Use of medication by young people with attention-deficit/hyperactivity disorder

Michael G Sawyer, Joseph M Rey, Brian W Graetz, Jennifer J Clark and Peter A Baghurst

ABSTRACT

Objectives: To examine the prevalence of psychotropic medication use by children with attention-deficit/hyperactivity disorder (ADHD) and children without ADHD. To identify factors associated with stimulant use by children in the community.

Design: A representative, multistage probability sample of Australian households was conducted in 1998. Parents completed questionnaires assessing children's mental health problems and health-related quality of life. They also completed a structured interview to identify children's psychiatric disorders and their use of medications during the previous six months.

Participants: Parent or main caregiver of 3597 children aged 6–17 years.

Main outcome measures: Rates of use of stimulants (dexamphetamine and methylphenidate), antidepressants and clonidine by children.

Results: Overall, 1.8% of children (95% CI, 1.5%–2.3%) were receiving stimulant medication. Of those with ADHD, 12.6% (95% CI, 9.8%–16.1%) were being treated with stimulants, 2.3% (95% CI, 1.3%–4.3%) with antidepressants, and 1.9% (95% CI, 1.0%–3.7%) with clonidine. Among children without ADHD, 0.5% (95% CI, 0.3%–0.8%) were receiving stimulant medication. This represented 22.9% (95% CI, 14.6%–34.0%) of all the children who were receiving stimulants. Variables significantly associated with stimulant use were being male, having ADHD, attending a paediatrician, and having higher scores on the Aggressive Behaviour and Attention Problems scales on the Child Behaviour Checklist.

Conclusions: About 13% of Australian children with ADHD, and a substantial number of children without ADHD, are taking stimulants. The question of whether Australian children are being undertreated or overtreated with stimulant medication depends on the criteria used to assess the appropriateness of stimulant use. Additional information is needed to clarify when stimulants should be used to treat ADHD.

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THERE IS CONCERN about the increasing use of stimulant medication in Australia and other countries.[1-3] In the United States, rates of stimulant use increased 2.5 times from 1990 to 1995.[4] Comparable information at a national level is not available in Australia; however, Valentine et al[5] reported marked increases in the use of stimulants in Western Australia and New South Wales in the early 1990s.

There is good evidence for the effectiveness of stimulant medication in treating children with attention-deficit/hyperactivity disorder (ADHD).[6] Increased prescribing of stimulants may reflect more frequent use of these medications to treat children appropriately diagnosed with ADHD. Alternatively, medical practitioners may be increasingly using stimulants to treat a *range* of childhood disorders. Only two previous studies, both conducted in the United States, have examined this issue.[1,7] The proportion of children with ADHD who were receiving stimulants differed markedly in the two studies: while Angold et al[7] reported that 72% of children with ADHD in a North Carolina study were being treated with stimulant medication, Jensen et al reported a figure of 12% in a survey of four US communities.[1] Although the percentage of children without ADHD receiving stimulants was small in both studies, about half of the children receiving stimulants in each study did not meet the criteria for ADHD.

Our study had three aims: (i) to identify the percentage of children in Australia with ADHD who were receiving stimulants and other psychotropic medications; (ii) to identify the number of children without ADHD who were receiving stimulants; and (iii) to identify factors associated with children's use of stimulants.

Women's and Children's Hospital, North Adelaide, SA.

Michael G Sawyer, MB BS, PhD, Professor, Research and Evaluation Unit, and Department of Paediatrics, University of Adelaide;
Brian W Graetz, MPsych (Clin), Project Manager, Research and Evaluation Unit;
Jennifer J Clark, BA(Hons), DipEd, Project Officer, Research and Evaluation Unit;
Peter A Baghurst, PhD, Head, Public Health Research Unit.

University of Sydney, Sydney, NSW.

Joseph M Rey, MB BS, PhD, Professor of Child and Adolescent Psychiatry, and Director, Child and Adolescent Mental Health Services, Northern Sydney Health.

Reprints will not be available from the authors. Correspondence: Professor Michael G Sawyer, Women's and Children's Hospital, 72 King William Road, North Adelaide, SA 5006.
michael.sawyer@adelaide.edu.au

METHODS

Participants

The participants were 3597 parents of children aged 6–17 years who participated in the Child and Adolescent Component of the Australian National Survey of Mental Health and Well-Being.[8] The survey methodology has been described in detail elsewhere.[8,9] In brief, the survey used a multistage probability sample of 4509 households to select a representative sample of Australian children aged 4–17 years (for brevity, the term "children" will be used to describe both young children and adolescents). Between February and May 1998, interviewers approached

randomly selected households, the number chosen being proportional to the population of each State or Territory. The response rate was 70%.

Ethical approval for the survey was obtained from the Research Ethics Committee at the Women's and Children's Hospital, Adelaide.

Measures

In face-to-face interviews, parents completed the parent version of the Diagnostic Interview Schedule for Children Version IV (DISC-IV).[10-12] The DISC-IV is a structured diagnostic interview that can be used by lay interviewers. It is designed to diagnose a range of mental disorders in children (eg, ADHD, conduct disorder, depressive disorder) based on *DSM-IV* criteria.[10] Psychometric properties are acceptable: the test–retest reliability for ADHD was 0.79 (kappa), with a validity of 0.72 (kappa).[12] Impairment criteria (outlined in *DSM-IV*) were not employed in the diagnostic assessment of ADHD because their use with the DISC-IV is still under development. However, subsequent analyses have shown that use of the impairment criteria makes little difference to the number of children diagnosed as having ADHD, and does not alter the relationship between the presence of ADHD and the use of stimulants.

Parents were also asked to fill out a Child Behaviour Checklist (CBCL),[13] a self-completed written questionnaire that assesses the number of emotional and behavioural problems experienced by children in a range of areas. Ratings are summarised as scores on a Total Behaviour Problem Scale (incorporating all the problem items on the checklist), an Externalising Scale (identifying disruptive behaviour problems) and an Internalising Scale (identifying emotional problems). There are eight other scales that rate specific emotional and behavioural problems (eg, anxiety/depressive problems, aggression problems, attention problems). Substantial information is available about the psychometric characteristics of the CBCL.[13]

In face-to-face interviews, parents were also asked about what help their children had received for emotional and behavioural problems during the previous six months (eg, services attended, medications prescribed). Parents who reported that their child had received medication were asked to show the interviewer the child's medicine so that the name could be correctly recorded.

Statistical analysis

We first examined the prevalence of stimulant use according to sex and diagnosis. Prevalence estimates were weighted to reflect (minor) deviations of the sample from the characteristics of the Australian population of children aged 4–17 (based on Australian Bureau of Statistics estimates as at 30 June 1998).

Subsequently, we investigated differences between groups of children using stimulants and those not using stimulants. Logistic regression analyses were used to identify the variables that were significantly associated with stimulant use ($P \leq 0.05$).

It should be noted that prevalence estimates are weighted and therefore not in exact agreement with estimates obtainable from raw numbers, where given.

RESULTS

Missing data

Data on some CBCL scale scores were missing for 342 children. A comparison of the age, sex and family structure of children with complete data and those with missing data showed that the only significant difference between the groups was that the latter were less commonly living with their family of origin (75% v 68%). Some CBCL data were missing for 2/52 children with ADHD who were receiving stimulants and 31/345 children with ADHD who were not receiving stimulants. Information about diagnostic status (ie, whether or not children had ADHD, based on DISC-IV responses) was missing for 35 children. These children had significantly higher scores on the Externalising and Attention Problems scales of the CBCL and were significantly older (mean, 11.4 years [95% CI, 10.2–12.6]) than other children in the study (mean, 9.4 years [95% CI, 9.3–9.5]). There were also data missing for demographic items, particularly for the question asking about parental income, to which 30% of parents did not provide a response. For these reasons, the number of participants varies in some analyses.

Medications used

Eighty-six children (2.4%; 95% CI, 1.9%–2.9%) had received medication for emotional and behavioural problems. Among those who had taken medication, 68 (79%) had taken one medication, 13 (15%) had taken two medications, four (5%) three medications, and one child had taken five psychotropic medications. An additional seven children had been treated with herbal remedies.

The medications most commonly used were stimulants (dexamphetamine or methylphenidate) (1.8% [68/3597]; 95% CI, 1.5%–2.3%), antidepressants (0.4% [13/3597]; 95% CI, 0.2%–0.6%) and clonidine (0.2% [10/3597]; 95% CI, 0.1%–0.4%). Three children had been treated with thioridazine, two with risperidone, two with sodium valproate, and two with other mood stabilisers. Among the 13 children treated with antidepressants, nine had received a selective serotonin reuptake inhibitor, two a tricylic antidepressant, one moclobemide, and one an unidentified antidepressant. Although not included in our analysis because diagnostic data were not obtained for 4- and 5-year-old children, 0.5% (5/912) of 4–5-year-olds had received stimulants.

Interviewers asked parents to explain why their children were being prescribed each medication. The majority of parents of children receiving stimulants said that the medication was for "ADD" or "ADHD". One child was said to be receiving the medication for "autism", one for "developmental delay", one for "a chemical imbalance in the brain", while for one child the reason was not given. Parents reported that antidepressants were largely being used to treat "depression" and/or "anxiety", while clonidine was described as being used to treat "ADD", "ADHD" or "sleeping problems".

1: Proportion (95% CI) of children being treated with stimulants, by ADHD subtype, sex and age

	Boys	Girls	Total
ADHD subtype (n = 397)			
Inattentive (*n* = 205)	8.5% (5.0%–14.0%)	1.4% (0.3%–7.8%)	6.3% (3.8%–10.3%)
Impulsive/hyperactive (*n* = 73)	15.4% (8.0%–27.5%)	7.7% (2.1%–24.1%)	11.5% (6.2%–20.5%)
Combined (*n* = 119)	27.1% (19.2%–36.7%)	13.8% (5.5%–30.6%)	23.8% (17.2%–32.0%)
Age group			
All ages (with any ADHD subtype) (*n* = 397)	15.6% (12.0%–20.1%)	5.6% (2.7%–11.1%)	12.6% (9.8%–16.1%)
6–12-year-olds (with any ADHD subtype) (*n* = 292)	16.8% (12.5%–22.3%)	4.2% (1.6%–10.2%)	13.0% (9.7%–17.2%)
13–17-year-olds (with any ADHD subtype) (*n* = 105)	12.2% (6.8%–21.0%)	10.0% (3.5%–25.6%)	11.6% (6.9%–18.9%)
All ages (no ADHD) (*n* = 3165)	0.7% (0.4%–1.3%)	0.2% (0.1%–0.6%)	0.5% (0.3%–0.8%)

ADHD = attention-deficit/hyperactivity disorder.

Children with ADHD

Among 6–17-year-olds, the prevalence of ADHD (based on DISC-IV data) was 11.2% (95% CI, 10.2%–12.2%) (5.8% "inattentive", 2.0% "hyperactive" and 3.3% "combined" subtypes).

Overall, 12.6% (95% CI, 9.8%–16.1%) of children with ADHD were being treated with stimulants. The prevalence of stimulant treatment according to ADHD subtype, sex and age group is presented in Box 1. A further 2.3% (95% CI, 1.3%–4.3%) of the children were being treated with antidepressants and 1.9% (95% CI, 0.9%–3.6%) with clonidine. Four children with ADHD had been treated with sodium valproate or another mood stabiliser, one with thioridazine, and one with risperidone.

While the percentage of children receiving stimulants who did not meet the criteria for ADHD was small (0.5%; 95% CI, 0.3%–0.8%), they represented 22.9% (95% CI, 14.6%–34.0%) of all the children taking stimulants. Although not meeting the criteria for ADHD, this latter group had a significantly higher mean score on the CBCL Externalising Scale (mean, 56.1; 95% CI, 50.8–61.3) than those not receiving stimulants (mean, 46.0; 95% CI, 45.7–46.4). They also had significantly higher scores for the Attention Problems Scale (on stimulants, 60.7 [95% CI, 55.6–65.7]; off stimulants, 53.2 [95% CI, 52.9–53.4]) and the Aggressive Behaviour Scale (on stimulants, 57.5 [95% CI, 53.4–61.5]; off stimulants, 52.6 [95% CI, 52.4–52.8]).

Demographic characteristics and use of services by children receiving stimulants

A higher proportion of children taking stimulants were living in low-income, single-parent, blended or "other" families (eg, living with relatives), and families with unemployed parents. They had also attended various health services more often than other children (Box 2). However, when all these variables were entered in a logistic regression model in which stimulant use was the dependent variable, the only factors that remained significantly associated with stimulant use were the child's sex (male) and having had consultations with a paediatrician (Box 3).

2: Demographic characteristics and attendance at services, according to stimulant treatment (% of children [95% CI])

	On stimulants (*n* = 68)	Not on stimulants (*n* = 3529)	*P*
Sex (*n* = 3597)			
Male	84.5% (74.3%–91.1%)	50.6% (49.0%–-52.2%)	< 0.001
Female	15.5% (8.9%–25.7%)	49.4% (47.8%–51.0%)	
Age (*n* = 3596)			
6–12 years	66.7% (55.2%–76.5%)	58.3% (56.8%–59.9%)	0.2
13–17 years	33.3% (23.5%–44.8%)	41.7% (40.1%–43.2%)	
Low income (< $680 per week before tax) (*n* = 2536)	58.9% (45.9%–70.8%)	39.7% (37.9%–41.6%)	0.004
Single-parent/step-blended/"other" family (*n* = 3593)	36.6% (26.4%–48.2%)	26.1% (24.7%–27.5%)	0.05
Father's schooling to age <16 years (*n* = 2634)	29.8% (18.7%–44.0%)	30.8% (29.1%–32.6%)	0.8
Mother's schooling to age <16 years (*n* = 3056)	43.3% (32.1%–55.2%)	30.4% (28.9%–32.0%)	0.02
Father unemployed (*n* = 2700)	26.0% (15.9%–39.6%)	14.4% (13.2%–15.7%)	0.02
Mother unemployed (*n* = 3182)	56.9% (44.8%–68.2%)	44.7% (43.0%–46.4%)	0.05
Services attended (in previous six months)			
School counsellor (*n* = 3592)	31.9% (22.1%–43.6%)	3.2% (2.7%–3.8%)	< 0.001
Family doctor (*n* = 3590)	31.9% (22.3%–43.4%)	2.1% (1.7%–2.7%)	< 0.001
Paediatrician (*n* = 3590)	57.7% (46.2%–68.5%)	1.1% (0.8%–1.5%)	< 0.001
Psychologist/social worker (*n* = 3592)	23.6% (15.3%–34.6%)	1.6% (1.3%–2.1%)	< 0.001
Psychiatrist (*n* = 3591)	11.3% (5.8%–20.7%)	0.6% (0.4%–0.8%)	< 0.001

3: Simple and adjusted odds ratios for stimulant use in children, by demographic characteristics and service use (*n*=1865)*

	Simple odds ratios (95% CI)	Adjusted odds ratio† (95% CI)
Demographic characteristics	5.3 (2.8–10.1)	3.3 (1.1–9.5)
Male	1.4 (0.9–2.4)	1.0 (0.4–2.5)
6–12 years	2.2 (1.3–3.7)	2.2 (0.8–6.3)
Low income (< $680 per week before tax)	1.6 (1.0–2.6)	1.4 (0.4–5.1)
Single-parent/step-blended/"other" family	0.9 (0.5–1.7)	0.5 (0.2–1.3)
Father's schooling to age < 16 years	1.7 (1.1–2.8)	0.8 (0.3–2.1)
Mother's schooling to age < 16 years	2.2 (1.1–4.1)	1.2 (0.4–4.0)
Father unemployed	1.7 (1.0–2.7)	0.9 (0.3–2.4)
Mother unemployed		
Services attended (in previous six months)	13.9 (8.1–23.7)	1.6 (0.5–5.3)
School counsellor	21.3 (12.4–36.8)	0.5 (0.1–1.8)
Family doctor	121.5 (69.4–212.7)	99.9 (27.5–362.6)
Paediatrician	18.4 (10.1–33.5)	4.0 (1.0–16.2)
Psychologist/social worker	24.0 (10.4–55.3)	5.3 (0.7–42.7)
Psychiatrist		

*Data were missing from some categories (see Box 2 for details). †Controlling for the effect of the other variables in the table.

Clinical characteristics of children receiving stimulants

The odds ratio (OR) for stimulant use among children with a diagnosis of ADHD relative to those without this diagnosis was 30.5 (95% CI, 16.9–55.1); for those with conduct disorder the OR was 13.8 (95% CI, 7.6–25.1); and for those with depressive disorder it was 4.7 (95% CI, 2.2–10.2). The ORs for scores on all the CBCL scales were also significant (Box 4).

A series of forwards and backwards stepwise logistic regression analyses were employed to identify a parsimonious model of predictor variables (ie, one that achieves the simplest explanation). In these analyses, stimulant use was the response variable. Attendance at a paediatrician, the child's sex, diagnosis (ie, ADHD, conduct disorder or depressive disorder) and the full set of CBCL scale scores were the explanatory variables. Inclusion of both the children's diagnoses and their CBCL scores made it possible to determine whether the severity of children's problems was associated with stimulant use, independent of diagnosis. The variables identified using the forwards and backwards procedures were identical. Children receiving stimulants were significantly more likely to have attended a paediatrician, to be male, to have ADHD, and to have a higher score on the Attention Problems Scale and Aggressive Problems Scale of the CBCL than children not on stimulants (Box 5). The adjusted OR for the score on the CBCL Anxious/Depressed Scale was significantly less than one, suggesting that the presence of anxiety/depression is associated with a lower likelihood of stimulant use after adjusting for the other variables in Box 4. The lower adjusted OR for ADHD in this multivariate analysis reflects the close relationship between having a high score on the Attention Problems Scale and being diagnosed with ADHD.

DISCUSSION

To the best of our knowledge, this survey is the first Australia-wide study examining the prevalence of psychotropic medication use by children and adolescents. Previous Australian and overseas studies have been confined to geographically circumscribed regions or to clinic populations.[1,5,7]

The proportion of children using psychotropic medications in our study (2.4%) was comparable to that reported by Jensen et al[1] for children in the United States (2.3%). In both studies the most frequently used medications were stimulants, followed by antidepressants, with only a very small number of children being prescribed other medications. The percentage of those with ADHD who were taking stimulants was similar in the two studies (12.6% [our study] versus 12% [Jensen et al]) but considerably smaller than that reported by Angold et al (72%).[7] It is possible that the higher rate identified in the study by Angold et al reflects a regional variation in prescribing patterns.

About half the children using stimulants in the two US studies did not meet the diagnostic criteria for ADHD,[1,7] compared with 23% in our study. The discrepancy almost certainly reflects the use of the broader *DSM-IV* criteria in our study rather than the narrower *DSM-III-R* criteria[14] used in both US studies. When *DSM-III-R* criteria are used, fewer children are identified as having ADHD.[15,16] The effect of using narrower criteria can be observed in the present study, where, if only ADHD combined subtype (broadly equivalent to ADHD in *DSM-III-R* and hyperkinetic disorder in *ICD-10*)[16,17] is used to identify those with ADHD, the proportion of children without ADHD receiving stimulants increases to 57% (38/67).

Are children in Australia being undertreated or overtreated with stimulant

4: Odds ratios for stimulant use in children per CBCL scale point (*n*=3255)*

CBCL scale	Odds ratio (95% CI)
Total Problem Scale	1.135 (1.110–1.160)
Externalising Scale	1.134 (1.110–1.159)
Internalising Scale	1.077 (1.056–1.098)
Attention Problems Scale	1.151 (1.127–1.176)
Aggressive Behaviour Scale	1.141 (1.117–1.165)
Social Problems Scale	1.136 (1.112–1.161)
Delinquent Behaviour Scale	1.130 (1.103–1.157)
Withdrawn Scale	1.096 (1.072–1.121)
Thought Problems Scale	1.114 (1.085–1.144)
Anxious/ Depressed Scale	1.090 (1.066–1.115)
Somatic Complaints Scale	1.045 (1.015–1.077)

* The odds ratio (and its confidence interval) for a given increase (say, *n* points) can be estimated by raising the estimates in the table to their *n*th power. CBCL = Child Behaviour Checklist.

5: Variables significantly related to stimulant use in children (*n* = 3134)

Variable	Adjusted odds ratio*
Sex (male)	2.5 (1.0–6.0)
Attending a paediatrician	31.5 (14.0–71.1)
ADHD (*DSM-IV* diagnosis)	4.5 (1.9–11.0)
Aggressive Behaviour Scale†	1.087 (1.036–1.140)
Attention Problems Scale†	1.073 (1.028–1.120)
Anxious/Depressed Scale†	0.910 (0.848–0.977)

*After forward stepwise logistic regression.

†Per unit scale score, the odds ratio (and its confidence interval) for a given increase (say, *n* points) can be estimated by raising the estimates in the table to their *n*th power.

ADHD = Attention-deficit/hyperactivity disorder. *DSM-IV = Diagnostic and statistical manual of mental disorders, 4th ed.*[10]

medication? The answer to this question depends on the criteria used to assess the appropriateness of stimulant use by children. As noted by Jensen et al,[1] a diagnosis of ADHD alone is a relatively crude criterion for determining the appropriateness of stimulant use. In our study a substantial proportion of children using stimulants did not meet even the broader *DSM-IV* criteria for a diagnosis of ADHD. However, parents identified many of these children as having a substantial number of externalising problems (eg, attention problems and aggressive behaviour). It is possible that these children have subsyndromal forms of ADHD. Alternatively, stimulant treatment may have reduced the original severity of their symptoms, or other behavioural problems may have been misdiagnosed as ADHD.

Even among those diagnosed with ADHD there is debate about the extent to which treatment should include the use of stimulant medication. For example, the National Institute for Clinical Excellence in the United Kingdom recommends that methylphenidate should only be used to treat children with "severe ADHD" (described as being equivalent to severe combined-type ADHD).[18] The guidelines estimate that about 1% of children in the community have this severe form of the disorder. This is substantially less than the 1.8% of children receiving stimulants in Australia. In contrast, recommendations published by the American Academy of Child and Adolescent Psychiatry suggest that the decision to medicate should be based on a diagnosis of ADHD (based on *DSM-IV* criteria) and persistent target symptoms that cause functional impairment at school and usually also at home and with peers.[19] If these criteria were employed to assess the appropriateness of stimulant use, it might be concluded that children in Australia are undermedicated.

One of the limitations of our study was that, in some areas, substantial amounts of data were missing. If, as seems likely, the children with missing data had a higher rate of mental health problems, we may be underestimating the prevalence of ADHD and psychotropic medication use by Australian children. Other limitations included the lack of information about the dosage of medication children were taking, the lack of reports from teachers and the lack of information about who was prescribing the medication.

Despite these limitations, the picture of psychotropic medication use by children is broadly consistent with clinical practice in Australia: paediatricians play an important role in managing children with ADHD, and stimulant medication is commonly prescribed for attention problems and disruptive behaviour.

There is a great need to clarify the circumstances under which stimulant medication should be used as part of the treatment of ADHD. This will require additional information about the degree to which children with different types or severities of ADHD are disadvantaged as a result of their disorder and the extent to which stimulant medication can help them overcome this disadvantage.

COMPETING INTERESTS

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