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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

There is concern about the increasing use of stimulant medication in Australia and other countries. In the United States, rates of stimulant use increased 2.5 times from 1990 to 1995. Comparable information at a national level is not available in Australia; however, Valentine et al. 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). Increased prescribing of stimulants may reflect more frequent use of these medications to treat children appropriately diagnosed with ADHD. Alternatively, medical practitioners may be increasing stimulant use to treat a range of childhood disorders. Only two previous studies, both conducted in the United States, have examined this issue.

The proportion of children with ADHD who were receiving stimulants differed markedly in the two studies: while Angold et al. 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. 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.

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. The survey methodology has been described in detail elsewhere. 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).

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

Ethical approval for the survey was
obtained from the Research Ethics
Committee at the Women’s and Chil-
dren’s Hospital, Adelaide.

Measures

In face-to-face interviews, parents com-
pleted the parent version of the Diag-
nostic 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, con-
duct disorder, depressive disorder)
based on DSM-IV criteria.10 Psychome-
metric properties are acceptable: the
test–retest reliability for ADHD was
0.79 (kappa), with a validity of 0.72
(kappa).12 Impairment criteria (out-
lined in DSM-IV) were not employed in
the diagnostic assessment of ADHD
because their use with the DISC-IV is
still under development. However, sub-
sequent analyses have shown that use of
the impairment criteria makes little dif-
fERENCE between groups of children
identified as having ADHD, and does not
alter the relationship between the pres-
ence of ADHD and the use of stimu-
lation.

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 (incorporat-
ing all the problem items on the check-
list), an Externalising Scale (identifying
disruptive behaviour problems) and an
Internalising Scale (identifying emo-
tional problems). There are eight other
scales that rate specific emotional and
behavioural problems (eg, anxiety/ de-
pressive problems, aggression prob-
lems, attention problems). Substantial
information is available about the psy-
chometric characteristics of the
CBCL.13

In face-to-face interviews, parents
were also asked what help their
children had received for emotional and
behavioural problems during the previ-
sous 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 diag-
nosis. 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 differ-
ces between groups of children using
stimulants and those not using stimu-
ulants. Logistic regression analyses were
used to identify the variables that were
significantly associated with stimulant
use (P ≤ 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 signifi-
cantly higher scores on the Externalis-
ing 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 demo-
graphic items, particularly for the ques-
tion 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 prob-
lems. Among those who had taken med-
ication, 68 (79%) had taken one
medication, 13 (15%) had taken two
medications, four (5%) three medica-
tions, and one child had taken five
psychotropic medications. An addi-
tional 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 tricyclic 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 pre-
scribed each medication. The majority
of parents of children receiving stimu-
lants 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 “anxi-
ety”, while clonidine was described as
being used to treat “ADD”, “ADHD”
or “sleeping problems”.

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

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

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, 65.7; 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, 57.5 [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])

<table>
<thead>
<tr>
<th>Sex (n = 3597)</th>
<th>On stimulants (n = 68)</th>
<th>Not on stimulants (n = 3529)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>84.5% (74.3%–91.1%)</td>
<td>50.6% (49.0%–52.2%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Female</td>
<td>15.5% (8.9%–25.7%)</td>
<td>49.4% (47.8%–51.0%)</td>
<td></td>
</tr>
<tr>
<td>Age (n = 3596)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6–12 years</td>
<td>66.7% (55.2%–76.5%)</td>
<td>58.3% (56.8%–59.9%)</td>
<td>0.2</td>
</tr>
<tr>
<td>13–17 years</td>
<td>33.3% (23.5%–44.8%)</td>
<td>41.7% (40.1%–43.2%)</td>
<td></td>
</tr>
<tr>
<td>Low income (&lt; $680 per week before tax) (n = 2536)</td>
<td>58.9% (45.9%–70.8%)</td>
<td>39.7% (37.9%–41.6%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Single-parent/step-blended/“other” family (n = 3593)</td>
<td>36.6% (26.4%–46.2%)</td>
<td>26.1% (24.7%–27.5%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Father’s schooling to age &lt;16 years (n = 2634)</td>
<td>29.8% (18.7%–44.0%)</td>
<td>30.8% (29.1%–32.6%)</td>
<td>0.8</td>
</tr>
<tr>
<td>Mother’s schooling to age &lt;16 years (n = 3056)</td>
<td>43.3% (32.1%–55.2%)</td>
<td>30.4% (28.9%–32.0%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Father unemployed (n = 2700)</td>
<td>26.0% (15.9%–39.6%)</td>
<td>14.4% (13.2%–15.7%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Mother unemployed (n = 3182)</td>
<td>56.9% (44.8%–68.2%)</td>
<td>44.7% (43.0%–46.6%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Services attended (in previous six months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School counsellor (n = 3592)</td>
<td>31.9% (22.1%–43.6%)</td>
<td>3.2% (2.7%–3.8%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Family doctor (n = 3590)</td>
<td>31.9% (22.3%–43.4%)</td>
<td>2.1% (1.7%–2.7%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Paediatrician (n = 3590)</td>
<td>57.7% (46.2%–68.5%)</td>
<td>1.1% (0.8%–1.5%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Psychologist/social worker (n = 3592)</td>
<td>23.6% (15.3%–34.6%)</td>
<td>1.6% (1.3%–2.1%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Psychiatrist (n = 3591)</td>
<td>11.3% (5.8%–20.7%)</td>
<td>0.6% (0.4%–0.8%)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
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 al1 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%).1,7 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 criteria14 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...
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. 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

None declared. The National Survey was funded by the Commonwealth Department of Health and Aged Care. Officials from the Department participated in the design of the study but were not involved in data collection, analysis and interpretation, or in writing this article.