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Medication Use by Adolescents and Adults with Fragile X Syndrome

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Abstract

Background—The behavioural challenges and medical conditions associated with fragile X syndrome (FXS) can lead to increased need for medications.

Method—This longitudinal study examined the use of prescription medications for psychotropic and non-psychotropic purposes by adolescents and adults with FXS drawn from a North American community sample ($N = 105$). Odds and probabilities of continuing or discontinuing medication were calculated. Predictors of medication use were calculated.

Results—More than two-thirds took psychotropic medication, and about one-quarter took non-psychotropic medication. Over a three-year period, those who initially took prescription medications were considerably more likely to remain on medications than to stop. Individuals with more autism symptoms, more behavioural problems, a mental health diagnosis, and greater family income were significantly more likely to use psychotropic medication three years later. Individuals who had more health problems, a mental health diagnosis, and were female were more likely to use non-psychotropic medication over this time period.

Conclusions—Findings highlight the elevated and ongoing use of medication by individuals with FXS. Implications for social and behavioural research on FXS are discussed.

Keywords

Fragile X syndrome; psychotropic medication; non-psychotropic medication; adolescents and adults

Fragile X syndrome (FXS) results from a mutation of the *FMR1* gene on the X chromosome (Hagerman & Hagerman 2002). Together with Down syndrome, FXS is one of the most common genetic causes of intellectual disability (ID). Individuals with FXS are at elevated risk of autism spectrum disorders (ASD; Smith *et al.* 2012) and are prone to manifest four

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behavioural symptom clusters: (1) Attention-Deficit/Hyperactivity Disorder- (ADHD) like symptoms, (2) anxiety-related symptoms, (3) emotional lability, and (4) aggressive and self-aggressive behaviours (Berry-Kravis & Potanos 2004). Affected individuals also experience medical conditions including seizures, otitis media, mitral valve prolapse, ocular disorders, sleep problems, and gastrointestinal disturbances at higher rates than the general population (Hagerman 2002; Kidd *et al.* 2014).

These behavioural and medical challenges can lead to increased need for medications. The purpose of this report is to present longitudinal data about predictors and patterns of medication use in adolescents and adults with FXS. Whereas much past research was based on prescription patterns in specialized FXS clinics, the present study was intended to provide information about levels and trends in medication use in a community-based sample.

The behavioural phenotype of adolescents and adults with FXS has been shown to change over time. For example, over a three-year period of time, adaptive behaviour significantly improved, particularly for adolescents, and the severity of behaviour problems decreased (Smith *et al.* 2012). Cross-sectional studies also suggest age-related differences consistent with this longitudinal profile (e.g., Bailey *et al.*, 2009). Thus, investigation of the stability of prescription medications during adolescence and adulthood is motivated in part by changes in the FXS behavioural phenotype during these life stages.

Patterns and Prevalence of Medication Use

Past research based on populations served in specialised fragile X clinics indicates that between 40% and 90% of individuals with FXS have been prescribed psychotropic medications (Amaria *et al.* 2001; Berry-Kravis & Potanos 2004), with rates varying by sex and age. Data from a US national survey of parents of individuals with FXS (Bailey *et al.* 2012) indicated that 61% of males and 38% of females took medication for at least one behavioural or neurological symptom. Anxiety was the most commonly treated symptom (42% of males and 26% of females). ADHD symptoms were commonly treated with medication during middle childhood and early adolescence, but less so during later adolescence and adulthood.

Much less is known about the use of medication for non-psychotropic purposes despite reports of more common physical health problems in FXS (Hagerman & Hagerman 2002; Kidd *et al.* 2014). The present study aimed to extend understanding of medication use by individuals with FXS by examining both psychotropic and non-psychotropic medication via longitudinal data spanning three years.

Longitudinal data make it possible to address questions of stability of medication use, which has not been studied in people with FXS. Findings from a study of people with autism spectrum disorders (Esbensen *et al.* 2009) using similar longitudinal methods indicated high stability. Defining stability as continuing to take the same category of medications over a three-year period of time, we hypothesized that individuals with FXS would likewise show strong stability in medication use over time because the symptoms of FXS are chronic and medications may be the most effective or convenient approach to manage symptoms.

Predictors of Medication Use

We also sought to identify factors associated with medication use. Factors that have been linked to psychotropic medication use in individuals with FXS or other intellectual and developmental disabilities include behaviour problems, autism, mental health challenges (e.g., anxiety disorders, ADHD), ID, and poorer health (Bailey *et al.* 2012; Berry-Kravis & Potanos 2004; Matson & Neal 2009; Nøttestad & Linaker 2003; Préville *et al.* 2001). We hypothesized that these variables would be associated with greater psychotropic medication use in our sample.

It is well established that males with FXS have more severe symptoms than females, due to X-inactivation (Santoro *et al.* 2012). Therefore, even though females in the general population are prescribed more psychotropic medications than males (Paulose-Ram *et al.* 2007), we expected the opposite pattern in our sample.

Past cross-sectional research has examined the association between age and psychotropic medication use (Amaria *et al.* 2001; Bailey *et al.* 2012; Berry-Kravis & Potanos 2004), but the age-related pattern is not clear. Amaria *et al.* reported greater medication use among adults than children. Yet, Berry-Kravis and Potanos found that the percentage of individuals with FXS taking medication did not differ by age, while Bailey (2012 *et al.*) reported that individuals of different ages were prescribed different types of psychotropic medications. The inconsistency of these findings contrasts with the finding that psychotropic medication use increases with age among individuals with an autism spectrum disorder (e.g., Esbensen *et al.* 2009), underscoring the need for more attention to age-related use of medication in FXS.

Very little is known about non-psychotropic medication use in FXS. Consequently, our hypotheses were based on findings from studies of individuals with other developmental disabilities (Kwok & Cheung 2007; Esbensen *et al.* 2009), and we predicted that those in poorer physical health, who had an ID, were female, and were older would be prescribed more non-psychotropic medication. Analyses predicting medication use controlled for family income because socioeconomic status has been found to be associated with psychotropic medication use by individuals with FXS (Préville *et al.* 2001; Bailey *et al.* 2012).

The present report builds on a parallel linked study (Esbensen *et al.* 2009) that included many of the same measures, research methods, and analytic approaches, although based on a longitudinal study of adolescents and adults with autism spectrum disorders. Comparison of results across the two reports can inform diagnostic-related similarities and differences in prescription practices for individuals with developmental disabilities.

Methods

Sample

Participants were drawn from an ongoing longitudinal study of families of individuals with the full mutation of FXS (n = 147) residing in 38 US states and one Canadian province

(Mailick *et al.* 2014). For inclusion in the study, which began in 2008, mothers had to be the biological parent of a son or daughter with the full mutation of FXS, the son/daughter was 12 years of age or older, and the son/daughter was co-residing with the mother or had at least weekly contact with the mother either in person or by phone. Mothers provided documentation from an appropriate health care professional confirming that the son/daughter had the full mutation of the gene causing FXS, and also documentation regarding the ID status of the son/daughter. Families were recruited through service agencies, clinics, and FXS foundations as well as from a university-based research registry of families having a child with a disability.

The data included in the present report were collected between 2008 and 2013 in three waves, referred to as Time 1, Time 2 and Time 3, approximately 18 months apart. Medication and other phenotypic data were obtained through parent interviews and questionnaires. All study procedures involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the World Medical Association Declaration of Helsinki. The protocol was approved by the Institutional Review Board at the University of Wisconsin-Madison. Written informed consent was obtained from all participants.

More than one-third (36.8%) of the families had more than one child with FXS. If a mother had multiple children with FXS, she was asked to report on the child who was living with her. If more than one child with FXS was co-residing, the mother reported on the child who she believed was most severely affected.

The sample for the present report was restricted to individuals for whom medication data were available at both Time 1 and Time 3 ($n = 114$). Nine participants were dropped because they were taking only experimental medications (resulting in an n of 105). The majority of participants were male (83%), Caucasian, non-Latino(a) (95%), and living in the family home (86%). The average age of participants at Time 1 was 20.59 years ($SD = 6.69$) with 52% age 12 – 19 and 48% age 20 – 42 years. Average household income was between $80,000 and $90,000. There were no significant differences in age, sex, and race/ethnicity of individuals with FXS between those included in/excluded from the present analysis. However, excluded cases were more likely to live with their parents and come from households with lower incomes and less-educated mothers.

Table 1 presents a list of co-occurring diagnoses of study participants. These diagnoses were made by health care professionals, according to parent report. Fully 80% had an ID, 58.1% had at least one mental health diagnosis, 38% had a learning disability, 30% had an anxiety disorder, and 25% had an autism spectrum diagnosis. Nearly all participants (96.2%) had at least one co-occurring diagnosis in addition to FXS.

Measures of Medication Use

Mothers provided a list of their children's current use of *prescription* medication and the reason for taking each medication. Parent-report of medications has been the method of data collection in the majority of studies of individuals with developmental disabilities (e.g.,

Coury *et al.* 2012; Mire *et al.* 2014). Medications were coded and classified based on Physician's Desk Reference Drug Guide for Mental Health Professionals (Comer 2002).

Medications were classified into two categories based on type and the reported reason for taking the prescription medication – psychotropic and non-psychotropic. Psychotropic medications included antipsychotics, antidepressants, anxiolytics, sedative/hypnotics, antimanic agents, and CNS stimulants. Anticonvulsants and hypotensive agents were classified as psychotropic if the individual was taking them for mood/behaviour problems. If the reason for taking anticonvulsants or hypotensive medication was to treat physical symptoms (i.e., seizures or hypertension), then these medications were classed as *non-psychotropic*. The most common reasons reported for taking psychotropic medications were anxiety, depression, aggression, ADHD, and sleep disorders.

Non-psychotropic medications included antilipemic, antiParkinson's, thyroid, antidiabetic, antibiotics, hormones, gastrointestinal medications, acne treatments, and other miscellaneous medications. The most common non-psychotropic medications were for seizures and hypertension.

Over-the-counter medications such as analgesics, laxatives, and vitamins/supplements were excluded, as were medications taken on a sporadic basis (e.g., rescue inhalers for asthma).

Psychotropic and non-psychotropic medication use were coded at Time 1 and Time 3 to indicate whether or not the individual with FXS used medication in a given category. In addition, a count of the number of medications taken was created for each category.

Time 1 Predictors of Time 3 Medication Use

Autism Symptoms—Mothers completed the Social Communication Questionnaire (SCQ; Rutter & Lord 2001) which consists of 40 yes/no items assessing an individual's current autism spectrum disorder-related communication and social functioning symptoms. Verbal items were excluded from this analysis so that individuals lacking verbal abilities would not be excluded for missing data, leaving 33 items which were summed. Higher scores indicate more severe impairment. Rutter and Lord (2001) have shown the SCQ to have adequate reliability and validity. It also had good reliability in this sample (Cronbach's alpha = .81). Scores at or above the cut-off of 15 suggest ASD; the mean SCQ score was 11.76 (SD = 5.52; range=0-27); 47% had scores at or above 15 on the 40 item scale.

Behaviour Problems—Mothers completed the "Behavior Problems" subscale of the Scales of Independent Behaviors—Revised (SIB-R; Bruininks *et al.* 1996), assessing common problem behaviours exhibited by individuals with developmental disabilities. Mothers reported on the frequency and severity of eight behavioural problems included in the SIB-R within the past six months: hurtful to self, unusual or repetitive, withdrawn or inattentive, socially offensive, uncooperative, hurtful to others, disruptive, and destructive of property. Mothers reported the frequency (1 = less than once/month to 5 = ≥once/hour) and severity (1 = not serious to 5 = extremely serious) of exhibited behaviours. We used algorithms provided by Bruininks *et al.* (1996) to derive a summary score for maladaptive behaviour, with higher scores indicating more severe maladaptive behaviour. Bruininks *et al.*

indicated that reliability and validity of this measure were satisfactory. Scores of 110, 120, 130, and 140 are considered marginally serious, moderately serious, serious, or very serious, respectively, whereas scores below 110 are not considered serious. The mean score for our sample was 112.52 (SD = 10.54). Almost half (49%) were rated as having a score in the *marginally serious* to *very serious* range, the remainder being rated as not having serious behaviour problems.

Physical Health Conditions—Mothers completed a checklist of 38 physical health symptoms, indicating whether their sons or daughters experienced/were treated for each symptom in the previous 12 months. This checklist was a modified version of a health problems checklist used in the Midlife Development in the United States (MIDUS) study (Brim *et al*. 2004) and has been used in prior research (e.g., Ferraro, Schafer, & Wilkinson, 2016). The average number of physical health conditions in this sample was 1 (SD = 1.33)

Mental Health Diagnosis—Mothers reported whether their sons or daughters had a current diagnosis for an anxiety disorder, ADHD, depression, obsessive compulsive disorder, or schizophrenia that was given by a health care professional. 57% of the sample had one or more of these diagnoses.

Intellectual Disability Status—A dichotomous variable indicated whether the adolescent/adult child had been diagnosed with an ID. ID status was determined through a clinical consensus procedure (Smith *et al*. 2012), which used record review to confirm maternal report. A variety of IQ tests were reported in the records supplied by the parent, and thus a dichotomous indicator of ID was used instead of exact IQ scores. 80% of the sample had an ID.

Demographic Characteristics—Seventeen percent of the sample was female. The participant's age at Time 1 was used as a continuous variable for some analyses and as a categorical variable for others (<20 years old vs. 20 years old and older). Age ranged from 12.00 to 41.75 years (mean age = 20.59 years; SD = 6.69). Household annual income was categorised on a 1 – 14 scale ranging from $1 - $10,000 to $160,000 or more. Median income was $90,000 - $100,000.

Results

Patterns of Medication Use over Time by Adolescents and Adults with FXS

Medication prevalence was high in this sample (see Table 2). By Time 3, nearly 70% were prescribed psychotropic medications, and one-quarter were prescribed non-psychotropic medications. High psychotropic medication use occurred both for adolescents (71% at Time 1 and 73% at Time 3) and adults (66% at Time 1 and 64% at Time 3). Non-psychotropic medication use was less frequent for both adolescents (11% at Time 1 and 20% at Time 3) and adults (26% at Time 1 and 32% at Time 3), but increasing over time. Differences between adolescents and adults in patterns of medication use were not significant.

Number of medications taken by category is also detailed in Table 2. Most participants were prescribed one or two medications. The majority were psychotropic medications, with the

average participant taking at least one such medication. Of those prescribed any medications, the average was 1.52 at Time 1 and 1.66 at Time 3 (range = 0 to 9). On average, individuals had fewer prescriptions for non-psychotropic than for psychotropic medications (M = 0.30 and 1.24 at Time 1, respectively, and M = 0.46 and 1.20 at Time 3, respectively).

As shown in Table 3, among the psychotropic medications, the most common were antidepressants (n = 44, 41.9% of the sample), CNS stimulants (n = 36, 34.2%), and antipsychotics (n = 24, 22.9%). Among the non-psychotropic medications, 8 individuals (7.6%) took anticonvulsants and 6 (5.7%) took hypotensive agents.

Likelihood of Starting and Stopping Medication Use

Next we calculated the odds of starting medication, stopping medication, staying medicated, or staying non-medicated between Times 1 and 3 for each medication category (see Table 4). We computed conditional probabilities of (a) remaining medication free, (b) stopping medication, (c) continuing medication, or (d) starting medication using the procedure described by Esbensen *et al.* (2009).

As predicted, there was greater stability in medication use than change during the study period. The odds of continuing to use any medication (psychotropic and/or non-psychotropic) were 23.67, while the odds of stopping medication were 0.04. For psychotropic medications, the odds were 11.00 for continuing this category of medications versus 0.09 for stopping. For non-psychotropic medications, the odds were 8.50 for continuing versus 0.12 for stopping. Thus, once started on medications, individuals with FXS are very likely to continue taking the same category of medications, at least over a three-year period. There was also significant stability in medication *non-use*, meaning that individuals who did not use medication at Time 1 were not likely to start using medication over the study period.

Predictors of Medication Use

Next, we examined the factors that predicted medication use (see Table 5), using logistic regression (Stata 14.2; StataCorp, 2015). Predictors were measured at Time 1 and medication use was measured three years later. Individuals who had more symptoms of autism at Time 1 had a significantly greater likelihood of taking psychotropic medication three years later. For every 1-point increase on the SCQ, the odds of taking psychotropic medication increased by 1.21. Individuals rated with more severe behavioural problems were also more likely to take psychotropic medication. For every 1-point increase on the SIB-R, the odds of taking a psychotropic medication three years later increased by 1.10. Having a mental health diagnosis strongly increased the risk of taking psychotropic medication by a factor of eight. Finally, for every 1-point increase in family income, the odds of taking a psychotropic medication increased by 1.21. Neither age nor gender predicted psychotropic medication use.

Individuals who had more physical health problems were more likely to take non-psychotropic medications. An increase of 1 physical health problem was associated with more than a two-fold increase in the odds of taking non-psychotropic medication. Having a

mental health diagnosis also increased risk of taking *non*-psychotropic medication by more than a factor of three. Non-psychotropic medication use was more likely among females with FXS (odds were over 6 times greater for females than males).

Table 6 portrays the estimated number of medications prescribed for individuals with FXS who had various levels of the significant predictors, net of the other variables in the model. These data show a strong association between clinical cut-points within the measures and medication use. From the baseline SIB-R score of 100, each 10-point increase on this measure was associated with a 42% increase in the number of psychotropic medications taken. As noted, a SIB-R score of 110, 120, 130, and 140 are considered to be marginally serious, moderately serious, serious, and very serious, respectively. Similarly, those with mental health diagnoses were likely to take twice as many psychotropic medications on average than those without mental health diagnoses, .67 vs. 1.39. Adolescents and adults with FXS who scored 10 or above on the SCQ were prescribed between one and two psychotropic medications, whereas those below were prescribed less than one such medication. For non-psychotropic medications, each additional health condition increased the number of non-psychotropic medication prescribed for the individual with FXS by 62%. Thus, prescription patterns reflected the severity of the individual's mental and physical health symptoms and conditions, as reflected in measures commonly used in social and behavioural research.

Discussion

By adolescence, most individuals with FXS take prescription medications, primarily psychotropic medications. Individuals with FXS are susceptible to ADHD symptoms, anxiety symptoms, emotional lability, and aggressive and self-injurious behaviours (Berry-Kravis & Potanos 2004), and the medication patterns observed in the present study are consistent with this profile.

Unlike most past research on medication practices and FXS, the present study was not based on a single clinic sample, but rather was a community sample spanning 38 states and one Canadian province. The data presented in this study can thus inform future research on the FXS phenotype across much of the life course, including social and behavioural research.

Much less is known about non-psychotropic drug use among adolescents and adults with FXS, and our study is the first to focus on such medications. Research has indicated that individuals with FXS often experience physical health problems at higher rates than their typically developing peers (Kidd *et al.* 2014; Hagerman 2002), and thus may have elevated need for medication. Surprisingly, those with mental health diagnoses were more likely to be taking medications for physical conditions, a subject worthy of future examination.

Consistent with our hypothesis and similar to past research on individuals with autism spectrum disorders (Esbensen *et al.*, 2009), stability in the use of medication over time was high for all medication categories. Individuals who were using at least one prescription medication were more than twenty times more likely to continue taking prescription medications than to stop, over three years. Only 8% of individuals taking psychotropic

medication and 11% of individuals taking non-psychotropic medication at Time 1 stopped three years later.

Longitudinal Predictors of Medication Use

A significant predictor of using psychotropic medication was family income, with a 1-point increase in income elevating the odds by twenty-one percent. One past study of medication use also implicated family income. Bailey *et al.* (2012) reported that males with FXS were more likely to be treated for anxiety and attention problems if their parents had higher income, while those from higher income families were *less* likely to be treated for anger or aggression. This is different than patterns in the general population. Preville *et al.* (2001) reported that in the general population, greater income was associated with a lower likelihood of taking psychotropic medication. Higher family income may make it possible for families of children with FXS to afford medication when it is needed, and possibly to travel to specialised FX clinics, where prescription practices may be different and care may be better than in the local community.

Greater non-psychotropic medication use among females appears to be driven by prescriptions for birth control medications. In this study, all women who took birth control medications did so for medical reasons (e.g., heavy menstrual periods, menstrual cramps). One woman was prescribed such medications both for medical reasons and for contraception.

Half of the present sample had a co-occurring mental health diagnosis. The prominence of mental health diagnoses and related characteristics (elevated behaviour problems and autism symptoms) in predicting medication use may reflect the profile of dysregulated behaviour in individuals with FXS. Past research has shown that adolescents and adults dually-diagnosed with FXS and autism had significantly higher levels of behavioural dysregulation even than those with idiopathic autism (Smith *et al.* 2012).

Strengths and Limitations

This study cannot be used to draw inferences about the effectiveness of medications for adolescents and adults with FXS, a goal for future clinical research. Instead, the study heightens understanding of how family social context (i.e., family income) and the behavioural phenotype of FXS are associated with medication patterns. Thus, future research on individuals with FXS and their families would be strengthened by inclusion of medication use, given the high prevalence of pharmacological treatment during adolescence and adulthood.

One limitation of this study was that it was based on a primarily Caucasian, non-Latino(a), middle-class volunteer sample in North America, and findings may not generalise to the full population of individuals with FXS or internationally. Additionally, our assessment of medication use began after many individuals already started medication. Indeed, 69% of our sample members were already using psychotropic medication at Time 1 and 18% were already using non-psychotropic medication. Consequently, our analyses regarding predictors of medication use may be limited in capturing other determinants when medication was first prescribed. Although parent report of medication use may be seen as a limitation, it also may

have some advantages because often the medical record includes medications that were prescribed but never taken. Parents' close contact with their child's medication patterns may enhance validity in this regard. Some medications may have been prescribed for multiple reasons, and we did not have access to the prescriber's motivations. For example, antidepressants are often used as anxiolytics and antiobsessionals, but this would not have been apparent unless parent reported reasons for medications included this information.

Juxtaposed against these limitations are several methodological strengths and novel approaches. One is that the data were obtained from a community-based sample, and may thus represent a broader range of prescription practices than reported in several previous studies in which data were obtained from a single clinic. Second, the current study included medications prescribed for physical conditions as well as mental health problems, which have not been included in previous FXS medication studies. Third, this was the first study to focus on adolescents and adults rather than on children.

The present study can inform future research on FXS in adolescence and adulthood and the need to include measures of medication in such investigations. Our findings can educate administrators, clinicians, and patients about the high probability of medication use by adolescents and adults with FXS, and increase their understanding that once a class of medications is prescribed, the individual with FXS is likely to continue taking medications of this type, at least over a three-year period. This pattern of continued medication use may contribute to the improving behavioural phenotype of FXS with respect to behaviour problems and adaptive behaviour (Bailey *et al.* 2009; Smith *et al.*2012) that has been reported during adolescence and adulthood, and also reflects the chronicity and severity of the symptoms of FXS over the life course and the need for treatment.

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Table 1

Diagnoses of Study Participants (n = 105)

Diagnosis	Time 1	
ASD diagnosis (multiple ASD diagnoses reported)	n	%
Asperger's disorder	1	1.0%
Autistic disorder	21	20.0%
PDD-NOS[a]	5	4.8%
Any ASD diagnosis	26	24.8%
Mental health diagnosis		
Anxiety disorder	31	29.5%
Attention deficit hyperactivity disorder (ADHD)	46	43.8%
Depression	3	2.9%
Obsessive compulsive disorder	6	5.7%
Schizophrenia	1	1.0%
Any mental health diagnosis	61	58.1%
Other developmental disability		
Cerebral palsy	2	1.9%
Epilepsy/seizures	11	10.5%
Intellectual disability (ID)	84	80.0%
Learning disability[c]	40	38.1%
Tourette syndrome	1	1.0%
Any co-occurring diagnosis (excluding ID)	79	75.2%
Any co-occurring diagnosis (including ID)	101	96.2%

[a] Pervasive developmental disorder not otherwise specified, per DSM-IV.

[b] Co-occurring diagnosis refers to ASD, mental health, or other developmental disability.

[c] In the US, learning disability (LD) originally referred to a handicap in a specific academic area, despite normal IQ. However, there is currently sufficient variability in criteria across the 50 states that there is wide discretion to use the term LD when there is substantial unevenness across academic subject areas and/or need for intervention, even in the presence of sub-average IQ.

Table 2

Percentage of Individuals Taking Each Type of Medication by Age Group

Type of medication	Time 1			Time 3		
	All	12-19	20+	All	12-19	20+
Use of Medication	%	%	%	%	%	%
Any medication	70	71	70	73	76	70
Psychotropic	69	71	66	69	73	64
Non-psychotropic	18	11	26	26	20	32
Average No. of Medications Taken	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Any medication	1.52 (1.47)	1.49 (1.44)	1.56 (1.51)	1.66 (1.74)	1.51 (1.51)	1.82 (1.96)
Psychotropic	1.24 (1.17)	1.31 (1.14)	1.16 (1.22)	1.20 (1.17)	1.18 (1.07)	1.22 (1.28)
Non-psychotropic	0.30 (0.46)	0.18 (0.64)	0.44 (0.95)	0.46 (1.05)	0.33 (0.92)	0.60 (1.16)
N	105	55	50	105	55	50

Age groups are based on age at Time 1.

Table 3

Number and Percentage of Individuals Taking Each Type of Medication: Sub-Categories of Psychotropic and Non-Psychotropic Medications (N = 105)

Medication	Time 1		Time 3			
	Total		Continuing	New	Total	
Psychotropic Medications	n	%	n	n	n	%
antidepressants	44	41.9%	37	6	43	40.9%
CNS stimulants	36	34.2%	29	1	30	28.6%
antipsychotics	24	22.9%	20	5	25	23.8%
anticonvulsants (for mood/behaviour problems)	9	8.6%	5	4	9	8.6%
hypotensive agents (for mood/behaviour problems)	6	5.7%	4	5	9	8.6%
anxiolytics	4	3.8%	2	3	5	4.8%
antimanic agents	1	0.9%	0	1	1	0.9%
sedative/hypnotics	0	0.0%	0	0	0	0.0%
Non-Psychotropic Medications						
anticonvulsants (for physical symptoms)	8	7.6%	7	1	8	7.6%
hypotensive agents (for physical symptoms)	6	5.7%	5	2	7	6.7%
anti-lipemic	3	2.9%	3	1	4	3.8%
hormones/birth control	2	1.9%	0	4	4	3.8%
gastrointestinal medications	2	1.9%	2	1	3	2.9%
antidiabetic	2	1.9%	2	0	2	1.9%
anti-Parkinson’s	1	0.9%	1	2	3	2.9%
thyroid	1	0.9%	1	0	1	0.9%
acne treatments	1	0.9%	0	1	1	0.9%
antibiotics	0	0.0%	0	1	1	0.9%
other miscellaneous medications	1	0.9%	1	3	4	3.8%

Table 4

Odds and probabilities of changes in medication use over time.

	Medication	Staying Non-medicated			Starting Medication			Staying Medicated			Stopping Medication			
		Odds	**Prob. %**	***N***	**Odds**	**Prob. %**	***N***	**Odds**	**Prob. %**	***N***	**Odds**	**Prob. %**	***N***	**Total N**
Full Sample	Any medication	4.17	81%	25	0.24	19%	6	23.67	96%	71	0.04	4%	3	105
	Psychotropic	4.50	82%	27	0.22	18%	6	11.00	92%	66	0.09	8%	6	105
	Non-psychotropic	7.60	88%	76	0.13	12%	10	8.50	89%	17	0.12	11%	2	105
	Medication	Staying Non-medicated			Starting Medication			Staying Medicated			Stopping Medication			
		Odds	Prob. %	*N*	Odds	Prob. %	*N*	Odds	Prob. %	*N*	Odds	Prob. %	*N*	Total N
Adolescents	Any medication	2.20	69%	11	0.45	31%	5	18.50	95%	37	0.05	5%	2	55
	Psychotropic	3.00	75%	12	0.33	25%	4	12.00	92%	36	0.08	8%	3	55
	Non-psychotropic	6.00	86%	42	0.17	14%	7	2.00	67%	4	0.50	33%	2	55
Adults	Any medication	14.00	93%	14	0.07	7%	1	34.00	97%	34	0.03	3%	1	50
	Psychotropic	7.50	88%	15	0.13	12%	2	10.00	91%	30	0.10	9%	3	50
	Non-psychotropic	11.33	92%	34	0.09	8%	3	Und.	100%	13	0.00	0%	0	50

Table 5

Logistic Regression Analysis: Time 1 Predictors of Use of Medication at Time 3 (n = 105)

	Psychotropic[a]			Non-Psychotropic[b]		
	OR: Exp(β)	**SE(β)**	**95% OR CI**	**OR: Exp(β)**	**SE(β)**	**95% OR CI**
Autism symptoms (SCQ)	1.21 **	0.07	[1.05, 1.38]	1.01	0.06	[0.90, 1.13]
Maladaptive behaviour (SIB-R)	1.10 *	0.04	[1.01, 1.19]	1.02	0.03	[0.95, 1.08]
Number of physical health conditions	0.70	0.23	[0.45, 1.09]	2.19 **	0.24	[1.13, 12.81]
Mental health diagnosis	7.99 ***	0.58	[2.56, 24.95]	3.83 *	0.62	[1.15, 12.91]
Intellectual disability	1.18	0.77	[0.26, 5.34]	1.01	0.74	[0.24, 4.35]
Female	4.98	0.90	[0.84, 29.26]	6.23 *	0.78	[1.36, 28.67]
Age (continuous)	1.07	0.05	[0.98, 1.17]	1.08	0.04	[0.99, 1.17]
Family income	1.21 *	0.09	[1.02, 1.43]	0.95	0.08	[0.28, 2.72]
Constant	0.00 **	5.00		0.00	3.92	

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Note: OR = odds ratio; CI = confidence interval.

[a] Psychotropic model fit: Likelihood ratio (full vs. constant only): $\chi^2 = 45.15$, $p < .001$; Hosmer-Lemeshow $\chi^2 = 8.57$, $p = .380$; Stukel $\chi^2 = 0.98$, $p = .612$; Tjur's $R^2 = 0.39$.

[b] Non-psychotropic model fit: Likelihood ratio (full vs. constant only): $\chi^2 = 31.78$, $p < .001$; Hosmer-Lemeshow $\chi^2 = 5.50$, $p = .703$; Stukel $\chi^2 = 0.65$, $p = .723$ Tjur's $R^2 = 0.30$.

Table 6

Estimated Number of Medications Taken by Levels of Significant Predictors: (n = 105)[a]

Psychotropic (Poisson)						Non-psychotropic (Negative Binomial)	
Maladaptive Behavior (SIB-R) Score Range: 100-147	**Average Predicted Number of Medications**	**Mental Health Diagnosis**	**Average Predicted Number of Medications**	**Autism symptoms (SCQ) Range: 0 - 25 2527**	**Average Predicted Number of Medications**	**Number of Physical Health Conditions Range: 0 - 6**	**Average Predicted Number of Medications**
100	0.70***	No	0.67***	0	0.76***	0	0.19***
110	0.99***	Yes	1.39***	5	0.88***	1	0.32***
120	1.41***			10	1.03***	2	0.51***
130	2.01***			15	1.20***	3	0.83**
140	2.86***			20	1.40***	4	1.34*
				25	1.63***	5	2.18
						6	3.54

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Significance indicates that number of prescriptions is different from 0. All continuous predictors are held at their means. Dichotomous predictors are held at their observed values.