

Misuse of prescribed psychotropic medication and drug crime offending: A follow-up case-control study of former adolescent psychiatric inpatients

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Abstract

Background: Various psychotropic prescription drugs are known to have potential for misuse. Among teenagers, non-medical use of prescription drugs may predate illicit drug use or occur concomitantly.

Aims: Our aim was to examine prescriptions of psychotropic medications among drug crime offenders and non-criminal controls in a psychiatric inpatient cohort of 13–17-year-olds. Our research question was: were prescribed psychotropic and potentially addictive drugs associated with later drug crime offending.

Methods: Our sample was of all 60 adolescents who had been convicted of a drug crime by young adulthood with a twice-sized control group, matched for gender, age and family-type, from a cohort of 508 adolescents consecutively admitted to a psychiatric inpatient care in Finland between April 2001 and March 2006. Adolescence-related information on substance use and psychiatric disorders was obtained by semi-structured interviews. Follow-up information on crimes and medication purchases was obtained from Finnish nationwide registers. The association of studied factors to drug crime offending was examined using step-wise binary logistic regression analysis.

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Results: 75% of drug crime offenders and 47% of non-criminal controls had used addictive psychotropic medications during the follow-up period ($p < 0.001$). 74% of all drug crime offenders' purchases of prescribed addictive drugs occurred within the year preceding drug crimes. Of addictive drugs, the use of clonazepam and gabapentoinoids was most likely to associate with drug crime offending (AOR 7.77, $p < 0.001$). Conduct and substance use disorders diagnosed in adolescence (AOR 3.49, $p = 0.010$; AOR 2.34, $p = 0.050$) were predictors for drug crime offending.

Conclusions: Our findings suggest that, when treating young adults with conduct disorder and a history of substance use, physicians should prescribe addictive medications with caution, favouring instead non-addictive medications complemented by psychosocial interventions.

KEYWORDS

adolescents, drug crime, medication therapy, prescription medications, psychiatric disorders, young adults

1 | INTRODUCTION

Psychotropic prescription drugs such as opioids, sedatives, and stimulants are known to have the potential for misuse (Boyd et al., 2015; Compton & Volkow, 2006; Holt & McCarthy, 2019; Schepis et al., 2018). Misuse of prescription medications includes non-medical misuse, when medication is used in ways not intended by the prescriber or use without a prescription, and medical misuse, when drugs are not used as prescribed, for example, in higher doses or more frequently or mixed with other substances. Reasons for misuse of prescription medications include self-medication for mental or physical health problems or use for intoxication (Boyd et al., 2006; Boyd & McCabe, 2008).

It is known that illicit drug use is associated with prescribed drug misuse among both adults (Becker et al., 2007; Novak et al., 2016) and adolescents (Carrasco-Garrido et al., 2018; Kokkevi et al., 2008). In Finland, illicit drug use has increased significantly among non-medical users of prescription medications between the years 2002 and 2014 (Karjalainen et al., 2017). Drug misuse affects both men and women (Degenhardt et al., 2019). Many studies have shown an association between wider drug use and criminal offending (e.g. Fazel et al., 2017; Moore et al., 2019) and prior mental disorders and risk of illicit drug use (Conway et al., 2016), with high rates of both problems among adolescents in detention (Beaudry et al., 2021; Teplin et al., 2012). Adolescent illicit drug use is associated with criminal outcomes in later life (White et al., 2020). Opioids may pose a particular problem to health care services for prisoners. Not only may their direct abuse be dangerous for health but, also, they can be disseminated forward among prisoners (Poole et al., 2020). In our study, we focus on the possible misuse of prescription medications that drug crime offenders have sought from the doctors.

Our aim was to examine use of prescription medications with a potential for abuse among adolescents and young adults who had been adolescent psychiatric inpatients and had committed at least one drug crime. Our research

question was whether use of potentially addictive prescription medications associate with later drug crime offending. A more specific question was about which medication group is most implicated.

2 | METHODS

2.1 | Ethics

The study protocol was approved by the Ethics Committee of the University Hospital of Oulu, Finland. All study participants and their legal guardians provided written, informed consent for participation in the study.

2.2 | Participants

This study is part of a clinical follow-up project, investigating long-term outcomes, and the associations of various psychosocial risk factors, with severe psychiatric and substance use disorders among 13–17 years old adolescents (mean age 15.5, SD 1.3 years). The initial service-based cohort consisted of all patients consecutively admitted to the acute psychiatric adolescent inpatient care at the Oulu University Hospital, during the 5 years April 2001 to March 2006 (hereafter referred to as index hospitalisation). This acute inpatient unit is designed and intended to provide quick interventions, whilst allowing enough time for diagnosis and development of a management and treatment plan, whether subsequently under outpatient care or other inpatient care. The median length of stay in this unit for this period was 9 days (inter-quartile range [IQR] 6–16 days). The catchment area of the hospital covers the regions of Oulu and Lapland in Northern Finland, which account for 43% of the total geographical area of the country.

Six hundred and thirty-seven adolescents were admitted to acute inpatient care during the data collection period, of whom one aged over 18 years, 26 with intellectual disability and three with an organic brain disorder were excluded from further study. Seventy-seven of the eligible patients did not provide informed consent and 22 did not complete their interviews because their stay in the hospital was too short. The final cohort was therefore of 508 patients (208 male, 300 female), showing a high participation rate (84% of eligible patients) in the study. A total of 60 (40 male, 20 female) had committed a drug crime by November 2016 and formed the cases for this study as drug crime offenders. One hundred and twenty cases were matched with drug crime offenders by age at admission to adolescent psychiatric care (± 2 years), gender (exact match), and family type (two parent family and other family types) at admission (exact match).

2.3 | Instruments

During index hospitalisation, all study participants were interviewed using the Finnish version of Schedule for Affective Disorder and Schizophrenia for School-Age Children Present and Lifetime (K-SADS-PL). The interviews were performed by the treating physician, or a trained medical student under supervision. The K-SADS-PL has been shown to be a valid method for defining DSM-IV based psychiatric disorders of adolescents. If information from the adolescent remained uncertain or seemed unreliable, the missing information was obtained from interviews with the parents or guardians (Ambrosini, 2000; Kaufman et al., 1997; Kim et al., 2004). Patients were also interviewed by nurses, using the European Addiction Severity Index (EuropASI) instrument. The EuropASI was used to obtain information on parents' psychiatric problems (Kokkevi & Hartgers, 1995).

2.4 | The follow-up information

2.4.1 | The crime register

In Finland, a person can be recorded in the criminal register from the age of 15 onwards (Finnish Legal Register Center, 2018). The information on criminal history was obtained from the Finnish Legal Register Center, with a census date in November 2016, the age of those included in the study varied between 22 and 33 years (referred to as young adulthood).

In Finland, it is illegal to import, export, distribute, purchase, manufacture or possess any of the drug-substances listed in the drug conventions in the Finnish Narcotic Drugs Act (Finnish Ministry of Justice, 2008). The drug crimes recorded were categorised as narcotics offences, aggravated narcotics offences, unlawful use of narcotics, or preparation of a narcotic.

2.4.2 | Prescriptions of psychotropic medications

The information on prescribed psychotropic medications was acquired from the Drug Register of the Social Insurance Institution (SII) of Finland. The Finnish Medicines Agency (Fimea) uses an international grouping system of medications, called Anatomical-Therapeutic-Chemical (ATC)-classification (WHO Collaborating Center for Drug Statistics Methodology, 2021). Psychotropic medications are included in the medication groups N02 (analgesics), N03 (antiepileptic drugs; clonazepam, gabapentin, pregabalin), N05 (antipsychotics, anxiolytics and sleeping medication), N06 (antidepressants and stimulants) and N07 B (drugs for treating addictions) (Supplementary Table 1). The data on psychotropic medications was divided into addictive (meaning high risk of misuse or dependence) and non-addictive (meaning low risk of misuse or dependence) psychotropic medications. In our study, the data on psychotropic medication purchases was available up to the end of the year 2012. At the end of the year 2012, drug crime offenders were aged between 22 and 30 years while the non-criminal controls were aged between 18 and 29 years.

2.5 | Adolescence-related information

Adolescence-related information refers to data collected during the index hospitalisation, between the ages of 13–17 years.

2.5.1 | Psychiatric disorders

All participant DSM-IV-based psychiatric diagnoses were assessed using the diagnostic K-SADS-PL interview. In our study, the adolescent psychiatric disorders were categorised into the following major groups: psychotic disorders (DSM-IV: 295, 296.0, 296.4-299.0, 297.1-299.0, 301.13, 301.22), anxiety disorders (DSM-IV: 300.00-300.02, 300.21-300.23, 300.29, 300.3, 308.3, 309.81), affective disorders (DSM-IV: 296.2-296.3, 300.4, 311), attention-deficit and disruptive behavioural disorders (DSM-IV: 312.8-312.9, 313.81, 314.00-314.01, 314.9, 299.80), and substance-related disorders (DSM-IV: 303.9, 304.0-304.6, 304.8-304.9, 305.0, 305.2-305.7, 305.9). Rating of multiple diagnoses belonging to several psychiatric disorder categories was allowed.

The information on personality disorder diagnoses (ICD-9: 301, ICD-10: F60.0-9) by young adulthood were based on the Care Register for Health Care, provided by the Finnish National Institute for Health Welfare (THL), covering diagnoses up to the end of the year 2016. Although personality disorder is sometimes recorded in clinical settings during childhood or adolescence, the instruction from the ICD-10 guides is that they should not be

diagnosed before the age of 16 years. The definition process for such diagnoses is described in an earlier publication (Kantojärvi et al., 2016).

2.5.2 | Nicotine dependence

Information on current smoking habits and the levels of nicotine dependence during adolescence were measured using the seven-item modified Fagerström Tolerance Questionnaire (mFTQ) for children and adolescents. The total score of the mFTQ may be between 0 and 9, with a sum score of 0–2 indicating “no nicotine dependence”, 3–5 “moderate” and 6–9 “high” dependence (Prokhorov et al., 1996). In our study, we used a cut-off between no dependence and moderate/high dependence.

2.5.3 | Other covariates

Information on weekly use of alcohol and cannabis during adolescence were based on the K-SADS-PL. Data on parental psychiatric and substance use related problems, as perceived by the adolescents, were obtained from the EuropASI.

2.6 | Statistical methods

The statistical significance of group differences in categorical variables was assessed using Pearson's Chi-square test or Fisher's Exact test and in continuous variables with Student's *t*-test or Mann-Whitney's *U* test. Associations between adolescent- and follow-up related variables with drug offending were assessed with binary logistic regression analysis, using the forward stepwise selection approach. In model 1, all adolescence-related factors (psychiatric disorders, level of nicotine dependence, weekly use of alcohol and cannabis, parental psychiatric and substance use problems), gender and age at admission of index hospitalisation were analysed as potential predictors of drug crime offending. In model 2, the register-based follow-up information on the use of psychotropic medication (ATC groups for opioids, antiepileptic drugs, benzodiazepines, sleeping medications, stimulants, drugs for treating addictions, antidepressants, antipsychotics, and other psychotropic medications), gender and age at the end of the follow-up data for psychotropic medications in year 2012 were analysed as potential predictors for drug crime offending. Model 3 used all variables included in model 1 and 2. The choice of variables for the statistical modelling was based on evidence-based knowledge of factors known to be related to offending according to published literature (Fazel et al., 2008; Hensel et al., 2020; Moore et al., 2019) and whether they were available in our database. All analyses were two-tailed, and a limit of statistical significance was set at $p < 0.05$. The statistical software used in our analyses was the IBM SPSS Statistics 27.

3 | RESULTS

Twenty (7%) of the female patients and 40 (19%) of the male patients went on to be convicted of a drug crime. Tables 1 and 2 show the binary comparisons between those convicted of drug offences and those not, treating the female and male patients, respectively, separately. Among the female patients, drug crime offenders were more commonly diagnosed with conduct disorders (75% vs. 35%) ($\chi^2(1) = 8.543$, $p = 0.006$) and more often reported moderate to high levels of nicotine dependency (85% vs. 55%) ($\chi^2(1) = 5.275$, $p = 0.043$) in adolescence than their non-criminal controls.

TABLE 1 The characteristics of the female drug crime offenders and non-criminal controls

	Females					
	Drug crime offenders			Non-criminal controls		
	n = 20			n = 40		
	Years (SD)	n	%	n	%	χ^2 ^a
Follow-up information						
The mean age for the first drug crime	22.3 (3.4)					
Number of drug crimes						
One or two	12	60.0				
Three or more drug crimes	8	40.0				
Other criminality						
Only drug crimes	2	10.0				
One or two crimes	5	25.0				
Recidivist (three or more crimes)	13	65.0				
Psychotropic medication purchases, yes	20	100.0	34	85.0	3.333	0.165
Adolescence-related information						
Psychiatric disorders in adolescence						
Psychotic disorders	2	10.0	7	17.5	0.588	0.704
Anxiety disorder	5	25.0	10	25.0	0.000	1.000
Affective disorder	9	45.0	23	57.5	0.837	0.418
Conduct disorder	15	75.0	14	35.0	8.543	0.006
Substance use disorder	12	60.0	14	35.0	3.394	0.097
Personality disorder ^b	2	10.0	1	2.5	1.579	0.544
Level of nicotine dependence (ND)						
Moderate/high	17	85.0	22	55.0	5.275	0.043
Alcohol, weekly use	6	30.0	18	45.0	1.250	0.402
Cannabis, weekly use	4	20.0	4	10.0	1.154	0.422
Parental psychiatric problems, yes	4	20.0	8	20.0	0.000	1.000
Parental substance use problems, yes	11	55.0	13	32.5	2.813	0.161

Note: Other criminality included all the other crimes, excluding drug crimes. Bold value indicates statistically significant p-values.

Abbreviation: SD, Standard deviation.

^adf = 1.

^bFollow-up information of adolescent diagnoses up to young adulthood.

Male drug crime offenders appeared to differ more extensively from their non-criminal controls; they were more commonly diagnosed with conduct disorder (85% vs. 46%) ($\chi^2(1) = 16.574, p < 0.001$), substance use disorder (72.5% vs. 32.5%) ($\chi^2(1) = 17.186, p \leq 0.001$), and more often reported moderate to high levels of nicotine dependency specifically (85% vs. 49%) ($\chi^2(1) = 14.707, p < 0.001$), weekly use of alcohol (60% vs. 29%) ($\chi^2(1) = 10.930, p = 0.001$) and cannabis (32.5% vs. 9%) ($\chi^2(1) = 10.830, p = 0.002$) in adolescence. The non-criminal controls, compared to drug crime offenders, were more commonly diagnosed with psychotic disorders (22.5% vs. 2.5%) ($\chi^2(1) = 8.004, p = 0.006$).

Table 3 shows the number of users and the number of prescription purchases of addictive psychotropic medications among drug crime offenders and non-criminal controls. A statistically significantly higher proportion of the drug crime offenders than non-criminal controls had bought addictive prescription psychotropic medications (75%

TABLE 2 The characteristics of the male drug crime offenders and non-criminal controls

	Males						χ^2 ^a	P
	Drug crime offenders			Non-criminal controls				
	n = 40			n = 80				
	Years (SD)	n	%	n	%			
Follow-up information								
The mean age for the first drug crime	20.3 (3.1)							
Number of drug crimes								
One or two	17	42.5						
Three or more drug crimes	23	57.5						
Other criminality								
Only drug crimes	3	7.5						
One or two crimes	1	2.5						
Recidivist (three or more crimes)	36	90.0						
Psychotropic medication purchases, yes	36	90.0	68	85.0	0.577	0.574		
Adolescence-related information								
Psychiatric disorders in adolescence								
Psychotic disorders	1	2.5	18	22.5	8.004	0.006		
Anxiety disorder	4	10.0	9	11.3	0.043	1.000		
Affective disorder	12	30.0	33	41.3	1.440	0.317		
Conduct disorder	34	85.0	37	46.3	16.574	<0.001		
Substance use disorder	29	72.5	26	32.5	17.186	<0.001		
Personality disorder ^b	8	20.0	9	11.3	1.679	0.266		
Level of nicotine dependence (ND)								
Moderate/high	34	85.0	39	48.8	14.707	<0.001		
Alcohol, weekly use	24	60.0	23	28.8	10.930	0.001		
Cannabis, weekly use	13	32.5	7	8.8	10.830	0.002		
Parental psychiatric problems, yes	6	15.0	12	15.0	0.000	1.000		
Parental substance use problems, yes	10	25.0	24	30.0	0.328	0.669		

Note: Other criminality included all the other crimes, excluding drug crimes. Bold value indicates statistically significant p-values.

Abbreviation: SD, Standard deviation.

^adf = 1.

^bFollow-up information of adolescent diagnoses up to young adulthood.

vs. 47%, $p < 0.001$), particularly (in order from highest to lowest) benzodiazepines (55% vs. 27.5%, $p < 0.001$), anti-epileptic drugs (47% vs. 9%, $p < 0.001$), opioids (43% vs. 17.5%, $p < 0.001$), and sleep medications (40% vs. 17.5%, $p = 0.001$). Among drug crime offenders, addictive prescription psychotropic medication purchases accounted for 67% ($n = 2837$) of all their psychotropic medication purchases during the follow-up period ($n = 4231$). Among non-criminal controls, the corresponding proportion was 12% ($n = 461$) of all their psychotropic medication purchases during the follow-up time ($n = 3864$).

The number of purchases of prescribed psychotropic medications occurring within the year prior to a drug crime offence being committed was also explored. Addictive psychotropic medications accounted for 738 (74%) of all psychotropic medication purchases occurring within the year prior to a drug crime offence being committed

TABLE 3 The number of users and prescription purchases of addictive psychotropic medications among drug crime offenders and non-criminal controls

ATC group	Drug crime offenders (N = 60)			Non-criminal controls (N = 120)			Difference between study groups ^a P
	% (n) of users	Purchases over lifetime		% (n) of users	Purchases over lifetime		
	% (n)	N	%	% (n)	n	%	
All psychotropic medications	93.3 (56)	4231	100	85.0 (102)	3864	100	
All addictive medications	75.0 (45)	2837	67.1	46.7 (56)	461	11.9	<0.001
Opioids	43.3 (26)	348	8.2	17.5 (21)	57	1.5	<0.001
Codeine, drug combination	21.7 (13)	139		10.8 (13)	42		
Buprenorphine	6.7 (4)	12		0.0 (0)	0		
Tramadol	23.3 (14)	197		8.3 (10)	15		
Antiepileptic drugs	46.7 (28)	625	14.8	9.2 (11)	99	2.6	<0.001
Clonazepam	31.7 (19)	198		5.8 (7)	30		
Gabapentin	15.0 (9)	140		1.7 (2)	5		
Pregabalin	28.3 (17)	287		5.0 (6)	64		
Benzodiazepines	55.0 (33)	1345	31.8	27.5 (33)	179	4.6	<0.001
Diazepam	38.3 (23)	339		12.5 (15)	59		
Chlordiazepoxide	15.0 (9)	14		2.5 (3)	16		
Oxazepam	25.0 (15)	321		8.3 (10)	17		
Lorazepam	1.7 (1)	2		3.3 (4)	36		
Alprazolam	41.7 (25)	669		8.3 (10)	51		
Sleeping medications	40.0 (24)	415	9.8	17.5 (21)	109	2.8	0.001
Nitrazepam	1.7 (1)	5		0.0 (0)	0		
Temazepam	25.0 (15)	163		2.5 (3)	3		
Zopiclone	18.3 (11)	72		10.0 (12)	81		
Zolpidem	16.7 (10)	175		6.7 (8)	25		
Stimulants	6.7 (4)	76	1.8	3.3 (4)	17	0.4	0.444
Methylphenidate	6.7 (4)	76		3.3 (4)	17		
Drugs for treating addiction	1.7 (1)	28	0.7	0.0 (0)	0	0	
Buprenorphine, drug combination	1.7 (1)	28		0.0 (0)	0		

Abbreviation: ATC, Anatomical-Therapeutic-Chemical.

^aStatistical significance of difference in the number of users between drug crime offenders and non-criminal controls.

(total $n = 1002$); the corresponding number and proportion for non-addictive medication purchases was 264, 26%. The proportions of purchases by classifications of drugs as addictive or non-addictive psychotropic medication are presented in the online Supplement Figure 1.

There was little difference between drug crime offenders and controls in users of non-addictive prescription medication, but some difference in number of purchases. Online Supplementary Table 2 shows that 90% of drug crime offenders had used non-addictive prescription psychotropic medications and non-addictive prescription psychotropic medications accounted for 33% ($n = 1394$) of all their 4231 psychotropic medication purchases during the follow-up time, whilst 83% of non-criminal controls had used non-addictive prescription psychotropic

medications but 88% ($n = 3401$) of all their 3864 psychotropic medication purchases had been for non-addictive psychotropic medication during the follow-up time.

Table 4 shows the results of stepwise logistic regression analyses, with drug crime conviction (yes/no) as the dependent variable. In model 1, adolescence-related factors, age at admission (adjusted odds ratio [AOR] 1.59; 95% CI 1.17–2.15), moderate/high ND (AOR 2.94; 95% CI 1.24–6.98) and conduct disorder (AOR 4.91; 95% CI 2.19–10.99) were all associated with drug crime offending. In model 2, using the follow-up related factors, age at the end of the follow-up (AOR 1.40; 95% CI 1.17–1.68) and use of antiepileptic drugs (AOR 9.38; 95% CI 3.95–22.28) were associated with higher likelihood of drug crime offending. In model 3, when all of the variables were entered into the model, age at the end of the follow-up (AOR 1.52; 95% CI 1.23–1.88), use of antiepileptic drugs (AOR 7.77; 95% CI 2.99–20.24) and conduct disorder (AOR 3.49; 95% CI 1.35–8.99) remained as independent predictors of drug crime offending. Furthermore, model 3 showed, that adolescent substance use disorder predicted drug crime offending (AOR 2.35; 95% CI 1.00–5.48), whilst drug crime offenders were less likely to suffer from psychotic disorders in adolescence (AOR 0.10; 95% CI 0.02–0.68).

4 | DISCUSSION

Our findings showed that the drug crime offenders were more likely to be users of prescribed addictive psychotropic medications than the young ex-psychiatric patients of similar age and gender who remained without convictions

TABLE 4 Adolescent and follow-up related factors in relation to drug crime offending

	Likelihood for drug crime offending		
	Adjusted OR	95% CI	<i>p</i> -value
Model 1 (adolescence-related factors)			
Age at admission (index hospitalisation)	1.59	1.17–2.15	0.003
Moderate/high nicotine dependence	2.94	1.24–6.98	0.014
Conduct disorder	4.91	2.19–10.99	<0.001
Model 2 (follow-up related factors)			
Age at the end of the follow-up ^a	1.40	1.17–1.68	<0.001
Use of antiepileptic drugs	9.38	3.95–22.28	<0.001
Model 3 (model 1 + model 2)			
Age at the end of the follow-up ^a	1.52	1.23–1.88	<0.001
Use of antiepileptic drugs	7.77	2.99–20.24	<0.001
Psychotic disorder	0.10	0.02–0.68	0.018
Conduct disorder	3.49	1.35–8.99	0.010
Substance use disorder	2.34	1.00–5.48	0.050

Note: Odds Ratios (ORs) with 95% Confidence Intervals (CIs) are based on the results of a binary logistic regression analysis using forward stepwise selection criteria. In model 1, all adolescence-related factors (psychiatric disorders, level of nicotine dependence, weekly use of alcohol and cannabis, parental psychiatric and substance use problem), gender and age at index hospitalisation of the study participants were entered to the model as potential predictors for drug crime offending. In model 2, the register-based follow-up information on the use of psychotropic medication (ATC groups for opioids, antiepileptic drugs, benzodiazepines, sleeping medications, stimulants, drugs for treating addictions, antidepressants, antipsychotics, and other psychotropic medication), gender and age at the end of the follow-up data for psychotropic medications in year 2012 were entered into the model as potential predictors for drug crime offending. In model 3, all variables used in models 1 and 2 were combined and then entered into the model as a potential predictor for drug crime offending. Antiepileptic drug use included purchases of Clonazepam, Gabapentin or Pregabalin.

^aDrug register was available up to the end of the year 2012.

for drug crimes or any other crimes, and that these were the former's most purchased medications both during the follow-up time and in the year preceding the drug crimes. Another key finding was that, of all addictive medications, the use of addictive antiepileptic drugs had the strongest association with drug crime offending. Another finding was that being diagnosed with conduct and/or substance use disorder in adolescence, was predictive for drug crime offending. Older age at the end of the follow-up time predicted drug crime offending, but this may only have reflected longer age period during which prescription medications were used. Our findings highlight the importance of doctors considering all clinical indications when prescribing addictive psychotropic medications and the need for caution when using these medications in treating patients with a history of substance or drug use.

In our study, addictive antiepileptic drugs included Clonazepam, Gabapentin, and Pregabalin. Gabapentin and Pregabalin are used to treat epilepsy and neuropathic pain, and Pregabalin is also used to treat generalised anxiety disorder (Current Care Guidelines, 2017, 2019, 2020). Clonazepam is used as an add-on therapy to treat epilepsy (Kälviäinen, 2015; Song et al., 2020). All three of these drugs have a high risk of abuse and non-medical use, potentially resulting from their associated relaxing and euphoric effect (Bockbrader et al., 2010), tolerance development, physical dependence, and withdrawal symptoms (Dokkedal-Silva et al., 2019; Evoy et al., 2017). Our findings show that use of addictive antiepileptic drugs has the strongest effect on predicting drug crime offending over opioids, benzodiazepines, and sleeping medications. This is an interesting finding, considering that Peltokorpi et al. (2021) found that tobacco smoking and alcohol use, the first prescriptions of benzodiazepines and opioids, and a diagnosis of substance dependence predated the first prescriptions of gabapentinoids. Our finding indicates that gabapentinoids may challenge the field of prescribing medications, when the "opioid crisis" (Volkow & Blanco, 2021) and misuse of benzodiazepines (Votaw et al., 2019) have been one of the major concerns in worldwide public health in the past decades.

Of adolescent psychiatric disorders, conduct and substance use disorders were predictors for drug crime offending in our study, which is in line with earlier studies (Beaudry et al., 2021; Bussing et al., 2010; Fazel et al., 2017; Teplin et al., 2012). Being diagnosed with substance use disorder in adolescence should also be considered worrisome because of the various cognitive deficits and other deleterious consequences following the exposure to different substances in adolescence (Spear, 2018; Volkow et al., 2014). Contrary to previous literature (Valuri et al., 2021), in our study, psychotic disorders were not associated with drug crime offending. In Finland, the statutory care guarantee means that the same timeframes apply to access to treatment for mental health services as to access for other medical services. All people permanently resident in Finland are insured against sickness regardless of their socio-economical status or any other background characteristic (Ministry of Social Affairs and Health, 2022a, 2022b). This may reflect good quality of treatment of psychotic disorders in Finland, for example, Kiviniemi (2014) found that 80% of the hospital-treated and 90% of the outpatient-treated patients with first-onset schizophrenia were able to live at home.

4.1 | Implications

Drug crime offenders' mental disorders, including substance use disorders, should be actively treated based according to recent care guidelines and stigmatisation avoided. In the treatment of drug crime offenders' mental disorders, use of necessary medications that are non-addictive should be emphasised as far as possible, together with psychosocial treatments. When prescribing addictive medications, treating physicians should take an active preventive role to minimise risk of developing dependence on these substances.

4.2 | Limitations and strengths

The findings of our study cannot be directly generalised to a wider adolescent population, because adolescents participating in our study had psychiatric disorders that were severe enough to require acute inpatient care. Although the participation rate in the study was high (84%), some selection bias may still exist, for example, socially disadvantaged families might have been particularly reluctant to give consent for participation. Unfortunately, our register-based follow-up data lacks laboratory tests verifying the blood concentrations of the medications studied or illicit drugs and, moreover, we do not have the information on illegally purchased prescription medications from black markets or the dark net. It is likely that our study underestimates the true prevalence of personality disorder and Attentional Deficit Hyperactivity Disorder (ADHD) people with these conditions often do not seek psychiatric treatment and, at the time of the data collection, the diagnostics for ADHD was not as advanced as it is today. The crime register data was available until November 2016, while the purchase data ended at the end of 2012. This may lead to an underestimation of the true prevalence of prescription medication purchases in relation to drug crimes because, in five cases, the first drug offences were committed after 2012. Moreover, the small number of cases in some subgroup analyses may have caused a lack of statistical power (Type II error). Further, a risk of spurious findings (Type I error) may also exist due to the numerous statistical comparisons performed in our study.

This study also has notable strengths in addition to the high participation rate, including its use of register data obtained from the national health, drug, and crime registers, making it possible to follow all the participants up to young adulthood. The nationwide registers have been shown to be reliable sources for data in scientific research (Miettunen et al., 2011). This study also used reliable and valid research instruments, such as the K-SADS-PL, the EuropASI, and the mFTQ for assessing substance use in adolescence and for defining adolescent psychiatric disorders.

5 | CONCLUSIONS

In conclusion, we found that more than one in 10 of former adolescent psychiatric inpatients had committed a drug crime by young adulthood. Although some expected diagnoses were disproportionately associated with this criminal outcome, our findings suggest that clinicians may inadvertently be contributing to the problem. Although proportions of young people receiving prescriptions for non-addictive medications were similar between the groups, the proportion buying prescriptions for addictive medications was much higher in the group who went on to commit a drugs offence. Prescribers already recognise and try to manage some of the risks when potentially addictive psychotropic medications are clinically the most appropriate, but there is potential for the patient receiving that medication to use it for illegal purposes. In practice, this is hard to do once a patient has returned to the community. Our study identified particular risks with Clonazepam and the gabapentinoids. Further research should focus on whether particular disorder-prescription combinations require specially tailored management strategies and on optimising clinician awareness of the risks as well as benefits.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

PATIENT CONSENT

All study subjects and their legal guardians provided written, informed consent for participation in the study.

DATA AVAILABILITY STATEMENT

The initial study population consists of adolescent psychiatric inpatients and, therefore, data cannot be released due to ethical and legal reasons.

ETHICS STATEMENT

The study protocol is approved by the Ethics Committee of the University Hospital of Oulu, Finland.

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