

Diagnosis of Attention-Deficit/Hyperactivity Disorder and Use of Psychotropic Medication in Very Young Children

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Context: Increases in diagnosis and treatment of attention-deficit/hyperactivity disorder (ADHD) have elicited public and professional concern. Research suggests that this trend warrants the inclusion of previously underdiagnosed children and adults. It is not clear whether this trend includes young children.

Objective: To identify patterns of diagnosis and treatment of ADHD in very young children over time.

Design: Descriptive study of Michigan Medicaid claims data.

Patients: Inclusion criteria included recorded ADHD diagnosis, continuous Medicaid eligibility during a 15-month period, and age 3 years or younger at the first date of service.

Main Outcome Measures: Diagnoses of ADHD, conditions commonly comorbid with ADHD, other chronic health conditions, and injuries; treatments such as psychological services and psychotropic medication; and the number of ambulatory visits.

Results: We identified 223 children aged 3 years or younger diagnosed with ADHD. Many had conditions commonly comorbid with ADHD (44%), other chronic health conditions (41%), and injuries (40%). More than half received psychotropic medication (57%); fewer received psychological services (27%). Twenty-two different psychotropic medications were used. Patterns included more than 1 psychotropic medication (46%) in 30 combinations of simultaneous use and 44 combinations of sequential use. The mean number of ambulatory visits was 18.

Conclusions: Children aged 3 years or younger had ADHD diagnosed and received markedly variable psychotropic medication regimens. Little information is available to guide these practices. The presence of comorbid conditions and injuries attests to these children's vulnerability. Resources must be identified that will enable physicians to better respond to the compelling needs of these children and their families.

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Editor's Note: The authors point out a pressing need to define better diagnostic criteria and effective treatment in very young children. There seems to be a real deficit in attention to this problem.

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ATENTION-DEFICIT/hyperactivity disorder (ADHD) is a neuropsychiatric syndrome associated with significant functional impairment, including poor academic outcomes, comorbid psychiatric and developmental conditions, and patient and family distress. Population-based studies estimate the prevalence of ADHD as about 4%.¹ Attention-deficit/hyperactivity disorder is typically identified and diagnosed in children during their early elementary school years and is one of the most common behavioral or psychological disorders of childhood.²

Public and professional concern about the increasing frequency of the diagnosis of

ADHD and treatment with stimulant medication has prompted examination of this complex issue,²⁻⁴ but appropriate identification of ADHD among previously underrepresented groups of children, adolescents, and adults and the use of stimulants for longer periods seems to account for most of this increase.³⁻⁵ In addition, the use of psychotropic medication for children younger than age 18 years has increased significantly over 3 decades.^{6,7} It is not clear, however, whether very young children are part of these trends.

Age of onset constitutes a critical issue in the diagnosis of ADHD.⁸ A recent study suggests that the criteria of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*, are valid for children aged 4 to 6 years, but the criteria are not yet validated for younger children.^{9,10} In addition, there is no systematic study of the safety and efficacy of psychotropic medications in very young children that might guide their use in this population.¹¹

SUBJECTS AND METHODS

DATA SOURCE

The data source for both this study and the larger study of which it is a part is claims for outpatient and pharmacy services in the Michigan Medicaid system of health care. Our data include claims from noncapitated health care plans for the 15-month period from October 1, 1995, to December 31, 1996. This includes emergency department contacts that did not result in hospitalization and all office-based visits. Capitated plans were not included because claims data were not available for Michigan Medicaid recipients in capitated plans during the study period.

SUBJECTS

Of the 1 096 455 individuals who were covered by Michigan Medicaid during this period, 721 455 (65.8%) were insured by noncapitated plans. Among these, 13 545 individuals had a claim for service with a diagnosis of ADHD as of December 31, 1996. This represents a period prevalence of 1.9% for ADHD among those in noncapitated Medicaid insurance programs. To examine patterns of diagnosis and treatment in very young children, a 15-month claims history was constructed for each individual that met the 3 inclusion criteria: a recorded diagnosis of ADHD, continuous eligibility for Medicaid during the 15-month period, and age of 3 years or younger at the first date of service. The rationale for limiting the study to patients with continuous eligibility was to capture all health care that the subjects received during the study period. The first date of service was selected as the point at which the age of recipients was defined; the age of the children changes as the study continues. A 15-month period was used to enable examination of critical diagnostic and treatment efforts over time.

OUTCOMES

Study outcomes elicited from the database represent 3 categories of practice actions: diagnoses formulated, treatments prescribed, and number of ambulatory health care visits.

The diagnoses were examined according to the *International Classification of Diseases, Ninth Revision, Clinical Modification*.¹² A diagnosis of ADHD was determined by the stem code for attention deficit disorder, 314.xx, including 314.00, 314.01, 314.1, 314.2, 314.8, and 314.9.⁹ The use of ADHD as a selection criterion reflects the inference that a physician considered problems presented by the child and family to be best defined within this diagnostic category; it does not reflect the diagnostic process.

Other diagnoses were aggregated as well. For example, all codes referring to difficulty with speech and language were grouped under the term *language disorder*. Diagnoses were counted per child rather than per date of service. For example, asthma was counted once per child regardless of the number of visits for that diagnosis.

Diagnoses were separately classified as either conditions commonly comorbid with ADHD or other medical diagnoses (**Figure 1**). Many of the diagnoses partially met the criteria for a chronic health condition because the conditions were expected to endure more than 3 months.¹³ Chronic conditions that occurred in only one child were not included. Diagnoses that were reviewed but not described in the study included common acute conditions, such as upper respiratory infection and pediculosis. An episode of injury was counted for all diagnostic codes related to injuries, accidents, trauma, burns, foreign bodies, poisonings, and ingestions. Multiple injuries occurring on the same day and follow-up visits for the same injury were counted as one episode of injury. For example, fracture of the radial head and fracture of the distal femur occurring on the same day or a visit for removal of sutures shortly after a visit for a laceration counted as one episode of injury.

The study identified 2 categories of treatment: psychological services and psychotropic medications. The fourth edition of *Current Procedural Terminology*¹⁴ (CPT) was used to identify psychological services associated with psychological evaluation, counseling, or testing. The Michigan Medicaid database includes all claims for these services at all sites, including community agencies, private offices, and schools. This study captures counseling provided by the physician in the context of an office visit only when the claims data specify the CPT code for counseling.

Medications were identified according to the National Drug Codes.¹⁵ We categorized medications as psychotropic using criteria established by Pincus et al.⁷ Diphenhydramine hydrochloride, hydroxyzine hydrochloride, chloral hydrate, and all anticonvulsants were excluded as psychotropic because the intent of their use could not be determined. To study the different aspects of polypharmacy, we examined the simultaneous and consecutive use of more than one psychotropic medication. Simultaneous use, defined as more than one medication within 7 days or a pattern of more than one medication in recurrent use over time, describes children who received more than one psychotropic medication at a time; consecutive treatment, defined as the use of different medications over the 15-month study period, describes children whose medications changed over time.

The number of ambulatory visits was counted for each child. All diagnostic codes and services with the same date of service were considered as one visit. This included services provided in any outpatient setting and in the emergency department.

This study explores basic questions that frame our understanding of ADHD and the care of very young children. The following questions are addressed: Are children diagnosed with ADHD very early in life? What treatments are made available to such children? Are there other health problems for which these children receive treatment? This study describes patterns of diagnosis and treatment for children aged 3 years or younger diagnosed with ADHD, starting with the first date of service and followed up for 15 months.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

We identified 223 children with ADHD aged 3 years or younger in the Michigan Medicaid system from October 1, 1995, to December 31, 1996. About one fourth of these children were aged 2 years or younger. **Table 1** describes the distribution of sex, ethnicity, and initial age of these children.

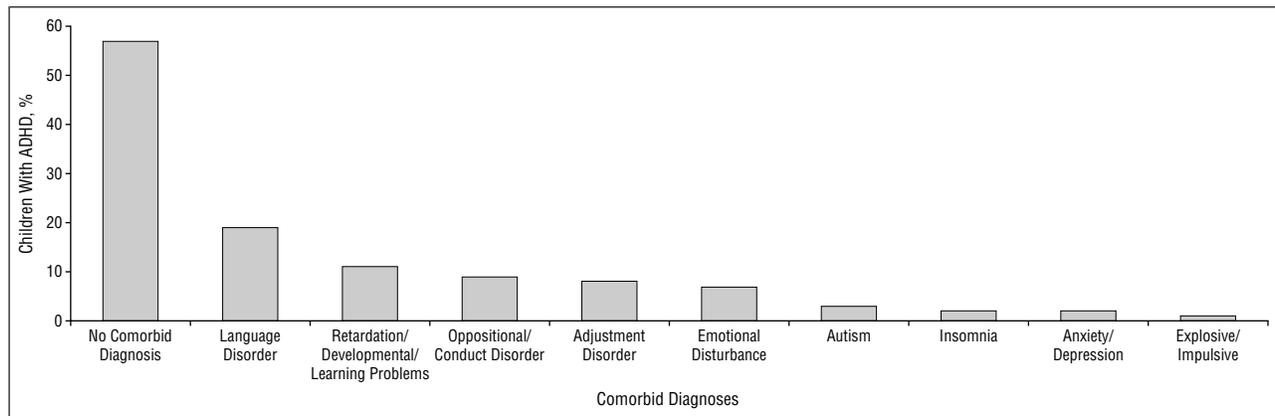


Figure 1. Distribution within the study group of comorbid psychological, behavioral, and developmental problems among children with attention-deficit/hyperactivity disorder (ADHD).

Table 1. Demographic Characteristics of Very Young Children With Attention-Deficit/Hyperactivity Disorder (N = 223)*

Demographic Characteristics	No. (%)
Sex	
Male	178 (79.8)
Female	45 (20.2)
Ethnicity	
White	152 (68.2)
African American	50 (22.4)
Hispanic	9 (4.0)
Unknown	12 (5.4)
Age at first date of service, y	
<1	5 (2.2)
1	5 (2.2)
2	50 (22.4)
3	163 (73.1)

*The inclusion criteria used to identify these patients from the Michigan Medicaid claims data included children younger than age 3 years who were continuously eligible for Michigan Medicaid during the entire 15-month period and for whom Medicaid claims requests were submitted for attention-deficit/hyperactivity disorder.

DIAGNOSTIC PATTERNS

Figure 1 illustrates the distribution within the study group of psychological, behavioral, and developmental problems that are common comorbid conditions among children with ADHD. A single comorbid condition was documented in 64 children (28.7%) and 2 or 3 comorbid conditions were found in 33 children (14.8%). Difficulty with language and cognitive development constituted the most frequent comorbid conditions.

Our study determined that the 223 children diagnosed with ADHD had additional medical problems (**Figure 2**); 91 children (40.8%) had chronic health conditions, such as congenital anomalies, diabetes, and asthma. Among these, 29 children (13.0% of the entire study group) had 2 to 6 chronic health conditions. Child maltreatment was diagnosed in 7 children (3.1%) and prolonged posttraumatic stress disorder in 3 children (1.3%).

Among these 223 very young children with ADHD, 90 (40.4%) were treated for injury during this 15-month study period (**Figure 3**). More than 1 episode

of injury was found for 28 children (12.6% of the entire study group).

TREATMENT PATTERNS

Treatment included psychotropic medications, psychological services, a combination of both, or neither (**Figure 4**). More than half of the children received psychotropic medication (n = 127 [57.0%]), and slightly more than one quarter received psychological services (n = 59 [26.5%]).

The treatment of these children included 22 different psychotropic medications (**Table 2**). All children were at least 2 years old at the time they received a psychotropic medication. Among the 127 children treated, 69 (54.3% of those treated) received 1 psychotropic medication and 58 (45.7% of those treated) received more than 1 psychotropic medication. Methylphenidate hydrochloride and clonidine hydrochloride were the most frequently used medications, both as single agents and in combination. The 5 children with autism or childhood psychosis were treated with psychotropic medication.

Simultaneous use of 2 or 3 psychotropic medications was observed for 44 children (34.6% of those treated). Thirty different combinations of medications were used; 22 of these were used only once. For example, 13 children received methylphenidate and clonidine simultaneously; one child received amitriptyline hydrochloride, methylphenidate, and clonidine simultaneously.

Consecutive use of 2 to 6 medications was observed for 58 children (45.7% of those treated). Forty-four different series of medications were used; 36 series were used only once. For example, 4 children received methylphenidate, then dextroamphetamine sulfate. One child received the following medications over time: clonidine, imipramine hydrochloride, nortriptyline hydrochloride, thioridazine, venlafaxine hydrochloride, and desipramine hydrochloride.

A significant temporal relationship between injury and psychotropic medication did not emerge. Of the 127 children receiving medication, 75 were free from injury, 9 were injured before receiving medication, and 43 were injured after receiving medication.

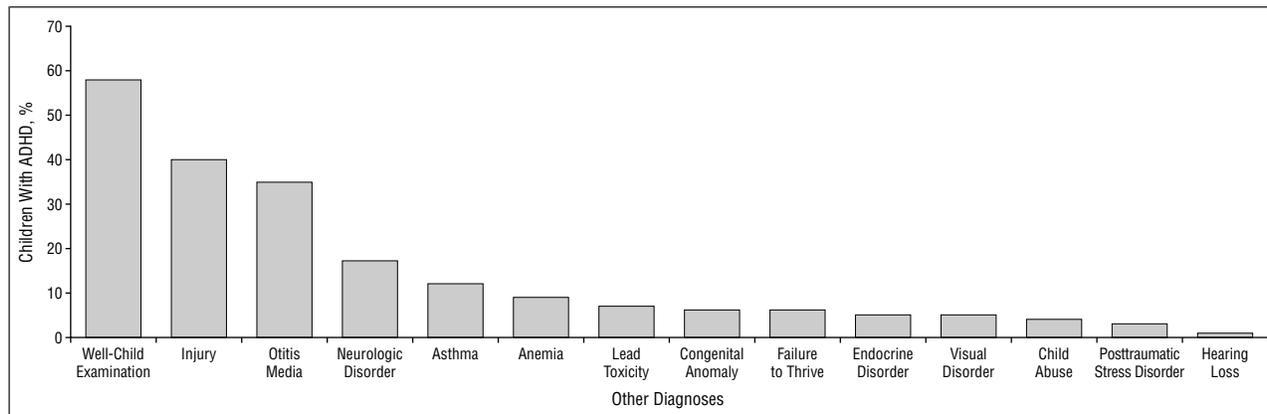


Figure 2. Other comorbid diagnoses in children with attention-deficit/hyperactivity disorder (ADHD).

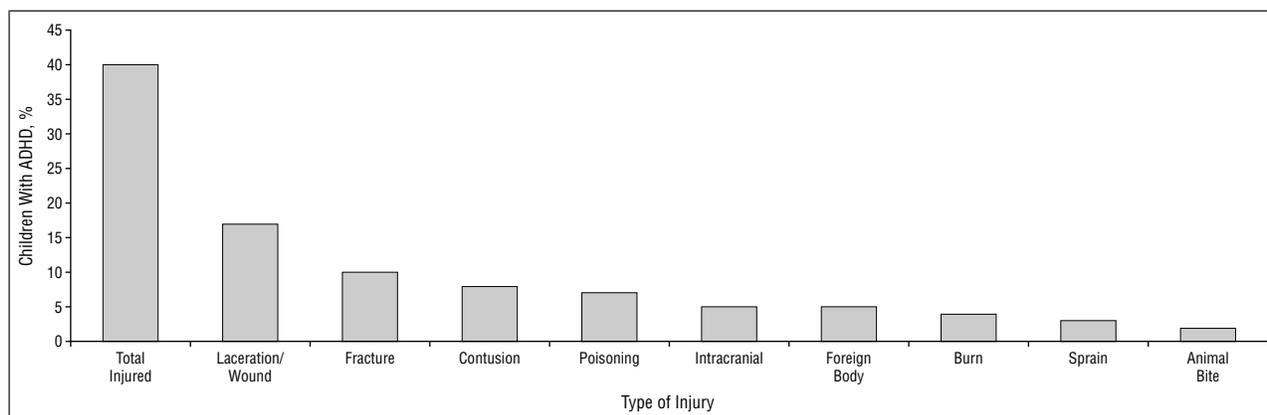


Figure 3. Types of injuries sustained by children with attention-deficit/hyperactivity disorder (ADHD).

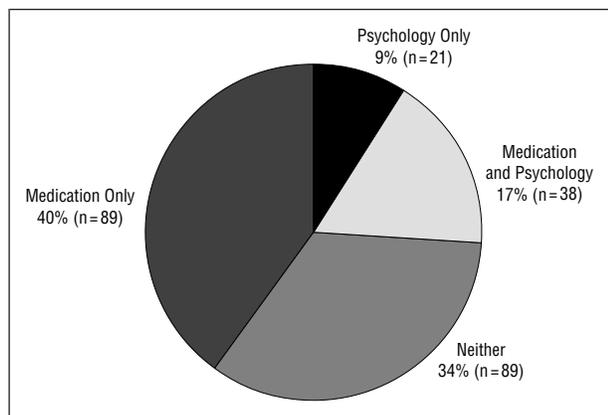


Figure 4. Distribution of treatment with psychotropic medication and psychology services.

AMBULATORY VISITS

The children in this study had a large number of ambulatory visits (median, 18) (Figure 5). Two children received only one visit in 15 months. Just under half of the children (n = 94 [42.2%]) were not seen for a health maintenance or well-child examination during the 15-month study period.

Limitations of this study reflect the use of a claims database. Claims data do not reveal clinical details enabling the assessment of the appropriateness of diagnosis

or treatment for a given child. This study focuses on discerning the presence and extent of patterns of care, and published research illustrates that claims data can contribute to an understanding of the prevalence of disorders and clinical practice patterns.¹⁶⁻¹⁸ Large administrative medical databases have elicited considerable scrutiny, given the potential they offer for efficient exploration of patterns of health care delivery.¹⁹ Claims data are subject to error in data elements such as age, sex, ethnicity, and omission of diagnostic coding.²⁰ However, in this study, separate claims examined over 15 months for each child allowed confirmation that these data elements remained consistent over time.

Additional criticisms of the use of large administrative databases note the limits imposed by the lack of a conceptual framework guiding analyses.²¹ In contrast, we place this study within the context of the trend toward increased diagnosis and treatment of ADHD. In addition, this research is part of continuing efforts to expand health services research for children and to empirically examine and reflect on patterns of care, particularly care provided to children historically underserved.

Because the Michigan Medicaid database does not group recipients in the age categories used in this study, we cannot derive prevalence rates. This study is also limited by lack of a comparison group that might allow, for example, consideration of injury rate in the children who do not have a diagnosis of ADHD but are of the same age within Michigan Medicaid or within a private insur-

Table 2. Psychotropic Medications Used in Children Aged 1 to 3 Years Diagnosed With Attention-Deficit/Hyperactivity Disorder

Generic Drug Name	No. of Children Treated* (N = 223)
Methylphenidate hydrochloride	73
Clonidine hydrochloride	48
Dextroamphetamine sulfate	31
Imipramine hydrochloride	24
Thioridazine hydrochloride	18
Pemoline	15
Guanfacine hydrochloride	9
Trazodone hydrochloride	9
Fluoxetine hydrochloride	7
Nortriptyline hydrochloride	6
Venlafaxine hydrochloride	5
Sertraline hydrochloride	2
Amitriptyline hydrochloride	1
Buspirone hydrochloride	1
Bupropion hydrochloride	1
Desipramine hydrochloride	1
Doxepin hydrochloride	1
Haloperidol	1
Lithium carbonate	1
Nefazodone hydrochloride	1
Risperidone	1
Temazepam	1

*Some children were treated with a simultaneous or consecutive regimen of drugs.

ance sector. The comorbidity and treatment for diagnoses made late in the study period may be underestimated. However, this 15-month study allows examination of patterns of care over a period that ranges from one third to the complete lifetime of the young children included as subjects.

COMMENT

Diagnosis of ADHD and psychopharmacologic treatment for very young children are not well supported by medical literature or published experience. The *DSM-IV* does not preclude the diagnosis of very young children if the diagnostic criteria are met. However, the dilemma associated with diagnosis at this age is the determination of behavior that falls outside the normal range. There is little to guide the diagnostic process for very young children. Likewise, there is a paucity of information about the efficacy and safety of psychotropic medications in this age group.

Parents of school-aged children with ADHD often describe problems that begin early in life, including hyperactivity, difficulty with daily routines, such as feeding and sleeping, and oppositional behaviors in the toddler years.² Diagnostic criteria for ADHD described in *DSM-IV* require that some symptoms be present before the age of 7 years. Studies have carefully described groups of children with highly problematic behaviors identified in early childhood whose problems persist into the school-age years and eventually meet the diagnostic criteria for conditions such as ADHD and oppositional disorder.²²⁻²⁴ In examination of psychiatric disorders among preschoolers, Lavigne and colleagues²⁵ reported that 2%

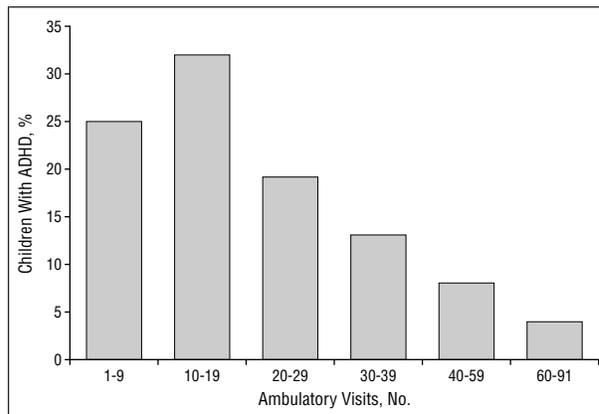


Figure 5. Ambulatory visits per child with attention-deficit/hyperactivity disorder (ADHD) over the 15-month study period.

of children aged 2 to 5 years met the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition*, criteria for ADHD. However, *DSM-IV* cautions that making this diagnosis in the early years of childhood is problematic; not all infants and toddlers with a high activity level and problematic behaviors meet the criteria for ADHD at a later age.⁹

Attention-deficit/hyperactivity disorder might not be the most accurate diagnosis for children less than 4 years old. The guidelines for the diagnosis and treatment of ADHD put forward by the American Academy of Child and Adolescent Psychiatry²⁶ and the American Academy of Pediatrics²⁷ do not address the diagnosis in children younger than age 4 years; however, there are newly published recommendations that do address the assessment of infant and toddler mental health problems.²⁸ Diagnostic categories specifically designed for this age group are described in *Zero to Three: Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood*²⁹ and in *The Classification of Child and Adolescent Mental Diagnoses in Primary Care*.³⁰ These 2 resources currently provide a comprehensive and appropriate conceptual framework for the diagnosis of young children and for their families, who are struggling with problems of behavior, interaction, and development.

Our finding of many comorbid conditions in this study group complements studies done in other populations of children that have found a high incidence of attention and behavior problems. These include learning and behavior problems among children with chronic health conditions and attention problems among young children with language disorder.^{31,32} Attention-deficit/hyperactivity disorder is known to be associated with a high injury rate, which was recently shown among preschool-aged children and was found in our study for very young children as well.¹⁰

The low use of psychological services found in our study group might reflect limited access to mental health services. Accessibility might be difficult because of geographical constraints or limited availability of professionals with experience in the mental health problems of very young children. Access might also be limited if these children and their families are unable to meet the

criteria for public mental health services, which are often limited to the most severe and disabling mental health problems of the community. Low use of services might also reflect a view by parents and physicians that the problems of these children are medical rather than psychological.

The array of psychotropic medications and the highly variable way in which they are used suggest a lack of guidance for treatment of very young children with these medications. Although stimulants are among the most widely studied psychotropic medications in children, systematic studies of the safety and efficacy of their use focus on children older than those identified in this study. According to a review of stimulant medication by Wilens and Biederman,³³ the youngest child included in these studies was 3 years old. Most published reports of the medications used in our study focus on accidental ingestion in toddlers and pregnancy and breast-feeding outcomes for mothers treated with psychoactive medications.³⁴⁻³⁶ Haloperidol, imipramine, and amitriptyline hydrochloride therapy are reported in cases of children aged 12 to 28 months.^{37,38} Risperidone, lithium carbonate, and buspirone hydrochloride therapy are reported in children as young as age 4 years.³⁹⁻⁴¹ The simultaneous use of psychotropics might be a reflection of the severity of the condition. The consecutive use of medications over time might indicate lack of effectiveness or the presence of side effects. However, studies of polypharmacy have not been done in this age group. The use of psychotropic medications as described for these children is not approved by the Food and Drug Administration. However, this is characteristic of many medications routinely used in pediatric populations and reflects the general paucity of research regarding the use of medications for children.

Dependence on claims data precludes directly linking specific medications to diagnoses or determining the appropriateness of medications for a specific child. However, the extreme variation in the use of psychotropic medications suggests haphazard use at worst and uninformed use at best. This may reflect the complexity and urgency of the problems being treated. This degree of variability, however, severely limits determination of the impact of these medications in the treatment of children.

Existing studies of care provided to patients with low income have documented that access to care, including well-child visits, remains a problem.⁴² In contrast, this study reveals a pattern of care for very young children in the Medicaid system consisting of aggressive diagnosis and treatment of problems identified but less-than-expected provision of well-child care. Other research has documented that African American children covered by Medicaid insurance are less likely than other recipients to receive psychotropic medications and that girls are less likely than boys to receive a diagnosis of and treatment for ADHD.^{20,43}

This study confirms that ADHD is diagnosed and psychotropic medications are used for children aged 3 years and younger. This study identifies a very vulnerable group of children at risk for serious developmental disorders, including language delays and mental retardation; chronic health conditions; and injury. Despite high use of medical services, many do not receive any speci-

fied well-child assessments, which would be expected for their age.

We speculate that physicians are responding to the urgent needs of these young children and their families, particularly issues of safety and development, by conferring a diagnosis of ADHD and treating with psychotropic medications. This study indicates that a framework for future study of ADHD needs to recognize the possibility that physicians respond to the needs of vulnerable patients and families without clear guidance.

The most important question prompted by these findings is this: how can physicians best work to organize resources and deliver services to meet the compelling need of these children and their families? This need cannot be neglected because widely known or accepted recommendations for diagnosis and treatment are lacking.

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