PRESCRIBING PATTERNS OF MEDICINE CLASSIFIED AS 'ANTIDEPRESSANTS' IN SOUTH AFRICAN CHILDREN AND ADOLESCENTS

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ABSTRACT
The main objective of this study was to characterise prescribing patterns of medicine classified as 'antidepressants' (hereafter simply referred to as antidepressants) in children and adolescents in the private health care sector of South Africa. A retrospective drug utilisation design was used to identify patients aged 19 years and younger from a South African pharmaceutical benefit management company’s database, whom were issued at least one antidepressant between 1 January 2006 and 31 December 2006. Prescribed daily dosages (PDDs) were calculated using the Statistical Analysis System® program. A total of 1 013 patients received a mean number of 2.88 (SD 3.04) prescriptions per patient. Females received more prescriptions than their male counterparts, with the highest prevalence in the 15 ≤ 19 years age group. The pharmacological groups most prescribed were the selective serotonin reuptake inhibitors (45.0%) and the tricyclics (42.7%), with imipramine (22.04%) and amitriptyline (19%) as the most commonly prescribed drugs. Approximately 30% (n = 2 300) of all antidepressants in the study population were prescribed off-label. Amitriptyline and imipramine were prescribed at daily dosages higher than recommended in children and adolescents aged 9 ≤ 15 years. Lithium, trimipramine, trazodone and sulpiride were prescribed at sub-therapeutic dosages in adolescents. This study provided insight in the prescribing patterns of medicine classified as antidepressants in South African children and adolescents. These drugs, however, have many indications. Further research is needed to determine reasons why specific drugs are prescribed in this population.

INTRODUCTION
The use of antidepressant drugs among children became a concern in October 2003 when health officials in Britain, France, Canada and the United States issued warnings that paroxetine – a popular selective serotonin reuptake inhibitor (SSRI) – might be associated with excess reports of suicidality in children and adolescents (Rosack 2003:1; United States Food and Drug Administration 2003). Soon after, the manufacturer of venlafaxine – a selective serotonin and noradrenaline reuptake inhibitor (SNRI) – issued a similar black box warning based on a study in which 4% of children and adolescents taking the drug described suicide ideation compared to 2% receiving placebo (Wyeth 2003:5). Since October 2004, the United States Food and Drug Administration (FDA) required that all antidepressant medications carry an expanded black-box warning incorporating information about an increased risk of suicidal thinking, feeling and behaviour in children and adolescents (Friedman & Leon 2007:2343).

Support for the safe and effective use of antidepressants in children and adolescents is diverse and inconsistent. A number of controlled trials support the use of antidepressants over placebo for the treatment of paediatric and adolescent depressive disorders, social phobia, panic disorders, generalised anxiety disorders, and obsessive-compulsive disorder (OCD) (APA 2006:15-157; Bridge et al. 2007:1690; Cotgrove 2007:750); eating disorders (Gowers 2008:331); pre-menstrual dysphoria (Silber & Valadez-Meltzer 2005:523) and nocturnal enuresis (Smelie et al. 1996:62). In addition, antidepressants are used for some clinically accepted off-label indications in paediatric and adolescent patients, such as sleep disturbances (Cutler & Dubik 2008:79); headache (Lewis 2002:361); neuropathic pain (Jacob 2004:350), attention deficit hyperactivity disorder (ADHD) (Pliszka 1991:313), autism and Tourette’s syndrome (Scahill et al. 2003:1130; APA 2006:157).
According to a collective expert report by the French National Institute of Health and Medical Research (INSERM 2002), about 5% of children of anxiety disorders under the age of 1 to 2% are hyperactive. They furthermore report that mood disorder increases in adolescence, with 3% of 13-19-year-olds affected. Bulimia nervosa affects 1% of girls between the ages of 17 and 19. Anorexia affects about 0.2% of girls between the ages of 15 and 19. Conversely, ADHD occurs more frequently in male children and adolescents than in females, in a ratio of approximately 3.1 (Arnold 1996:355; Gaub & Carlson 1997:1036). Autism and schizophrenia are much rarer, affecting less than 1% of children and adolescents (INSERM 2002).

Selective serotonin reuptake inhibitors, in particular fluoxetine, should be considered as first-line treatment in children aged eight years and older (Kastelic, Labellette & Riddle 2000:118). Sertraline and fluoxetine have also been approved for the treatment of paediatric OCD (Geller et al. 2003:1920). No other SSRIs or SNRIs have been expressly registered for the use in major depressive disorders in the under-18s, although they are currently used ‘off-label’ in Canada, the United Kingdom (UK), Ireland, New Zealand, Australia, the Netherlands and South Africa (World Health Organization 2004:8). Nocturnal enuresis is common in young children but continues in as many as 5% by 10 years of age (British National Formulary for Children 2008).

Drug therapy is not usually appropriate for children under the age of seven years; it can however be used when alternative measures have failed. Tricyclic antidepressants (TCAs) such as amitriptyline, imipramine, and less often nortriptyline can be used. The TCAs are, however, not recommended as first-line treatment in adolescents due to their side-effect profile, which includes cardiotoxicity, a lower seizure threshold and anticholinergic action (Sung & Kirchner 2000:2303; Murray, de Vries & Wong 2004:1098). Monoamine oxidase inhibitors (MAOIs) are also not recommended for use in adolescents due to a lack of evidence to support their use and because of dietary restrictions associated with this class of drug (Everett 2002:213). Any antidepressant approved for adult patients can, however, legally be prescribed for children (FDA 2005).

Small but significant numbers of children are taking antidepressants. A sharp increase in the use of psychotropic medicine during the 1990s in American children and adolescents (Olsson et al. 2002:520) included the prescribing of antidepressants to pre-school children, even at the young age of two years (Zito et al. 2000:1026). A New Zealand paper recently reported concerns by medical authorities at figures suggesting 2000:1026). A New Zealand paper recently reported concerns by medical authorities at figures suggesting a dramatic increase in the use of antidepressants in the under-18 age group in the UK; according to Boseley (2003) there are currently around 50 000 children and adolescents taking them. A relatively recent study published in the *Pharmacopoeiologica and Drug Safety Journal* (Kairuz et al. 2003:379-382) reported a prescribing prevalence of 59% among 166 adolescents and young adults over a 14-month period in South Africa.

Data pertaining to children and adolescents’ psychopharmacology, specifically in South Africa, are limited, with dosages often extrapolated from adult data (Scribante 2005). Clinical observations, nonetheless, suggest that children and adolescents need larger weight-adjusted doses of most medication than do adults due to the shortened half-life of medicine. Dosing with antidepressants among the under-18s should thus start at the lowest possible dose, slowly titrated upwards (Scribante 2005).

In the absence of data on the prescribing patterns of antidepressants among South African children and adolescents, this study aims to investigate these patterns as well as their prevalence in a sub-population of private health care patients below the age of 20 (for the year 2006), with reference to the prescribing frequency and prescribed daily dosage.

**SUBJECTS AND METHOD**

**Study design and data source**

A retrospective drug utilisation study design was used to explore the pharmacological treatment of children and adolescents with medicines classified as antidepressants in a section of the private health care sector of South Africa. Data were obtained from a South African pharmaceutical benefit management (PBM) company, which manages the benefits of medical schemes and insurance companies in South Africa by providing a real-time auditing process to claims from pharmacies and other service providers. In 2006, this company performed reconfirmed claim switching for 35 of South Africa’s medical schemes 1. The claims database sample was therefore considered representative of the average patient served by the private health care sector of South Africa, given his/her choice of medical insurance.

The medicine claims database for 2006 consisted of computerised data on a total number of 996 786 claims for a total number of 2 370 567 dispensed medicine items. The data were obtained directly from the central database of the PBM; therefore no forthright manipulation of the data by the researchers was possible. It was assumed that all data were reliable and valid. The datasets were however verified by testing for outlying data, as well as by performing random data checks.

The database provided information about the drug’s trade name, the NAPPI-code (such as, type of medication and strength/concentration), the date the prescription was filled, prescription number, patient dependant-, physician-, pharmacy- and medical scheme identification numbers, and the number of the medicine items prescribed. Unique encrypted numbers were used to prohibit the identification of the patient, thus maintaining anonymity.

Certain limitations that could limit the scope of the study were identified, namely the lack of detailed clinical data (such as diagnosis or medical history) and certain demographic data (such as weight or body mass index) as well as the duration of treatment or number of days’ supply of medicine items. The relevance of some utilisation patterns and prescribed daily dosages could therefore not be determined. External validity was also limited, implying that the results of the study can be generalised to the specific database and study population only. The practical justification of using this database included the fact that the claims database employed in this study was electronically available and accessible. Claims not submitted through the PBM (such as patients who paid cash for their medication and/or were not members of a medical scheme) were thus excluded from the study.

Permission to conduct the study was granted by the PBM and the North-West University’s ethics committee.

**Study population and measurements**

The study population consisted of children and adolescents aged 19 years and younger who filled at least one prescription for an antidepressant during a 12-month period (1 January 2006 to 31 December 2006). Information for all medicine claims records for this period was obtained. Antidepressant medicine usage was analysed according to four patient age strata: children younger than 5 years and 5–9 years, and adolescents 9 ≤ 15 years and 15 ≤ 19 years.

The study population represented 17.5% (n = 996 786) of the total number of prescriptions, and 18.5% (n = 2 370 567) of the number of medicine items dispensed on the database for 2006 2.

1. South Africa has about 160 medical schemes totalling around seven million beneficiaries, of which only about 40 are open to the public (Insurance Za 2008).

2. A prescription in South Africa can contain more than one medicine item.
Assessment of treatment with antidepressants in children and adolescents included measures of the prescribing frequency of the antidepressant and prescribed daily dosages. Antidepressant medications were identified on the basis of a list of medications used by South African health care professionals (that is the Monthly Index of Medical Specialties, or MIMS, 2006) (Snyman 2006:16-35). Medicines were assigned to one of seven classes: tricyclic, non-tricyclic, mono-amine oxidase inhibitors, selective serotonin reuptake inhibitors, serotonin and noradrenaline reuptake inhibitors, lithium, and others (such as reboxetine, sulpiride, flupenthixol, trazodone, fluphenazine, and mirtazapine). NAPPI-codes were used to identify each antidepressant item on the database according to product name, package size, and strength/concentration (Snyman 2006:4).

‘Medication use’ was defined as having at least one prescription claim for an antidepressant during the study period. The prescribed daily dosage (PDD) was used to determine sub-therapeutic as well as higher than optimal doses of antidepressants in the study population by measuring the average number of tablets prescribed as well as the average strength that a patient received per day. ‘Sub-therapeutic dosing’ was defined as receiving doses lower than therapeutic dosing standards and ‘higher than optimal doses’ was defined as exceeding therapeutic dosing standards.

The therapeutic dosing range for children and adolescents was compiled from indications specified in MIMS (Snyman 2006:16-35); the South African Medicines Formulary (Gibbon 2003:440-450); Malahyde Information Systems (2008), the British National Formulary for Children (2008), Sweetman (2008), and Centers for Disease Control and Prevention (2000). Areas were denoted as ‘-‘ when none of the references clearly stated a dosage for the age group (see study population and measurements).

The following references were used during construction of this table: Snyman (2006:16-35); Gibbon (2003:440-450); Malahyde Information Systems (2008), the British National Formulary for Children (2008), Sweetman (2008), and Centers for Disease Control and Prevention (2000).

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Areas were denoted as ‘-‘ when none of the references clearly stated a dosage for the age group (see study population and measurements).
Data analysis

Basic descriptive statistics, for example, frequencies, the arithmetic mean (average) and the PDD were used to characterise the study sample, and were calculated using the Statistical Analysis System® SAS for Windows 9.1® program (SAS Institute Inc. 2002–2003).

The PDD was calculated as the number of milligrams dispensed (quantity prescribed multiplied by the strength or concentration per unit) divided by the days' supply. (For the purpose of this study, a month consisted of 30 days.)

RESULTS

Patient characteristics and general prescribing patterns

Table 2 tabulates the number of prescriptions by age group; a total of 234 children nine years and younger, and 779 adolescents aged 10–19 years received a total of 444 and 1 856 prescriptions for an antidepressant during the study period. The mean number of antidepressant prescriptions per patient per year was 2.88 (SD 3.04).
### Table 3
Prescribed daily dosages (PDDs) of prescribed active ingredients on the database

| Tablets/Rx | Tablets/day | PDD (mg) | Tablets/Rx | Tablets/day | PDD (mg) | Tablets/Rx | Tablets/day | PDD (mg) | Tablets/Rx | Tablets/day | PDD (mg) | Tablets/Rx | Tablets/day | PDD (mg) |
|------------|-------------|----------|------------|-------------|----------|------------|-------------|----------|------------|-------------|----------|------------|-------------|----------|----------|
| 0 ≤ 5 years | 5 ≤ 9 years | 9 ≤ 15 years | 15 ≤ 19 years |
| Amoxapine 10 mg | 42.58 | 1.42 | 14.19 | 32.45 | 1.08 | 10.82 | 30.72 | 1.02 | 10.24 | 30.33 | 1.01 | 10.11 |
| Amoxapine 25 mg | 35 | 1.17 | 12.85 | 29.18 | 1.27 | 31.73 | 33.69 | 1.12 | 28.08 | 40.80 | 1.36 | 34.00 |
| Bupropion 150 mg | 187.29 | 6.24 | 936.45 | 192.22 | 6.41 | 961.1 | 182.50 | 6.08 | 912.5 | 142.50 | 4.75 | 712.5 |
| Citalopram 10 mg | 30 | 1 | 10 | 26.28 | 0.94 | 9.42 | 29.34 | 0.98 | 9.78 | 29.74 | 0.99 | 19.82 |
| Clomipramine 10 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Clomipramine 15 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Clomipramine 25 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Clomipramine 50 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Dothiepin 25 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Duloxetine 30 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Escitalopram 10 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Fluoxetine 20 mg | 59.75 | 1.99 | 39.84 | 40.73 | 1.36 | 27.15 | 49.51 | 1.65 | 33.01 | 33.41 | 1.11 | 22.27 |
| Fluoxetine 40 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Imipramine 10 mg | 29.86 | 0.99 | 9.95 | 42.95 | 1.43 | 14.32 | 49.16 | 1.64 | 16.39 | 36.61 | 1.22 | 12.20 |
| Imipramine 25 mg | 35.00 | 1.17 | 29.17 | 31.69 | 1.06 | 26.41 | 41.39 | 1.38 | 34.49 | 37.39 | 1.25 | 31.16 |
| Lithium 250 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Lithium 500 mg | 30 | 1 | 450 | - | - | - | - | - | - | - | - | - |
| Lofepramine 70 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Mitrazapine 15 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Mitrazapine 30 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Moclobemide 150 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Moclobemide 300 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Paxil 12.5 mg | 14 | 0.47 | 9.33 | 33.56 | 1.12 | 22.37 | 26.47 | 0.88 | 17.65 | 28.59 | 0.95 | 19.06 |
| Paxil 25 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Paxil 30 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Reboxetine 4 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Sertraline 50 mg | 36 | 1.2 | 60 | 30.00 | 1 | 50 | 28.00 | 0.99 | 49.85 | 29.27 | 0.98 | 48.78 |
| Sertraline 100 mg | 133.33 | 4.44 | 111.11 | 60.00 | 2 | 50 | 100.00 | 3.33 | 83.33 | 100.00 | 3.33 | 83.33 |
| Sertraline Forte 200 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Trimipramine 25 mg | - | - | - | - | - | - | - | - | - | - | - | - |
| Trimipramine 50 mg | 30 | 1 | 50 | - | - | - | - | - | - | - | - | - |
| Venlafaxine 7.5 mg | 45 | 1.5 | 112.5 | 30.00 | 1 | 75 | 30.00 | 1 | 75.00 | 29.96 | 0.99 | 74.90 |
| Venlafaxine 150 mg | - | - | - | - | - | - | - | - | - | - | - | - |

1 The average number of tablets per day was calculated by dividing the average number of tablets per prescription (Rx) by 30.
2 The average number of tablets per day (in mg) or the PDD was calculated by multiplying the average number of tablets per day (‡) by the formulation strength of the product.
About 26% of the study population was female, compared to 26% males (sex was not recorded for 46.3% of patients). In patients aged 9 ≤ 15 years, antidepressant use was 1.4 times more common in males than females, compared with a 7:4 female:male ratio in those aged 16–19 years.

The most commonly prescribed pharmacological groups of antidepressants were the SSRIs (43.0%) and the TCAs (42.7%) (see Table 2). The most commonly prescribed antidepressant drugs were imipramine (21.6%) and amitriptyline (19%). SNRIs accounted for 116 prescriptions (5.0%), whereas sulpiride accounted for 99 (4.3%) prescriptions.

In the age group younger than five years, the most frequently prescribed antidepressant was amitriptyline, accounting for 28.8% (n = 125) of the medicine items prescribed in this age group. The second most often prescribed antidepressants in this group were bupropion (13.6%) and sulpiride (13.6%) (see Table 2). About 18% (n = 125) of prescribed medicines in this group were for SSRIs, such as citalopram (52.2%), fluoxetine (34.8%), and paroxetine (13%). Further investigation revealed that about 11% (n = 125) of the antidepressant prescriptions in this age group were for patients below the age of three years. This included six prescriptions issued to children between the ages of 24 and 36 months (containing inter alia fluoxetine 20 mg and bupropion 150 mg), and seven prescriptions to children between 12 and 24 months (containing inter alia bupropion 150 mg, ethipramine 25 mg, trimipramine 50 mg, citalopram 10 mg, and sulpiride 25 mg / 5 ml). The youngest patient on the database that received an antidepressant prescription was six weeks old (sulpiride 50 mg).

The tricyclic antidepressant imipramine presented as the most prescribed active ingredient in the age group 5 ≤ 9 years (50.5%; n = 319), followed by amitriptyline (22.9%, n = 319). Prescriptions to patients in the age group 9 ≤ 15 years formed the largest percentage of the study population (40.2%, n = 2 300). The pharmacological group mostly prescribed to this age group proved to be the tricyclic antidepressants (22.7%, n = 2 300), in particular imipramine (32.5%, n = 924) and amitriptyline (22.0%, n = 924), followed by the SSRIs (15.2%, n = 2 300), in particular citalopram (32.3%, n = 350) and fluoxetine (23.4%, n = 350). Patients aged 16 to 19 years received about 41% (n = 2 300) of prescriptions in the study population. The pharmacological group that includes the SSRIs and tricyclic antidepressants was prescribed most often in this age group (59.9% and 18.7%, n = 932). The most prescribed antidepressant item in this age group was fluoxetine (19.7%) followed by citalopram (15.9%, n = 932).

Prescribed daily dosages

Antidepressants are rarely prescribed to children younger than five years, and if so, only in small dosages (DeLar et al. 2003:150; Martin et al. 2003:72) (that is, amitriptyline and clomipramine for the treatment of pain-related conditions, depression, and cataplexy associated with narcolepsy and OCD) (see Table 1). The PDD calculated for amitriptyline (that is 29.18 mg) was slightly higher than the maximum recommended daily dosage for the treatment of pain in children aged 2–12, which is 20–25 mg/day (see Table 1). Results further showed a number of antidepressants prescribed to this age group that are not recommended for use in children and adolescents, such as, bupropion, citalopram, fluoxetine, fluvoxamine/nortriptyline, imipramine, lithium, paroxetine, sulpiride, trazodone, trimipramine, and venlafaxine (see Table 1). The PDDs for all of these antidepressants were higher than those recommended for older children (that is children above the age of five).

Children between ages 5 ≤ 9 years also received a number of antidepressants not recommended or indicated for use in this age group, for example, bupropion, citalopram, duloxetine, escitalopram, fluoxetine, fluvoxamine, imipramine, paroxetine, sertraline, sulpiride, and venlafaxine (see Table 1). The PDD calculated for amitriptyline 25 mg (that is 31.75 mg) was higher than the maximum recommended daily dosage for this medicine in this specific age group, which is 20 mg/day.

Adolescents 9 ≤ 15 years again received a number of antidepressants not recommended or indicated for use in this age group, for example, bupropion, dothiepin, escitalopram, fluoxetine, moclobemide, paroxetine, and venlafaxine (see Table 1). The PDDs calculated for clomipramine 25 mg and 75 mg (that is 61.11 mg and 125 mg, respectively) were higher than the maximum recommended daily dosages for this medicine, which is 50 mg/day. PDDs calculated for some of the antidepressants that were on average below the recommended minimum daily dosages were calculated as 25 mg/day compared to the recommended 1000–1500 mg/day for the treatment of depression or 300–400 mg/day for prophylaxis) and trimipramine 25 mg (12.5 mg/day compared to the recommended 50–100 mg/day). Trazodone 50 mg had a PDD of 50 mg/day compared to the recommended 75–100 mg/day for adolescents (calculation based on using the 50th percentile on the average weight-for-age percentiles for children aged 2–20).

Adolescents aged 15 ≤ 19 years yet again received a number of antidepressants not recommended or indicated for use in this age group, for example, bupropion, dothiepin, duloxetine, escitalopram, fluoxetine, flupenthixol, liofepramine, mirtazapine, moclobemide, paroxetine, reboxetine, and venlafaxine (see Table 1). Calculated PDDs were not above the maximum recommended daily dosages for patients in this age group, but a number of items were prescribed at doses far below those recommended for this age group, for example, sulpiride (81.25–100 mg/day) compared to the recommended 150–460 mg/day.

DISCUSSION

In the absence of data on the prescribing patterns of antidepressants among South African children and adolescents, this study aimed to investigate these as well as their prevalence in a sub-population of private health care patients below the age of 20, with reference to prescribing frequency and prescribed daily dosage. There are five key findings.

Firstly, the results of this study show that females receive more prescriptions for antidepressants than their male counterparts, with the highest prevalence in the 15 ≤ 19 year age group (see Table 1), but only recorded in about 54% of the study population. According to Gelder, Mayou and Geddes (1999:137), females have a higher risk for developing depression relative to males and the prevalence for major depressive disorders in Western countries is 40–90 per 1 000 females compared to 20–30 per 1000 males. Weissman and Jensen (2003:34) report that the incidence of major depressive disorder (MDD) increases in children particularly before puberty, with a peak age of onset between 15 and 20 years of age. Research indicates that a number of other ailments also become more common and frequent during adolescence; inter alia headaches and premenstrual dysphoric disorder. The latter disorder, described as ‘a periodic, recurrent, debilitating condition with severe psychological or effective symptoms during the late luteal phase’, also often begins during adolescence in females (Silver & Valadez-Meltzer 2005:518). According to Deubner (1977:173) one third of children age seven years, and half of those at least 15 years of age have headaches. Boys are frequently more affected than girls before the onset of puberty, and thereafter headaches occur more frequently in girls. Using antidepressants as a proxy for identifying ailments in a prescription claims database should however be done with caution and, when possible, in combination with clinical data, the latter of which lacked in this study.

Secondly, the most commonly prescribed pharmacological groups of antidepressants were the TCAs (42.7%) and SSRIs
Prescribing ‘antidepressants’ in South African children and adolescents

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