to these medications.

*(Am J Pharm Benefits. 2012;4(2):49-56)*

**PRACTICAL IMPLICATIONS**

This study quantifies the degree to which there may be inappropriate use of psychotropic medications in children and adolescents.

- The proportion of children and adolescents receiving ADHD medications and also having a valid diagnosis was 82.1%.
- Among children receiving antidepressants or antipsychotics, there was a valid medical diagnosis for 62.7% and 67.4% of the patients.
- Considerable health disparities exist among children receiving psychotropic medications, with whites being much more likely to be treated than minority groups, including Hispanics, blacks, and Native Americans.

In addition, we assessed the prevalence of use of these medications by enrollees.

## METHODS
### Subjects

Subjects included in this study were children who were 17 years or younger on January 1, 2006, and continuously enrolled through calendar year 2006 in either the Medicaid or SCHIP program in Arizona.

### Study Design and Data

This retrospective analysis was a cross-sectional study using administrative databases. Demographically de-identified medication claims and medical/facility claims data were used. Data of interest was limited to those members aged 17 years or less who were continuously enrolled for 12 months in 2006. The requirement of continuous enrollment eliminated all members less than 1 year of age. There were 160,714 subjects with at least 1 pharmacy claim and 232,284 with at least 1 medical/facility claim.

### Medications

Three groups of psychotropic medications were selected for this study, based on expected substantial utilization and concern about potential inappropriate use. The medications included in each group (attention deficit hyperactivity disorder [ADHD], antidepressants, antipsychotics) were all marketed during 2006 and are listed in **Table 1**. They included central nervous system stimulants and atomoxetine, the selective serotonin reuptake inhibitors (SSRIs) and bupropion, and the atypical antipsychotics. Claims for study medications were identified by using all NDC (National Drug Code) codes associated with each generic ingredient name.

### Defining Appropriateness of Use of the Medications

For each study medication, we identified age- and diagnosis-specific indications for appropriate use. These were determined by reviewing the FDA-approved product package inserts. In addition, we searched for relevant practice guidelines using the Agency for Healthcare Research and Quality's National Guideline Clearinghouse (www.guidelines.gov) and websites for major specialty societies. The PubMed Mesh database (www.pubmed .gov) was also searched for each medication name using birth to 23 months, 2 to 5 years, 6 to 12 years, and 13 to 18 years age limits. The MicroMedex database (Thomson Reuters Healthcare, New York, NY) was accessed for additional recommended indications. When a specific lower age limit of a "childhood" indication in a reference was not stated, it was assumed to be 6 years of age; for "adolescent," 13 years of age; for "adult," 18 years of age. All indication age ranges were adjusted to fit 4 standard age groups: 0 to 2, 3 to 5, 6 to 12, and 13 to 17 years. A board-certified pediatrician (MRB) and 2 pharmacists (DCM, TW) reviewed this information and concurred on the indications for appropriate use.

Diagnostic codes for the indications for appropriate medication use were determined using the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* (World Health Organization as modified by the National Center for Health Statistics). In view of previous experience working with the limited validity of diagnostic coding in administrative claims data, we decided to use *ICD-9-CM* codes limited to 3 digits for this analysis. As a consequence, this study had reduced precision.

### Outcomes

The primary outcome for this study was the percent of use of study medications meeting appropriateness criteria. The numerator for appropriate use was defined as the number of unduplicated pharmacy claims for a medication for which there was a medical/facility claim for the same subject with an *ICD-9-CM* code for an age group–specific recommended indication. The denominator was the total number of unduplicated pharmacy claims for each medication of interest. We report the results aggregated at the medication class level. A secondary outcome was the prevalence of psychotropic medication use and was defined as the number of subjects with at least 1 prescription claim for a study medication during the study year times 1000 divided by the total number of subjects. Both prevalence and appropriate use measures were stratified by total number of subjects, male and female subjects, subjects by race (white, black, Hispanic, Native American, Asian/Pacific Islander/Cuban/Haitian, other, and unspecified), and subjects by age group (1 to

**Table 1. Study Medications by Cohort**

| Cohort 1: ADHD | Cohort 2: Antidepressants | Cohort 3: Antipsychotics |
|---|---|---|
| Methylphenidate | Fluoxetine | Clozapine |
| Dexmethylphenidate | Fluvoxamine | Olanzapine |
| Dextroamphetamine | Paroxetine | Quetiapine |
| Dextroamphetamine + amphetamine | Sertraline | Risperidone |
| Methamphetamine | Citalopram | Ziprasidone |
| Modafinil | Escitalopram | Aripiprazole |
| Atomoxetine | Bupropion | |

ADHD indicates attention deficit hyperactivity disorder.

2 years, 3 to 5 years, 6 to 12 years, and 13 to 17 years). Data analysis was performed using SAS version 9.1 (SAS Institute, Cary, North Carolina).

## RESULTS

Of the 274,569 subjects, 14,481 had at least 1 prescription for any study medication during 2006, resulting in a prevalence of use of 52.7 per 1000 subjects (95% confidence interval [CI]: 51.9-53.5). As seen in **Table 2**, the prevalence of ADHD medications was 39.2 per 1000 subjects (95% CI: 38.5-39.9), for antipsychotics it was 21.2 per 1000 subjects (95% CI: 20.7-21.7), and for antidepressants it was 13.3 per 1000 subjects (95% CI: 12.9-13.7). The total number of subjects in the 3 cohorts of subjects using the different medication groups exceeds the number of subjects using any study medication because of a considerable degree of co-prescribing of these medications.

The prevalence of use of any study medication by males was more than twice that of females (males 71.3 per 1000 subjects [95% CI: 70.0-72.6]; females 33.1 per 1000 subjects [95% CI: 32.1-34.1]; *P* <.001). The sex difference was greatest for ADHD medications (males 56.7 per 1000 subjects [95% CI: 55.5-57.9]; females 20.6 per 1000 subjects [95% CI: 19.8-21.4]; *P* <.001) and least for antidepressants (males 14.6 per 1000 subjects [95% CI: 14.0-15.2]; females 11.9 per 1000 subjects [95% CI: 11.3-12.5]; *P* <.001). The prevalence of use of any study medication in the 1 to 2 year age group was very low (0.7 per 1000 subjects [95% CI: 0.5-0.9]). The 3 to 5 year age group was substantially higher for any medication use, 19.6 per 1000 subjects (95% CI: 18.4-20.8; *P* <.001), with the prevalence for ADHD medications being 15.9 per 1000 subjects (95% CI: 14.9-16.9) and for antidepressants only 1.9 per 1000 subjects (95% CI: 1.4-2.0). The prevalence of use for these medications was still higher in the 6 to 12 and 13 to 17 year age groups. The prevalence of use of ADHD medications was highest in the 6 to 12 year age group (62.9 per 1000 subjects [95% CI: 61.5-64.3]), but the prevalence

of use of both other medication groups was highest in the 13 to 17 year age group (antipsychotics 39.9 per 1000 subjects [95% CI: 38.3-41.5]; antidepressants 34.6 per 1000 subjects [95% CI: 33.1-36.1]).

With respect to racial differences, the prevalence of medication use was highest (171.9 per 1000 subjects [95% CI: 163.9-179.9]) among the 8534 subjects for whom the racial category was listed as unspecified. Otherwise, the prevalence of use of any study medication was highest for whites (111.5 per 1000 subjects [95% CI: 109.0-114.0]), then progressively lower for blacks (75.1 per 1000 subjects [95% CI: 71.0-79.2]), Hispanics (26.9 per 1000 subjects [95% CI: 26.1-27.7]), and Native Americans (15.2 per 1000 subjects [95% CI: 13.7-16.7]). The prevalence of use of the 3 medication groups had a similar pattern. As seen in **Table 3**, 2 other racial categories, Asian/Pacific Islander + Cuban/Haitian and other, each had less than 0.7% of subjects.

The overall rate of appropriate use was 74.5% (95% CI: 73.9-75.0), but varied considerably by medication class. As seen in **Table 4**, the percentage of appropriate use for ADHD medications was 82.1% (95% CI: 81.5-82.8), but was lower for antipsychotics (67.4% [95% CI: 66.2-68.5]) and antidepressants (62.7% [95% CI: 61.2-64.2]). There was little difference in appropriate use by sex (male 75.1% [95% CI: 74.5-75.8], female 72.9% [95% CI: 71.8-73.9]; *P* = .0003). Based on the evidence review, there was no appropriate use in the 1 to 2 year age group overall or in the 3 to 5 year age group for antipsychotics or antidepressants, as there were no recommended indications for those groups. Only a total of 2.8% of psychotropic medication use was in those groups. In the 6 to 12 and 13 to 17 year age groups, the medication class with the highest percent appropriate use was ADHD medications (83.7% [95% CI: 82.9-84.5] and 82.0% [95% CI: 80.7-83.3]) and lowest was antidepressants (61.7% [95% CI: 59.3-64.0] and 66.3% [95% CI: 64.4-68.3]). There was little difference in percent appropriate use by race of recipient of any medication or of each medication group.

**Table 2.** Prevalence of Medication Use by Medication Cohort (users per 1000 subjects)

| | Any Study Medication | | | ADHD Cohort | | |
|---|---|---|---|---|---|---|
| | Prevalence | 95% CI | N[a] | Prevalence | 95% CI | N |
| **Total** | 52.7 | 51.9-53.5 | 14,481 | 39.2 | 38.5-39.9 | 10,759 |
| **Sex** | | | | | | |
| Male | 71.3 | 70.0-72.6 | 10,067 | 56.7 | 55.5-57.9 | 8007 |
| Female | 33.1 | 32.1-34.1 | 4414 | 20.6 | 19.8-21.4 | 2752 |
| **Age (years)** | | | | | | |
| 1-2 | 0.7 | 0.5-0.9 | 39 | 0.2 | 0.1-0.3 | 12 |
| 3-5 | 19.6 | 18.4-20.8 | 1080 | 15.9 | 14.9-16.9 | 878 |
| 6-12 | 76.2 | 74.6-77.8 | 8263 | 62.9 | 61.5-64.3 | 6823 |
| 13-17 | 87.2 | 84.9-89.5 | 5099 | 52.1 | 50.3-53.9 | 3046 |
| **Race** | | | | | | |
| White | 111.5 | 109.0-114.0 | 7038 | 83.1 | 80.9-85.3 | 5246 |
| Black | 75.1 | 71.0-79.2 | 1193 | 57.4 | 53.8-61.0 | 911 |
| Hispanic | 26.9 | 26.1-27.7 | 4207 | 19.9 | 19.2-20.6 | 3103 |
| Native American | 15.2 | 13.7-16.7 | 410 | 8.5 | 7.4-9.6 | 230 |
| Asian/Pacific Islander + Cuban/Haitian | 23.2 | 17.8-28.6 | 69 | 17.8 | 13.0-22.6 | 53 |
| Other | 122.8 | 99.9-145.7 | 97 | 78.5 | 59.7-97.3 | 62 |
| Unspecified | 171.9 | 163.9-179.9 | 1467 | 135.2 | 127.9-142.5 | 1154 |

CI indicates confidence interval.
[a]N = number of users.

## DISCUSSION

Concerns about appropriate psychopharmaceutical use in children abound in the media and scientific literature. The findings of this study provide evidence that use of psychotropic medications in children in a Medicaid/SCHIP health system is largely in accordance with published guidelines and/or manufacturer labeling. This study also adds to the limited public knowledge base regarding the prevalence of use of psychotropic medications in child and adolescent enrollees of the Medicaid and SCHIP programs, high-risk groups based on socioeconomic status and rate of disabilities.

### Appropriateness of Use

We were interested in assessing how closely the use of psychotropic medications adhered to the recommended indications for their use. It is important to note that many of these medications do not have an FDA-approved indication for use in children and adolescents. So-called "off-label" use, though, is legal and frequently supported for specific indications by practice guidelines and the professional literature. However, recommendations are often based on few studies involving small numbers of subjects. Nonetheless, providers seeing young patients in their offices with significant mental health symptoms often consider the use of these medications in spite of the limited evidence base.

Within the limits of our methodology, we determined that the proportion of appropriate use of any study medication was 74.5% (95% CI: 73.9-75.0). The proportion of documented appropriate use differed by medication class. It was 82.1% (95% CI: 81.5-82.8) for ADHD medication, 67.4% (95% CI: 66.2-68.5) for anti-psychotics, and 62.7% (95% CI: 61.2-64.2) for antidepressants. We did not find similar assessments for appropriateness of use in the literature. However, 2 studies used different methodologies to suggest a lack of appropriate use. The first study indicated that 57% of children receiving stimulant medications never had parent-reported ADHD symptoms.[17] In the second study, 57% of children in outpatient treatment for depression received a prescription for an antidepressant, though the American Academy of Child and Adolescent Psychiatry practice guideline suggests restricting their use to only more severe or resistant cases.[18,19]

One potential explanation for the lower level of appropriateness of use for both the antidepressant and anti-psychotic medication groups, compared with ADHD medications, was the high prevalence of the ADHD diagnosis among the recipients of each of these medication groups (46.8% and 58.3%, respectively). ADHD has common mental health co-morbidities,[20,21] including depression, a major indication for use of antidepressants, and conduct disorder/oppositional defiant disorder, indications

www.ajpblive.com

| Antipsychotic Cohort | | | Antidepressant Cohort | | |
|---|---|---|---|---|---|
| Prevalence | 95% CI | N | Prevalence | 95% CI | N |
| 21.2 | 20.7-21.7 | 5828 | 13.3 | 12.9-13.7 | 3655 |
|  |  |  |  |  |  |
| 28.8 | 27.9-29.7 | 4061 | 14.6 | 14.0-15.2 | 2068 |
| 13.2 | 12.6-13.8 | 1767 | 11.9 | 11.3-12.5 | 1587 |
|  |  |  |  |  |  |
| 0.5 | 0.3-0.7 | 28 | 0.1 | 0-0.2 | 5 |
| 7.7 | 7.0-8.4 | 427 | 1.7 | 1.4-2.0 | 94 |
| 28.0 | 27.0-29.0 | 3042 | 14.1 | 13.4-14.8 | 1532 |
| 39.9 | 38.3-41.5 | 2331 | 34.6 | 33.1-36.1 | 2024 |
|  |  |  |  |  |  |
| 45.0 | 43.4-46.6 | 2843 | 29.7 | 28.4-31.0 | 1874 |
| 31.0 | 28.3-33.7 | 493 | 16.9 | 14.9-18.9 | 269 |
| 9.6 | 9.1-10.1 | 1493 | 6.4 | 6.0-6.8 | 1008 |
| 7.4 | 6.4-8.4 | 201 | 5.4 | 4.5-6.3 | 145 |
| 7.5 | 4.4-10.6 | 22 | 4.1 | 1.8-6.4 | 12 |
| 65.8 | 48.5-83.1 | 52 | 31.6 | 19.4-43.8 | 25 |
| 84.8 | 78.9-90.7 | 724 | 37.7 | 33.7-41.7 | 322 |
|  |  |  |  |  |  |

for anti-psychotics.[19,22] Inaccurate coding practices could result in the use of the *ICD-9-CM* code for ADHD rather than the correct diagnostic code for the comorbid condition actually being treated. In addition, incomplete diagnostic coding is a well-known problem with medical claims data.[23,24]

## Prevalence of Use

The prevalence of use of any psychotropic medication (52.7 per 1000 subjects [95% CI: 51.9-53.5]) in Arizona was similar to that found in previous studies, though population characteristics, particularly racial composition, and medications differ among the studies. Studies of 4 state Medicaid programs and 1 SCHIP program showed annual prevalence ranging from 45 to 62.6 per 1000 subjects. These estimates are remarkably similar to each other, and to this study, despite the differences in the populations and the medications included. This also suggests that the medications we selected to include adequately represented psychotropic medications in general use.

The prevalence of use of ADHD medications in this study, 39.2 per 1000 subjects (95% CI: 38.5-39.9), was similar to that found for stimulants in 3 Medicaid programs (37.2 to 46.3 per 1000 subjects).[3,25] The prevalence of use of antipsychotic medications was 21.2 per 1000 subjects (95% CI: 20.7-21.7). In 5 Medicaid programs it ranged from 5.4 to 14.9 per 1000 subjects,[3,26] suggesting an upward trend over time from the 1996-2001 period of those studies to 2006. The prevalence of use of antidepressant medications in this study was 13.3 per 1000 subjects (95% CI: 12.9-13.7), similar to the 8.8 to 20.5 per 1000 subjects found in 3 Medicaid programs.[3,27]

Our analysis found disparities by race in use of these medications, as have previous studies of Medicaid programs. Whites in this study had a prevalence of use of any medication 1.5 times higher than for blacks, 4.1 times

**Table 3. Characteristics of Subjects**

|  | All Subjects N = 274,569 (100%)[a] | Using Any Study Medication N = 14,481 (5.3%) | P |
|---|---|---|---|
| **Sex** |  |  |  |
| Male | 141,180 (51.4%) | 10,067 (69.5%) | <.001 |
| Female | 133,389 (48.6%) | 4414 (30.5%) |  |
| **Age (years)** |  |  |  |
| 1-2 | 52,438 (19.1%) | 39 (0.3%) | <.001 |
| 3-5 | 55,198 (20.1%) | 1080 (7.5%) |  |
| 6-12 | 108,468 (39.5%) | 8263 (57.1%) |  |
| 13-17 | 58,465 (21.3%) | 5099 (35.2%) |  |
| **Race** |  |  |  |
| White | 63,116 (23.0%) | 7038 (48.6%) | <.001 |
| Black | 15,881 (5.8%) | 1193 (8.2%) |  |
| Hispanic | 156,282 (56.9%) | 4207 (29.1%) |  |
| Native American | 26,993 (9.8%) | 410 (2.8%) |  |
| Asian/Pacific Islander + Cuban/Haitian | 2973 (1.1%) | 69 (0.5%) |  |
| Other | 790 (0.3%) | 97 (0.7%) |  |
| Unspecified | 8534 (3.1%) | 1467 (10.1%) |  |

[a]Percentages may not add up to 100% due to rounding.

**Table 4.** Proportion of Appropriate Medication Use by Medication Cohort (percent of uses matching indications)

| | Any Study Medication | | | ADHD Drug | | |
|---|---|---|---|---|---|---|
| | Appropriate (%) | 95% CI | N[a] | Appropriate (%) | 95% CI | N |
| Overall | 74.5 | 73.9-75.0 | 17,475 | 82.1 | 81.5-82.8 | 10,296 |
| **Sex** | | | | | | |
| Male | 75.1 | 74.5-75.8 | 12,347 | 83.5 | 82.8-84.3 | 7842 |
| Female | 72.9 | 71.8-73.9 | 5128 | 78.1 | 76.6-79.5 | 2454 |
| **Age (years)** | | | | | | |
| 1-2 | 0.0 | – | 0 | 0.0 | – | 0 |
| 3-5 | 46.5 | 44.2-48.9 | 790 | 72.5 | 69.8-75.1 | 790 |
| 6-12 | 77.0 | 76.3-77.7 | 10,228 | 83.7 | 82.9-84.5 | 6715 |
| 13-17 | 76.6 | 75.6-77.5 | 6457 | 82.0 | 80.7-83.3 | 2791 |
| **Race** | | | | | | |
| White | 75.8 | 75.0-76.6 | 8821 | 83.3 | 82.4-84.2 | 5138 |
| Black | 73.4 | 71.4-75.4 | 1386 | 80.5 | 78.0-82.9 | 824 |
| Hispanic | 72.7 | 71.6-73.7 | 4669 | 80.4 | 79.1-81.7 | 2890 |
| Native American | 70.6 | 67.1-74.1 | 462 | 79.0 | 74.0-84.0 | 203 |
| Asian/Pacific Island + Cuban/Haitian | 69.9 | 61.0-78.8 | 72 | 76.2 | 65.7-86.7 | 48 |
| Other | 73.3 | 66.6-80.1 | 121 | 81.4 | 72.3-90.5 | 57 |
| Unspecified | 74.8 | 73.2-76.5 | 1944 | 83.6 | 81.6-85.6 | 1136 |

ADHD indicates attention deficit hyperactivity disorder; CI, confidence interval.
[a]N = number appropriate.

higher than for Hispanics, and 7.3 times higher than for Native Americans. One should keep in mind that our data did not include information on prescriptions paid by other sources, such as the Indian Health Service. Other studies have shown the prevalence for whites as high as 2.4 times that for blacks and 1.7 times that for Hispanics. In addition, there was an apparent association in this study between use of psychotropic medications and not providing a racial identification at enrollment, which was not noted in the other studies referenced above.

This study also indicates a sex difference in the use of these medications. Prevalence of use of any medication was 2.2 times higher for males than for females. This difference has been reported in earlier studies of Medicaid enrollees, ranging from 1.6 to 2.4 times higher for males.[3,28,29] One reason for this difference is the known higher prevalence of diagnosing ADHD for males (2.8 times higher than for females in this study).[30] The prevalence of use of ADHD medications was, indeed, 2.8 times higher for males in our analysis, and has ranged from 3.0 to 3.5 times higher for males in other studies involving Medicaid enrollees.[3,25,27,29]

Concern has been expressed in the literature and lay press about the increasing use, and safety, of psychotropic medications in infants and preschool children.[8-15] The prevalence of use of any medication in this study for a combined 1 through 5 year age group was 10.4 per 1000 subjects (95% CI: 9.8-11.0). The prevalence in 2 other Medicaid programs in 1995 for subjects aged 0 through 4 years was similar at 9.8 and 15.3 per 1000.[3] The prevalence in these same 2 programs plus 5 others in 2001 for ages 2 through 4 years was 23 per 1000 subjects.[31] The prevalence of use of ADHD medications in this study for the 3 to 5 year age group was 15.9 (95% CI: 14.9-16.9), and for a combined 1 to 5 year age group 8.3 per 1000 subjects (95% CI: 7.7-8.8). The prevalence of use of stimulant medication for subjects aged 2 to 4 years in 3 Medicaid programs was 8.9, 11.2, and 12.3 per 1000.[11,28] For subjects aged 0 to 4 years in 2 Medicaid programs, the prevalence of stimulants was 4.2 and 6.8 per 1000.[3] In another Medicaid program, the prevalence was 13 per 1000 for subjects aged 1 to 5 years and in a second it was 6.2 for subjects aged 0 to 5 years.[25,27]

## Limitations

Limitations of this study include the use of administrative data, originally collected for reasons unassociated with this study. There was a risk of misclassification,

| | Antipsychotic | | | Antidepressant | | |
|---|---|---|---|---|---|---|
| | Appropriate (%) | 95% CI | N | Appropriate (%) | 95% CI | N |
| | 67.4 | 66.2-68.5 | 4667 | 62.7 | 61.2-64.2 | 2512 |
| | | | | | | |
| | 66.0 | 64.6-67.3 | 3174 | 59.7 | 57.7-61.7 | 1331 |
| | 70.5 | 68.6-72.5 | 1493 | 66.5 | 64.3-68.7 | 1181 |
| | | | | | | |
| | 0.0 | – | 0 | 0.0 | – | 0 |
| | 0.0 | – | 0 | 0.0 | – | 0 |
| | 69.1 | 67.6-70.6 | 2499 | 61.7 | 59.3-64.0 | 1014 |
| | 78.2 | 76.7-79.7 | 2168 | 66.3 | 64.4-68.3 | 1498 |
| | | | | | | |
| | 70.9 | 69.4-72.4 | 2412 | 61.6 | 59.5-63.7 | 1271 |
| | 64.3 | 60.4-68.3 | 368 | 66.2 | 60.8-71.6 | 194 |
| | 62.1 | 59.8-64.4 | 1077 | 63.9 | 61.1-66.8 | 702 |
| | 64.3 | 58.3-70.4 | 155 | 66.7 | 59.3-74.1 | 104 |
| | 57.7 | 38.7-76.7 | 15 | 64.3 | 39.2-89.4 | 9 |
| | 73.9 | 63.5-84.3 | 51 | 50.0 | 30.8-69.2 | 13 |
| | 66.6 | 63.5-69.7 | 589 | 61.7 | 56.6-66.7 | 219 |

programs in other states. There was evidence of racial disparity in use of these medications. The majority of use was consistent with recommended indications. This was, to our knowledge, the first study to assess the appropriateness of use of psychotropic medications using an evidence-based methodology. These findings need to be replicated in further studies on other populations.

particularly related to errors in age and eligibility determination. However, those variables were also important data elements required for business use, reducing the likelihood of such misclassification. The decision to limit the study population to those members continuously eligible during the study period might have made the sample population not representative of the source population. The determination of appropriateness of use was based on our evaluation of the review literature and practice guidelines. It is possible that our literature searches failed to identify relevant sources that would have impacted our evaluation. Our measure of appropriateness was also subject to coding biases. In addition to possible miscoding and incomplete coding of diagnoses, physicians can be reluctant to assign a diagnosis to a patient in certain circumstances. Also, as discussed previously in the Methods section, our use of diagnostic codes limited to 3 digits caused decreased precision.

## CONCLUSIONS

The prevalence of use of psychotropic medications by children and adolescents in Arizona was generally consistent with that previously reported from Medicaid

## REFERENCES

1. Costello EJ, Egger H, Angold A. 10-year research update review: the epidemiology of child and adolescent psychiatric disorders: I: methods and public health burden. *J Am Acad Child Adolesc Psychiatry*. 2005;44(10):972-986.

2. Angold A, Costello EJ, Erkanli A. Comorbidity. *J Child Psychol Psychiatry*. 1999; 40(1):57-87. doi:10.1111/1469-7610.00424.

3. Zito JM, Safer DJ, DosReis S, et al. Psychotropic practice patterns for youth: a 10-year perspective [see comment]. *Arch Pediatr Adolesc Med*. 2003;157(1): 17-25.

4. Ramchandani P. Treatment of major depressive disorder in children and adolescents: most selective serotonin reuptake inhibitors are no longer recommended. *BMJ*. 2004;328(7430):3-4. doi:10.1136/bmj.328.7430.3.

5. Selective serotonin reuptake inhibitors (SSRIs): Overview of regulatory status and CSM advice relating to major depressive disorder in children and adolescents including a summary of available safety and efficacy data. http://www.mhra.gov.uk/Safetyinformation/Safetywarningsalertsandrecalls/Safetywarningsandmessages-formedicines/CON019494. Medicines and Healthcare products Regulatory Agency website. Published September 29, 2003.

6. FDA statement on recommendations of the psychopharmacologic drugs and pediatric advisory committees. Washington, DC: US Food and Drug Administration; September 16, 2004.

7. Summary minutes of the CDER psychopharmacologic drugs advisory committee and the FDA pediatric advisory committee. Food and Drug Administration Center for Drug Evaluation and Research; September 13-14, 2004.

8. Cooper WO, Hickson GB, Fuchs C, Arbogast PG, Ray WA. New users of anti-psychotic medications among children enrolled in TennCare [see comment]. *Arch Pediatr Adolesc Med*. 2004;158(8):753-759.

9. Patel NC, Sanchez RJ, Johnsrud MT, Crismon ML. Trends in antipsychotic use in a Texas Medicaid population of children and adolescents: 1996 to 2000. *J Child Adolesc Psychopharmacol*. 2002;12(3):221-229.

10. Olfson M, Marcus SC, Weissman MM, Jensen PS. National trends in the use of psychotropic medications by children. *J Am Acad Child Adolesc Psychiatry*. 2002;41(5):514-521.

11. Zito JM, Safer DJ, dosReis S, Gardner JF, Boles M, Lynch F. Trends in the prescribing of psychotropic medications to preschoolers. *JAMA*. 2000;283(8): 1025-1030.

12. Biederman J, Mick E, Hammerness P, et al. Open-label, 8-week trial of olanzapine and risperidone for the treatment of bipolar disorder in preschool-age children. *Biol Psychiatry*. 2005;58(7):589-594.

13. Wigal T, Greenhill L, Chuang S, et al. Safety and tolerability of methylpheni-date in preschool children with ADHD [see comment]. *J Am Acad Child Adolesc Psychiatry*. 2006;45(11):1294-1303.

14. DeBar LL, Lynch F, Powell J, Gale J. Use of psychotropic agents in preschool children: associated symptoms, diagnoses, and health care services in a health maintenance organization. *Arch Pediatr Adolesc Med*. 2003;157(2):150-157.

15. Vitiello B. Psychopharmacology for young children: clinical needs and research opportunities. *Pediatrics*. 2001;108(4):983-989.

16. Dreyer BP. The diagnosis and management of attention-deficit/hyperactivity disorder in preschool children: the state of our knowledge and practice. *Curr Probl Pediatr Adolesc Health Care*. 2006;36(1):6-30.

17. Angold A, Erkanli A, Egger HL, Costello EJ. Stimulant treatment for children: a community perspective. *J Am Acad Child Adolesc Psychiatry*. 2000;39(8):975-984; discussion 984-994.

18. Olfson M, Gameroff MJ, Marcus SC, Waslick BD. Outpatient treatment of child and adolescent depression in the United States. *Archives of General Psychiatry*. 2003;60(12):1236-1242.

19. Birmaher B, Brent D. Practice parameters for the assessment and treatment of children and adolescents with depressive disorders. Washington, DC: American Academy of Child and Adolescent Psychiatry; 1998. www.aacap.org.

20. Pliszka S; AACAP Work Group on Quality Issues. Practice parameter for the assessment and treatment of children and adolescents with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry*. 2007;46(7):894-921.

21. Spencer TJ, Biederman J, Mick E. Attention-deficit/hyperactivity disorder: diagnosis, lifespan, comorbidities, and neurobiology. *J Pediatr Psychol*. 2007;32(6): 631-642.

22. Pappadopulos E, Macintyre Ii JC, Crismon ML, et al. Treatment recommendations for the use of antipsychotics for aggressive youth (TRAAY): part II. *J Am Acad Child Adolesc Psychiatry*. 2003;42(2):145-161.

23. Ladouceur M, Rahme E, Pineau CA, Joseph L. Robustness of prevalence estimates derived from misclassified data from administrative databases. *Biometrics*. 2007;63(1):272-279.

24. Wang PS, Walker A, Tsuang M, Orav EJ, Levin R, Avorn J. Strategies for improving comorbidity measures based on Medicare and Medicaid claims data. *J Clin Epidemiol*. 2000;53(6):571-578.

25. Winterstein AG, Gerhard T, Shuster J, et al. Utilization of pharmacologic treatment in youths with attention deficit/hyperactivity disorder in Medicaid database. *Ann Pharmacother*. 2008;42(1):24-31.

26. Patel NC, Crismon ML, Hoagwood K, et al. Trends in the use of typical and atypical antipsychotics in children and adolescents. *J Am Acad Child Adolesc Psychiatry*. 2005;44(6):548-556.

27. Rushton JL, Whitmire JT. Pediatric stimulant and selective serotonin reuptake inhibitor prescription trends: 1992 to 1998. *Arch Pediatr Adolesc Med*. 2001;155(5): 560-565.

28. Martin A, Van Hoof T, Stubbe D, Sherwin T, Scahill L. Multiple psychotropic pharmacotherapy among child and adolescent enrollees in Connecticut Medicaid managed care. *Psychiatric Services*. 2003;54(1):72-77.

29. Fox MH, Foster CH, Zito JM. Building pharmacoepidemiological capacity to monitor psychotropic drug use among children enrolled in Medicaid. *Am J Med Quality*. 2000;15(4):126-136.

30. Sciutto MJ, Eisenberg M. Evaluating the evidence for and against the overdiagnosis of ADHD. *J Atten Disord*. 2007;11(2):106-113.

31. Zito JM, Safer DJ, Valluri S, Gardner JF, Korelitz JJ, Mattison DR. Psychotherapeutic medication prevalence in Medicaid-insured preschoolers. *J Child Adolesc Psychopharmacol*. 2007;17(2):195-203. **ajpb**