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Association of Cohort and Individual Substance Use With Risk of Transitioning to Drug Use, Drug Use Disorder, and Remission from Disorder: Findings From the World Mental Health Surveys

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Abstract

Importance: Limited empirical research has examined the extent to which cohort-level prevalence of substance use predicts onset of and transitioning into greater involvement in drug use.

Objective: To use cross-national data to examine time-space variation in cohort-level drug use to predict onset and transitions across stages of drug use, abuse, dependence, and remission.

Design, Setting and Participants: The World Health Organization World Mental Health Surveys carried out cross-sectional general population surveys in 25 countries using a consistent research protocol and assessment instrument. A total of 90,027 adults from representative household samples were interviewed face-to-face in the community in relation to drug use disorders. The surveys were conducted between 2001 and 2015. Data analysis performed from July 2017 to July 2018.

Main outcomes and Measures: Data on timing of onset of lifetime drug use, DSM-IV drug use disorders, and remission from these disorders was assessed using the Composite International

Diagnostic Interview. Associations of cohort-level alcohol prevalence and drug use prevalence were examined as predictors of these transitions.

Results: Among the 90,027 respondents (48.1% [SE 0.2%] men; mean [SE] age, 42.1 [0.1] years), one in four respondents (24.8%; SE 0.2) reported either illicit drug use or extra-medical use of prescription drugs at some point in their lifetime, but with substantial time-space variation in this prevalence. Among users, 9.1% (SE 0.2) met lifetime criteria for abuse and 5.0% (SE 0.2) dependence. Individuals with polydrug use had an increased risk of both abuse and dependence and reduced probability of remission from abuse. Birth cohort prevalence of drug use was significantly associated with both initiation and illicit drug use transitions. For example, after controlling for individuals' experience of substance use and demographics, for each additional 10% of an individual's cohort using alcohol or drugs, a person's odds of initiating drug use increased by 28% and 12% respectively (OR 1.28 (95%CI:1.26–1.31) and 1.12 (95%CI:1.11–1.14)).

Conclusions and Relevance: Birth cohort substance use predicts drug use involvement over and above the effects of individuals' own history of alcohol and other drug use. This has important implications for understanding the causal pathways into and out of problematic drug use.

Introduction

Improved understanding of determinants of drug use disorders (DUDs) and transitions through different levels of involvement is important to assist in identifying critical time periods when specific interventions may be best targeted and shed light on potential factors that may affect such trajectories. Research on trajectories of drug use has most often considered the transition between use and dependence[1,2] or focused on specific populations such as people in treatment for DUDs[3–5].

The general population studies that have explored the natural history of substance use show that social contextual risk factors have a differential role according to transition stage[2,6–10]. For example, substance use is linked to social and peer-level variables[11]; and evidence suggests that the extent to which behaviour is normative may be associated with adverse substance use outcomes (with people engaging in less normative behaviour having a greater likelihood of problematic substance use)[12, 13].

Previous studies have found that chronological age, historical period and birth cohort effects are associated with differences in substance use and related problems[14–17]. Age-related differences in substance use and related problems have often been attributed at least in part to developmental and maturational factors[18], especially when cross-sectional comparisons are made between age groups within a sample covering a broad age range of a population [19–21].

However, individuals are also strongly influenced by the broader social context in which they live. Substance use influences (e.g., substance use norms, enforcement of sanctions against drug use, drug availability, and perceptions of risk), have varied widely across geographical locations and in different time periods in history. Cohort effects include the shared social and environmental influences on individuals born at particular times as they mature, experiencing the extant period effects, including changes in period effects over time. There are complex issues involved in distinguishing period and cohort effects[22,23], and although there is evidence of both influences, research has shown that substance use behaviours are especially related to cohort effects[17,24,25], which may modify period effects, and perhaps have other social influences. Supporting this possibility, we previously used a national study of Australian adults to investigate associations of levels of involvement with alcohol and cannabis use with birth cohort use[26] and found that the level of alcohol or cannabis use within an individual's age cohort predicted risks of progressing further into involvement with alcohol and cannabis use, respectively[26].

In the current paper, we present for the first time, country-level data on lifetime prevalence of illicit drug use, DSM-IV drug abuse and dependence, and remission from use disorders. We also conduct the first-ever analyses of the influence of cohort effects on individuals' drug use cross-nationally using the WHO World Mental Health (WMH) Surveys (www.hcp.med.harvard.edu/WMH)[27], a unique database made up of 27 population surveys conducted in 25 countries across the globe. We examine the extent to which an individual's birth cohort's use of both alcohol and drugs at various points in the life course predicts the individual transitioning across levels of involvement with drug use net of the effects of the individual's own history of substance use at that point in time.

Method

Sample

Data come from 27 WMH surveys that assessed DUDs. Six surveys were conducted in countries classified by the World Bank at time of data collection as low or lower-middle income (Colombia [national], Iraq, Nigeria, People's Republic of China [PRC], Peru, and Ukraine), six in countries classified as upper-middle income (Brazil, Bulgaria, Colombia [Medellin-region], Lebanon, Mexico, and South Africa) and 15 in 14 in countries classified as high income (Argentina, Australia, Belgium, France, Germany, Israel, Italy, Japan, Netherlands, New Zealand, Northern Ireland, Poland, Spain [separate national and regional surveys], and the United States). Most surveys were based on nationally representative household samples. The sample characteristics for all participating surveys are shown in eTable 1. Informed consent was obtained before beginning interviews in all countries. Procedures for obtaining informed consent and protecting human subjects were approved and monitored by the Institutional Review Boards of organisations coordinating surveys in each country. Full details of the WMH surveys have been published previously[27–31] and are summarised in the eMethods.

Combining participants from all 27 surveys, 90,093 respondents were administered the drug module. Sixty-six respondents (35 from Israel, 15 from Mexico, 11 from Japan, and 5 from

South Africa) provided no valid answers to any drug use question and were excluded. Therefore, a total of 90,027 respondents are included in the analyses described here.

Data Analysis

Age of onset and speed of transition between various drug stages were examined. These stages were use (first time using any drug), DSM-IV abuse, DSM-IV dependence, remission from abuse without dependence (defined as absence of all abuse symptoms for more than 12 months at time of interview) and remission from dependence (absence of all dependence symptoms for more than 12 months at time of interview). To improve cross-national comparability, all survey data was restricted to persons aged 18 and over at time of interview.

All analyses were carried out in SAS® Version 9.4[32] using weighted data, and accounting for the complex survey design features, namely stratification and clustering. Person weights were used to adjust for probability of selection, nonresponse and post-stratification factors, and, as noted above, Part II data weights adjusted for over-sampling of Part I respondents with mental disorders. These weighting procedures ensured that all samples are representative of the survey region's population at time of data collection.

Life-table (actuarial) estimates of the survival functions for age of onset and remission were produced using the SAS PROC LIFETEST procedure and are reported as weighted prevalence. Discrete-time logistic regression models were used to investigate the impact of cohort and individual substance use variables on commencement of illicit drug use, transitions from use to disorder (abuse and dependence), and from disorder to remission (among those with a valid age of onset of remission – see eMethods). These analyses were conducted in SAS PROC SURVEYLOGISTIC using person-year as the unit of analysis and a logistic link function.

Person-year datasets were created in which each year in the life of each respondent during which they were at risk of transitioning, from the age of onset of the initial stage up to and including the age of onset of the transition or age at interview (whichever came first), was treated as a separate observational record. The year of transition was coded 1 and earlier years coded 0, on a dichotomous response variable. Survival coefficients and standard errors (SEs) are presented as odds ratios (ORs) and 95% confidence intervals (CIs). Multivariable significance tests were made with Wald χ^2 tests using Taylor series design-based coefficient variance-covariance matrices and significance evaluated at 0.05 with two-sided tests.

A country/region-specific contextual variable representing cumulative lifetime prevalence of substance use in the individual's birth cohort at each year of life was constructed and used to predict transitioning to each drug stage. An individual's birth cohort was based on their year of birth +/– five years, which created 11- year wide survey-specific cohorts centred around their year of birth. The cohort widths were reduced for those aged between 18 and 22 years to, as close as possible, ensure symmetry around birth year; total band width was of size two for 18-year-olds (18–19), three for 19-year-olds, (18–20), five for 20-year-olds (18–22), seven for 21-year-olds (18–24) and nine for 22-year-olds (18–26). Cohorts were top-coded for those aged 65 or older. The predictor variable was the estimated proportion of people

(/10) in the individual's birth cohort who had used the specific substance (either alcohol or drugs) as of each prior year of age; in this way, it captured the percentage of people in the cohort who had already commenced use at any given age. In order to capture only the most prominent changes in cohort use, cohort use prevalence was set to zero for person years below the age of 12 and top-coded for 30 years and over. Linearity of the cohort use variables were investigated.

To investigate the impact of the individual's own prior involvement with alcohol on risk of drug transitions, four mutually exclusive, time-varying dummy variables were included as predictors for highest lifetime-to-date level of alcohol involvement (none versus either use, abuse, dependence, or remission from abuse/dependence). In addition, models for transitions after first use considered the types of drugs being used, with indicators for onset of cannabis, cocaine and other drug use (prescription drugs combined with 'other drugs' due to small numbers) as well as whether two or more of these drug categories had been used. A total of six models investigating cohort and individual substance involvement were investigated: (1) prevalence of cohort drug use, (2) prevalence of cohort alcohol use, (3) individuals' level of alcohol involvement, (4) type of drugs, (5) number of drugs, and (6) all cohort and individual substance-related variables. All models adjusted for a wide range of variables (see eMethods). Data analysis was performed from July 2017 to July 2018.

Results

Prevalence of use, abuse, dependence, use disorders and remission

Lifetime prevalence estimates for use of any drug and specific drugs are shown in Table 1. Across countries, 24.8% (SE 0.2) of respondents reported lifetime illicit drug use or extra-medical use of prescription drugs. Within each country income grouping, cannabis was the most commonly used drug of those considered; the United States (42.3%) and New Zealand (41.9%) had the highest lifetime cannabis prevalence. The United States (16.2%) and Murcia (Spain, 7.8%) had the highest lifetime prevalence of cocaine use. Highest estimates of extra-medical prescription drug use were observed in some countries in Europe, whereas Iraq (1.3%), China (5.9%), Lebanon (6.3%), Japan (7.0%) and Bulgaria (7.3%) had the lowest rates of any drug use.

Table 2 shows prevalence estimates of lifetime DUDs overall and conditional on ever having used drugs, as well as remission rates overall and among those with the specific use disorders. The lifetime prevalence (SE) of drug abuse and drug dependence in the total sample were 2.2% (0.1) and 1.2% (0.1), respectively (Table 2). Again, there was considerable geographic variation. Around one in seven drug users developed a DUD (14.0%; SE 0.3), with the rate of abuse (9.1%; SE 0.2) higher than dependence (5.0%; SE 0.2). Remission prevalence rates for the entire cohort were 1.8% (0.1) for abuse and 0.9% (<0.1) for dependence. Conditional remission estimates were 78.0% (1.1) for drug abuse and 70.7% (1.7) for drug dependence.

Age of onset and time to transition across stages of involvement

Figure 1 shows the cumulative age of onset (AOO) curves for onset of illicit drug use, abuse, dependence, remission from abuse and remission from dependence (left) and the cumulative time to transition between drug stages (right). Onset of drug use largely occurred during the late teenage years (median AOO of 19 years). For DUDs, the median AOO was slightly earlier for abuse (20 years) compared to dependence (21 years). This was similar for remission, with the median AOO of remitting from abuse one year younger than the median AOO of dependence remission (28 vs. 29 years).

The transition from initial use to DUD onset was often quite fast, with over half of all users who developed abuse doing so within three years of first use. Median time-to-dependence was slightly longer at five years from first use. Among those that eventually remitted, time with the disorder was slightly longer for dependence than abuse at six and five years, respectively.

Predictors of transitions between stages of drug involvement

Table 3 summarises the results from five models investigating the association of each substance-related variable with transitions between stages of drug involvement, with adjustment for all socio-demographic variables (complete set of results are shown in eTables 2–7).

Cohort-level substance use as predictors—In the transition models that considered prevalence of drug use in an individual's age cohort (Model I), an increase in an individual's cohort's drug use was associated with an increased individual risk of commencing drug use, developing a DUD and remitting from those disorders. With the exception of transitions to dependence, similar results were also observed when examining the prevalence of cohort alcohol use (Model II).

Individual-level substance use history as predictors—At the individual level, having already developed alcohol abuse or dependence, or remitted from either disorder, were all strongly associated with an increased risk of starting drug use, transitioning to DUDs, but also remitting from DUDs (Model III). Considering the types of drugs used (Model IV), cocaine and other drugs both increase risks of transitioning to drug dependence; people with a history of cannabis use were also more likely to remit from both drug abuse and drug dependence than those who had not used cannabis. When considering only the number of drugs used (Model V), the use of two or more drug types increased the odds of transitioning to abuse and dependence and reduced the odds of remitting from abuse.

Including both individual and cohort substance use history—Table 4 presents the results obtained when including all individual and cohort-level substance use variables considered above in the same model (also adjusting for sociodemographic variables). Once adjusting for an individual's own prior substance involvement, an increase in their cohort's drug use and alcohol use was associated with an increased individual risk of commencing drug use and remitting from DUDs but was no longer associated with developing DUDs. Most other effects observed in the separate models described above remained significant.

Analyses at the country income level were also investigated, the results of which are shown in eTables 8–13. Findings were largely consistent between country income group analyses, and the pooled analyses presented here.

Discussion

The primary aim of the present study was to provide cross-national data on the epidemiology of drug use, abuse and dependence, and use a unique cross-national dataset to examine transitions across levels of involvement with drug use, and the extent to which alcohol and other drug use in an individual's birth cohort predicted an individual's risk of these transitions, in addition to that person's own prior involvement in alcohol and drug use. At an individual level, extent of involvement with both alcohol and drug use strongly predicted risks of transitioning into drug abuse and drug dependence, consistent with previous findings[33,34]. Even after having remitted from alcohol use disorder, individuals remained at increased risk of beginning drug use and transitioning to DUDs. Interestingly, individuals who had previously remitted from alcohol use disorder also had a higher likelihood of remitting from DUDs than those who never used alcohol.

But net of these associations, extent of illicit drug use in an individual's birth cohort was associated with significantly increased risk of the individual beginning drug use and remitting from DUDs. Cohort alcohol use also positively predicted commencement of illicit drug use and remission from drug abuse. That is, the more people in an individual's cohort who had a history of using those substances, the greater the likelihood of the individual remitting from the DUD after developing this disorder.

These findings speak to the social context in which substance use occurs. One of the most consistent findings in substance use research is that substance use of one's peers predicts a greater likelihood of involvement with substance use for an individual[35]. Here, we have further shown that this is a generalised pattern, whereby it is not only substance use among one's friends, but in one's peer cohort more generally. This may be through multiple mechanisms, such as impacts on perceived drug use norms[36] and increased opportunities to use substances[37]. Furthermore, cohort substance use was shown not only to be associated with greater involvement with drugs, but even stronger associations are observed for transitions to remission from DUDs. This may reflect the fact that individuals exposed to higher cohort-level prevalence also have greater access to treatment services than individuals exposed to lower cohort-level prevalence, or perhaps that as cohort substance use increases those who are transitioning to these disorders may be less problematic or use disorder prone at the individual level and, as a result, remit from those disorders at a higher rate. These findings also suggest that the risk for commencing drug use and remission from problems is not constant but varies, in this case according to the extent to which substance use is occurring among one's age peers.

Although higher rates of use in an individual's cohort was associated with an increased likelihood the individual will start using drugs, there was no independent effect of cohort use on the transition to abuse or dependence once use had begun. This suggests that while higher rates of use in an individual's cohort increases the likelihood that the individual will start

using drugs, the propensity to transition to problematic use is not affected by such external variables; by contrast, we found that it was affected by their own prior substance use history. Therefore, any intervention aiming to reduce substance use within a cohort might also reduce individual-level risk for transitioning into greater levels of involvement with drug use. The type of substance such interventions should target warrants further investigation, especially considering cohort alcohol use had a stronger effect on commencing drug use than cohort drug use, but implementation would ideally be early in life and before opportunities to use either substance arise (see eTable 16). If this occurred, the smaller group of individuals who nonetheless developed DUDs despite the decrease in prevalence of use within that cohort would be more refractive cases.

Limitations

This study provided detail regarding the prevalence and timing of various stages across the full trajectory of both alcohol and illicit drug use, with clinically valid diagnoses and inclusion of contextual predictors not previously accounted for within the literature. Data on age of onset for each stage were obtained via retrospective self-report and may be subject to 'forward telescoping', whereby participants are more likely to report events as closer to the point of interview than is accurate[38,39]. However, this literature does not suggest that the order of recalled events will be altered.

Investigating the interactive effects of the personal and contextual variables on risk of transitioning involvement with illicit drugs was beyond the scope of this paper. However, future work should investigate whether conditional relationships exist between individual-level predictors (substance use, history of mental disorder) and cohort contextual variables which impact individuals' risk of commencing use and transitioning to greater involvement with drugs.

The WMH surveys have several important limitations. There is not full representation of all countries, regions, country income levels or other country characteristics. There was variation in response rates across countries, the year in which the studies were administered, and possibly cross-national differences in willingness to disclose personal information about drug use and problems. Respondent information is subject to the limitations of recall inherent in retrospective reporting, leading to potential underestimates in lifetime prevalence. Survival bias may also contribute to downward bias in lifetime estimates.

In addition to these general limitations, there are some limitations specific to the assessment of DUDs. The WMH surveys are household surveys, which have limitations when used to assess less common and more stigmatised behaviours. Illicit drug use can be a rare occurrence and geographically concentrated, and surveys such as the WMH surveys that rely on stratified sampling methods are poorly suited to capturing concentrated geographic 'pockets' of drug use. Furthermore, the use of households as the primary sampling unit will not capture marginalised groups who do not live in traditional household contexts (e.g. homeless, prison, hospital, or other non-household accommodation). These factors mean that prevalence rates presented here should be considered lower-bound estimates; "true" lifetime prevalence of DUDs may be substantially higher.

Transition times to drug use disorders (DUDs) have been shown to differ widely depending on substance class[40]. As most surveys assessed DUDs at the general illicit drug level, it was not possible to evaluate transition times at the drug-specific level. The estimates presented here therefore represent averages of first transitions across all (single and multi-type) illicit drug users.

Due to the way in which symptom onset and recency is assessed in the CIDI, it was only possible to assess remission at the time of interview. Given the chronic nature of DUDs, if we had information on lifetime remission (i.e. any period in life with an absence of symptoms for more than 12 months) we may have found other variables were associated with remission from DUDs.

Conclusion

We have found, across countries, that an individual's personal risk of transitioning to greater involvement with drug use is impacted by their history of involvement with drugs and alcohol, and the substance use histories of their age cohort. These variables predict transitioning into and out of problematic drug use, when considering them together, in addition to a range of other sociodemographic correlates. These findings have important implications for our understanding of the causal pathways into and out of problematic substance use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

Question:

Does the extent to which alcohol and other drugs are used in an individual's birth cohort impact an individual's risk of commencing drug use, transitioning to problematic use, and remitting?

Findings:

Using cross-national data from the World Mental Health Surveys, an individual's personal risk of transitioning to greater involvement with drug use is impacted by the substance use histories of their age cohort, as well as their own history of involvement with drugs and alcohol. Results were statistically significant after controlling for socio-demographics and were consistent across country income levels.

Meaning:

Any intervention to reduce substance use within a cohort would also reduce individual-level risk for transitioning into greater levels of involvement with drug use.
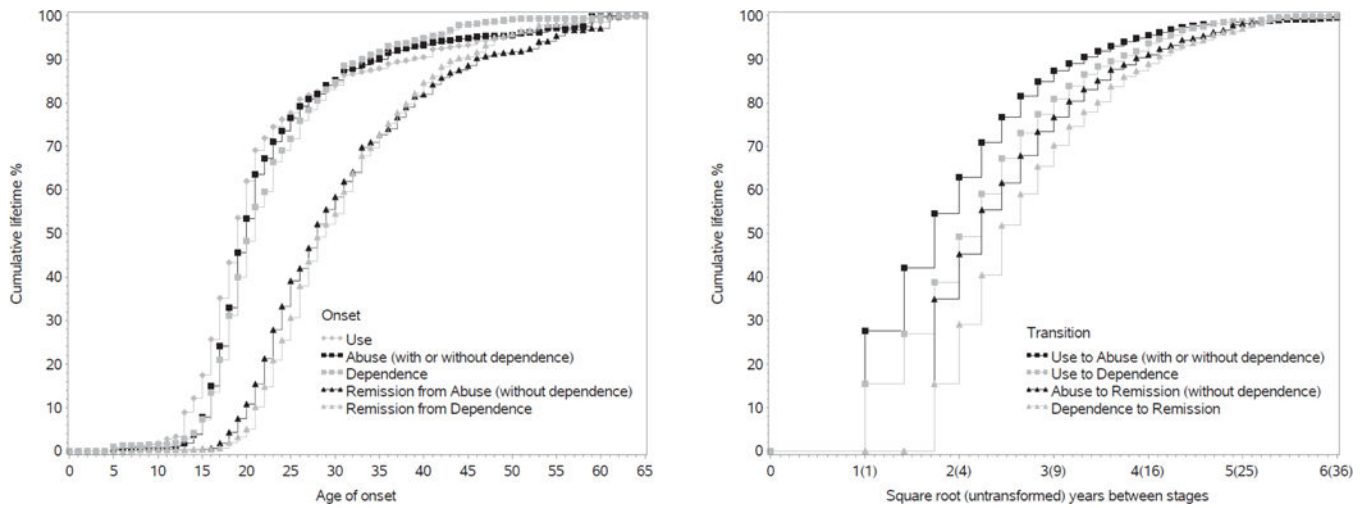
Figure 1. Age of onset (left) and transition times between (right) drug use, use disorders and remission

The left panel shows the cumulative age of onset curves for illicit drug use, abuse (without hierarchy), dependence, remission from abuse and remission from dependence. Each curve includes respondents with and without the specific diagnosis, where age of onset for the latter is censored at age of interview. Estimates were scaled up to reach 100%. The right panel shows the cumulative curves for time to transition between various drug stages. Each curve includes only those respondents with a diagnosis of the second stage. For left and right panels, persons with missing age of onset of remission were excluded from associated curves (N=147 – remission from abuse; N=104 – remission from dependence).

Table 1.

Lifetime prevalence of overall drug use and specific drug use in the World Mental Health Surveys

Country[a]	N[b]	Cannabis		Cocaine		Prescription drugs[f]		Other drugs		Any drugs[d,e]	
		%[c]	SE	%[c]	SE	%[c]	SE	%[c]	SE	%[c]	SE
Low and Lower-Middle	18,179	5.3	0.2	2.0	0.1	4.7	0.2	0.6	0.1	10.0	0.3
Colombia	4,426	10.8	0.6	4.0	0.4	2.2	0.3	0.9	0.2	12.7	0.7
Iraq	4,332	0.0	0.0	0.0	0.0	1.2	0.2	0.1	0.0	1.3	0.2
Nigeria	2,143	2.7	0.5	0.1	0.1	18.7	1.3	0.5	0.2	20.4	1.3
Peru	3,930	7.9	0.4	4.8	0.2	4.3	0.3	1.0	0.1	13.3	0.5
China	1,628	0.3	0.1	0.0	0.0	5.8	0.9	0.2	0.2	5.9	0.9
Ukraine	1,720	6.4	1.0	0.1	0.0	2.4	0.6	0.8	0.2	8.4	1.2
Upper-Middle	20,051	9.2	0.3	3.1	0.2	7.8	0.4	1.5	0.1	16.2	0.5
Brazil	5,037	11.8	0.7	5.2	0.4	6.9	0.3	2.5	0.3	17.6	0.7
Bulgaria	2,233	1.3	0.5	0.0	0.0	6.1	0.6	0.0	0.0	7.3	0.8
Lebanon	1,031	4.6	0.9	0.7	0.3	2.0	0.6	0.3	0.2	6.2	1.1
Medellin	1,673	21.9	1.9	6.3	0.9	2.7	0.6	1.8	0.4	22.7	1.9
Mexico	5,767	7.8	0.5	4.0	0.4	1.8	0.3	1.0	0.2	10.1	0.5
South Africa	4,310	8.4	0.6	0.7	0.3	21.5	1.5	1.7	0.3	27.2	1.7
High	51,797	24	0.3	4.4	0.1	13.6	0.2	6.2	0.2	33.3	0.3
Argentina	2,116	14.2	1.0	5.8	0.6	14.4	1.1	3.3	0.5	26.3	1.3
Australia	8,463	19.8	0.6	2.9	0.3	2.5	0.2	7.3	0.4	21.4	0.6
Belgium	1,043	10.4	1.6	1.5	0.6	43.5	3.0	2.8	0.8	47.6	2.8
France	1,436	19	1.6	1.5	0.4	43.4	2.0	4.8	0.7	52.7	1.7
Germany	1,323	17.5	1.6	1.9	0.5	62.3	2.5	3.4	0.7	66.4	2.5
Israel	4,824	11.5	0.5	0.9	0.1	1.7	0.2	1.8	0.2	12.9	0.5
Italy	1,779	6.6	0.8	1.0	0.3	66.0	2.0	0.9	0.2	66.8	2.0
Japan	1,671	1.5	0.4	0.5	0.2	4.8	0.7	1.8	0.5	7.0	0.8

Country[a]	N[b]	Cannabis		Cocaine		Prescription drugs[f]		Other drugs		Any drugs[d,e]	
		%[c]	SE	%[c]	SE	%[c]	SE	%[c]	SE	%[c]	SE
Murcia	1,459	23.1	1.3	7.8	1.1	0.9	0.5	3.1	0.8	24.2	1.5
Netherlands	1,094	19.8	1.3	1.9	0.2	20.1	2.4	4.1	0.8	35.9	2.4
New Zealand	12,790	41.9	0.7	4.3	0.3	6.6	0.3	10.2	0.4	42.9	0.7
Northern Ireland	1,986	17.3	1.1	3.5	0.5	2.3	0.4	4.5	0.7	18.2	1.2
Poland	4,000	3.8	0.3	0.4	0.1	5.1	0.3	1.5	0.2	8.7	0.5
Spain	2,121	15.9	1.3	4.1	0.7	61.5	2.6	3.5	0.7	64.5	2.6
United States	5,692	42.3	1.0	16.2	0.6	11.3	0.5	11.1	0.6	44.2	1.1
All Countries	90,027	16.9	0.2	3.6	0.1	10.5	0.2	4.0	0.1	24.8	0.2

SE - standard error;

[a] County income group reflects economic development status at time of data collection based on The World Bank country level ranking.

[b] N = The total unweighted number of respondents who responded to illicit drug use question(s) (for the specific drug, where applicable).

[c] Prevalence estimates are based on weighted data.

[d] Used at least one of the drug categories considered; cannabis, cocaine, prescription drugs and other drugs. Any drugs not captured by the first three categories were grouped as 'other drugs' (more detail provided in Methods).

[e] Respondents were included in the 'Any drugs' category if they provided information relating to the use of at least one drug.

[f] All ESEMED surveys (Belgium, France, Germany, Italy, Netherlands and Spain) asked three separate extra-medical use questions (1. Used without a prescription; 2. Used more than prescribed; and, 3. Used so regularly in a non-medical setting that you couldn't stop) for each prescription drug category. In contrast, most other surveys asked a single question pertaining to any extra-medical use of specific/any prescription drugs. The more detailed question structure in the ESEMED interviews is likely the reason for the high rates of prescription drug use in these surveys.

Table 2.

Conditional lifetime prevalence of DSM-IV drug use disorders and remission in the World Mental Health surveys [a]

Country [b]	N [d]	Prevalence								Conditional prevalence [g]									
		Abuse [c]		Dependence		Remission from abuse [c]		Remission from dependence		Abuse [c] among users		Dependence among users		Any drug use disorder among users		Remission among LT abuse cases [f]		Remission among LT dependence cases	
		% [e]	SE	% [e]	SE	% [e]	SE	% [e]	SE	% [d]	SE	% [d]	SE	% [d]	SE	% [d]	SE	% [d]	SE
Low and Lower-Middle	18,179	0.6	0.1	0.3	0.0	0.5	0.1	0.2	0	6.1	0.6	3.2	0.5	9.3	0.9	75	5.5	56.4	6.7
Colombia	4,426	0.9	0.2	0.8	0.2	0.7	0.1	0.4	0.1	6.8	1.3	6.4	1.3	13.2	2.1	75	8.3	54.7	7.6
Iraq	4,332	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	11.4	7.6	0.9	0.9	12.3	7.6	-	-	-	-
Nigeria	2,143	1.0	0.2	0.0	0.0	0.8	0.2	0.0	0.0	5.0	1.1	0.1	0.1	5.1	1.1	-	-	-	-
Peru	3,930	0.8	0.1	0.3	0.1	0.7	0.1	0.1	0.1	5.8	0.8	2.1	0.8	8.0	1.2	-	-	-	-
China	1,628	0.4	0.2	0.0	0.0	0.4	0.2	0.0	0.0	7.5	3.2	0.2	0.2	7.7	3.2	-	-	-	-
Ukraine	1,720	0.4	0.2	0.6	0.2	0.2	0.1	0.4	0.2	5.0	2.5	6.7	1.9	11.7	2.6	-	-	-	-
Upper-Middle	20,051	1.7	0.1	0.8	0.1	1.1	0.1	0.5	0.1	10.4	0.7	4.9	0.6	15.3	0.9	67.7	3.2	64.1	4.4
Brazil	5,037	1.5	0.2	1.4	0.3	1.3	0.2	0.9	0.2	8.6	1.0	7.9	1.6	16.5	1.8	83.1	5.2	62.4	6.3
Bulgaria	2,233	0.2	0.1	-	-	0.2	0.1	0.0	0.0	2.3	1.2	0.0	0.0	2.3	1.2	-	-	-	-
Lebanon	1,031	0.3	0.3	0.1	0.1	0.3	0.3	0.0	0.0	5.6	4.6	2.3	1.5	7.8	3.8	-	-	-	-
Medellin	1,673	3.4	0.5	1.9	0.4	2.9	0.5	1.1	0.3	14.9	2.2	8.2	1.7	23.1	2.8	84.9	4.6	57.3	10.1
Mexico	5,767	0.9	0.2	0.5	0.1	0.7	0.1	0.3	0.1	9.1	1.5	4.9	1.1	14.0	1.6	76.6	6.6	-	-
South Africa	4,310	3.4	0.3	0.6	0.2	1.6	0.2	0.5	0.1	12.4	1.4	2.3	0.6	14.7	1.8	48.2	5.6	-	-
High	51,797	3.0	0.1	1.7	0.1	2.4	0.1	1.3	0.1	9.1	0.3	5.2	0.2	14.3	0.3	80.5	1.2	72.9	1.9
Argentina	2,116	3.0	0.5	1.2	0.3	2.1	0.3	0.7	0.2	11.4	1.7	4.4	1.1	15.9	1.9	68.2	7	63.9	8.5
Australia	8,463	4.6	0.2	2.9	0.3	4.0	0.2	2.3	0.3	21.6	1.2	13.5	1.4	35.1	1.7	86.2	1.8	79.8	3.6
Belgium	1,043	3.4	0.7	1.1	0.6	2.3	0.5	0.4	0.2	7.1	1.4	2.3	1.3	9.4	1.8	69.2	13.1	-	-
France	1,436	2.6	0.3	0.9	0.3	2.2	0.2	0.6	0.3	5.0	0.5	1.7	0.5	6.6	0.9	84.3	2.7	-	-

Country[b]	N[d]	Prevalence								Abuse[c] among users		Dependence among users		Conditional prevalence[g]					
		Abuse[c]		Dependence		Remission from abuse[c]		Remission from dependence						Any drug use disorder among users		Remission among LT abuse cases[f]		Remission among LT dependence cases	
		%[e]	SE	%[e]	SE	%[e]	SE	%[e]	SE	%[d]	SE	%[d]	SE	%[d]	SE	%[d]	SE	%[d]	SE
Germany	1,323	2.4	0.5	0.5	0.3	2.2	0.4	0.2	0.1	3.6	0.7	0.7	0.4	4.4	0.8	90	6.1	-	-
Israel	4,824	1.4	0.2	0.3	0.1	1.1	0.2	0.3	0.1	10.8	1.3	2.3	0.6	13.1	1.4	81.6	4.8	-	-
Italy	1,779	2.1	0.4	0.4	0.1	1.8	0.4	0.3	0.1	3.1	0.6	0.6	0.2	3.7	0.6	87.4	5.9	-	-
Japan	1,671	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0	3.0	1.4	0.7	0.5	3.7	1.5	-	-	-	-
Murcia	1,459	2.4	0.7	1.2	0.4	1.7	0.7	0.6	0.2	10.0	2.4	5.2	1.5	15.2	2.5	-	-	-	-
Netherlands	1,094	1.0	0.3	1.1	0.6	0.9	0.3	1.0	0.6	2.9	0.9	3.0	1.7	5.8	1.8	-	-	-	-
New Zealand	12,790	3.1	0.2	2.5	0.2	2.6	0.2	1.6	0.1	7.2	0.5	5.8	0.4	13.0	0.6	82.8	2.3	65.2	3.4
Northern Ireland	1,986	2.7	0.4	0.6	0.2	1.5	0.3	0.4	0.1	14.8	2.3	3.5	0.9	18.4	2.5	54.2	8.6	-	-
Poland	4,000	1.2	0.2	0.2	0.1	0.4	0.1	0.1	0.0	13.5	1.7	2.8	0.9	16.2	2.0	36.8	7.1	-	-
Spain	2,121	3.8	0.5	0.3	0.1	3.2	0.6	0.3	0.1	5.9	0.9	0.5	0.1	6.3	0.9	84.8	5.7	-	-
United States	5,692	4.9	0.3	3.5	0.2	4.1	0.2	2.9	0.2	11.1	0.7	7.8	0.5	18.9	0.9	83.1	1.7	83.5	2.6
All Countries	90,027	2.2	0.1	1.2	0.1	1.8	0.1	0.9	0.0	9.1	0.2	5.0	0.2	14.0	0.3	78	1.1	70.7	1.7

SE - standard error; LT – lifetime;

Empty cells (−) indicate the estimates were not provided due to small sample sizes (n<30).

[a] Disorder and remission diagnoses are for any drug.

[b] Country income group reflects economic development status at time of data collection based on The World Bank country level ranking.

[c] Excludes those persons with lifetime drug dependence.

[d] N = The total unweighted number of respondents.

[e] Prevalence estimates are based on weighted data.

[f] Remission from abuse excludes those persons with lifetime drug dependence.

[g] Inclusion in the denominator is conditional on persons having met a certain level of drug involvement.

Table 3.

Association of each substance-related variable (excluding all others) with transitions between stages of lifetime illicit drug use, use disorders and remission, adjusted for all sociodemographic variables[a]

	Transition 1: Commencing Use		Transition 2: Use to abuse (with and without dependence)		Transition 3: Use to dependence		Transition 4: Remission from abuse (without dependence)[e]		Transition 5: Remission from dependence[e]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model I										
Percentage of age cohort already using drugs[b]	1.31*	(1.29–1.33)	1.11*	(1.07–1.16)	1.10*	(1.03–1.18)	1.65*	(1.54–1.77)	1.65*	(1.44–1.88)
X^2_1 [p]	1389.01**	[<0.001]	24.84**	[<0.001]	7.16**	[0.007]	197.06**	[<0.001]	53.87**	[<0.001]
Model II										
Percentage of age cohort already using alcohol[b]	1.51*	(1.49–1.54)	1.13*	(1.07–1.19)	1.08	(0.99–1.18)	1.44*	(1.30–1.61)	1.67*	(1.12–2.50)
X^2_1 [p]	2043.51**	[<0.001]	21.85**	[<0.001]	2.94	[0.086]	44.00**	[<0.001]	6.22**	[0.013]
Model III										
Highest level of individual's alcohol involvement[e]										
Use	4.64*	(4.39–4.90)	1.50*	(1.26–1.80)	1.39	(0.99–1.96)	1.39*	(1.11–1.72)	1.94*	(1.19–3.18)
X^2_1 [p]	3087.76**	[<0.001]	19.60**	[<0.001]	3.53	[0.060]	8.61**	[0.008]	6.95**	[0.008]
Abuse	10.78*	(9.38–12.40)	5.52*	(4.40–6.92)	3.80*	(2.50–5.78)	1.36*	(1.07–1.72)	2.18*	(1.32–3.62)
X^2_1 [p]	1120.27**	[<0.001]	219.64**	[<0.001]	39.03**	[<0.001]	6.38**	[0.012]	9.14**	[0.003]
Dependence	12.81*	(10.29–15.94)	6.48*	(4.94–8.50)	6.33*	(4.12–9.73)	1.49*	(1.12–1.99)	1.76*	(1.09–2.84)
X^2_1 [p]	522.38**	[<0.001]	182.37**	[<0.001]	71.06**	[<0.001]	7.59**	[0.006]	5.30**	[0.021]
Remission	4.08*	(3.20–5.21)	2.59*	(1.78–3.78)	2.01*	(1.20–3.37)	2.25*	(1.67–3.02)	3.28*	(1.99–5.40)
X^2_1 [p]	128.18**	[<0.001]	24.48**	[<0.001]	7.08**	[0.008]	28.88**	[<0.001]	21.70**	[<0.001]
Joint test of all four indicators - X^2_4 [p]	3251.41**	[<0.001]	465.08**	[<0.001]	150.16**	[<0.001]	30.29**	[<0.001]	42.15**	[<0.001]

	Transition 1: Commencing Use		Transition 2: Use to abuse (with and without dependence)		Transition 3: Use to dependence		Transition 4: Remission from abuse (without dependence)[e]		Transition 5: Remission from dependence[e]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model IV										
Type of drug(s) already used by individual										
Cannabis			3.10*	(2.53–3.81)	2.53*	(1.76–3.63)	1.68*	(1.36–2.08)	1.65*	(1.20–2.27)
X^2_1 [p]			116.54**	[<0.001]	25.02**	[<0.001]	22.50**	[<0.001]	9.56**	[0.002]
Cocaine			3.22*	(2.79–3.72)	3.54*	(2.83–4.42)	1.1	(0.96–1.26)	0.88	(0.73–1.06)
X^2_1 [p]			255.96**	[<0.001]	123.08**	[<0.001]	1.98	[0.159]	1.74	[0.187]
Other			2.62*	(2.28–3.01)	3.25*	(2.61–4.04)	0.80*	(0.71–0.89)	0.92	(0.75–1.12)
X^2_1 [p]			184.01**	[<0.001]	112.36**	[<0.001]	16.55**	[<0.001]	0.67	[0.412]
Joint test of all three indicators - X^2_3 [p]			696.02**	[<0.001]	379.52**	[<0.001]	43.05**	[<0.001]	12.99**	[0.005]
Model V										
Individual used 2+ drug types			5.17*	(4.66–5.73)	5.99*	(5.02–7.16)	0.86*	(0.76–0.98)	0.91	(0.74–1.13)
X^2_1 [p]			976.45**	[<0.001]	390.67**	[<0.001]	5.45**	[0.020]	0.74	[0.389]
Total sample size (N^f)	90,022		23,073		23,073		2,088		1,167	

OR - odds ratio; CI - confidence interval;

[a] All transitions are based on weighted person-year data. Each model (I-V, for all transitions) was estimated with only the one drug-related variable entered at a time as predictor of each transition controlling for:

Transition 1 – person-year age groups; sex; education level; major depressive episode; broad bipolar disorder; number of anxiety disorders; and survey.

Transition 2 – Included all controls specified for Transition 1 as well as age tertile of commencing alcohol use[c].

Transition 3 – Included all controls specified for Transition 2 as well as drug abuse.

Transition 4 and 5 – Included all controls specified in Transition 2 as well as speed to transition from use to disorder[d] and years with disorder.

[b] Percentage (/10) of +/–5-yr specific cohort who had used the substance by the prior person year.

[c] Individuals' age of commencing drug use is split into survey-specific tertiles among all those who ever used illicit drugs.

[d] Individuals' speed of transition from drug use to disorder is split into survey-specific tertiles.

[e]Individuals with a missing age of onset of remission were excluded from the model (N=147 for remission from abuse and N=104 for remission from dependence).

[f]N = The total unweighted number of respondents included in model conditioning on initial stage.

Table 4.

Associations of all substance-related variables with transitions between stages of lifetime illicit drug use, use disorders and remission, adjusted for all sociodemographic variables [a]

Model VI	Transition 1: Commencing Use		Transition 2: Use to abuse (with and without dependence)		Transition 3: Use to dependence		Transition 4: Remission from abuse (without dependence) [e]		Transition 5: Remission from dependence [e]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Percentage of age cohort already using drugs [b]	1.12*	(1.11–1.14)	1.04	(0.99–1.09)	1.04	(0.96–1.13)	1.57*	(1.46–1.69)	1.59*	(1.39–1.83)
X^2_1 [p]	205.46**	[<0.001]	2.19	[0.139]	1.04	[0.308]	138.99**	[<0.001]	44.36**	[<0.001]
Percentage of age cohort already using alcohol [b]	1.28*	(1.26–1.31)	0.99	(0.94–1.05)	0.94	(0.85–1.04)	1.11*	(1.00–1.22)	1.19	(0.86–1.64)
X^2_1 [p]	639.15**	[<0.001]	0.07	[0.792]	1.28	[0.258]	4.22**	[0.040]	1.07	[0.300]
Highest level of individual's alcohol involvement [e]										
Use	3.59*	(3.40–3.80)	1.22*	(1.02–1.47)	1.17	(0.81–1.70)	1.00	(0.79–1.27)	1.68*	(1.03–2.74)
X^2_1 [p]	2027.16**	[<0.001]	4.54**	[<0.001]	0.74	[0.390]	0.00	[0.995]	4.33**	[0.037]
Abuse	8.20*	(7.16–9.38)	3.76*	(2.98–4.74)	2.56*	(1.65–3.97)	0.92	(0.71–1.20)	1.90*	(1.15–3.15)
X^2_1 [p]	933.29**	[<0.001]	125.44**	[<0.001]	17.43**	[<0.001]	0.37	[0.545]	6.21**	[0.013]
Dependence	9.77*	(7.90–12.08)	4.33*	(3.27–5.74)	4.19*	(2.67–6.59)	1.11	(0.82–1.49)	1.5	(0.93–2.42)
X^2_1 [p]	441.06**	[<0.001]	104.69**	[<0.001]	38.54**	[<0.001]	0.43	[0.510]	2.78	[0.096]
Remission	3.10*	(2.43–3.95)	1.76*	(1.21–2.57)	1.39	(0.81–2.40)	1.59*	(1.18–2.14)	2.78*	(1.69–4.55)
X^2_1 [p]	84.01**	[<0.001]	8.58**	[0.003]	1.41	[0.235]	9.14**	[0.003]	16.43**	[<0.001]
Joint test of all four indicators - X^2_4 [p]	2238.03**	[<0.001]	304.38**	[<0.001]	99.35**	[<0.001]	26.23**	[<0.001]	35.78**	[<0.001]
Type of drug(s) used by individual										
Cannabis			0.84	(0.62–1.13)	1.07	(0.66–1.73)	2.06*	(1.61–2.64)	1.65*	(1.16–2.34)

Model VI	Transition 1: Commencing Use		Transition 2: Use to abuse (with and without dependence)		Transition 3: Use to dependence		Transition 4: Remission from abuse (without dependence)[e]		Transition 5: Remission from dependence[e]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
X^2_1 [p]			1.36	[0.244]	0.07	[0.790]	32.54**	[<0.001]	7.62**	[0.006]
Cocaine			1.42*	(1.14–1.76)	2.35*	(1.78–3.10)	1.28*	(1.08–1.52)	0.83	(0.67–1.03)
X^2_1 [p]			9.75**	[0.002]	36.01**	[<0.001]	7.91**	[0.005]	2.99	[0.084]
Other			0.82	(0.64–1.04)	1.48*	(1.06–2.07)	1.06	(0.88–1.28)	0.99	(0.77–1.29)
X^2_1 [p]			2.67	[0.102]	5.31**	[0.021]	0.43	[0.514]	<0.01	[0.969]
Joint test of all three indicators - X^2_3 [p]			35.36**	[<0.001]	48.37**	[<0.001]	43.82**	[<0.001]	11.82**	[0.008]
Individual used 2+ drug types			4.69*	(3.56–6.18)	2.90*	(1.97–4.29)	0.58*	(0.46–0.74)	0.83	(0.58–1.18)
X^2_1 [p]			120.52**	[<0.001]	28.74**	[<0.001]	19.96**	[<0.001]	1.07	[0.300]
Total sample size (N^f)	90,022		23,073		23,073		2,088		1,167	

OR - odds ratio; CI - confidence interval;

[a] All transitions are based on weighted person-year data. Models were estimated with all drug-related variables entered as predictors of each transition (excluding type and number of drugs in commencing use) controlling for:

Transition 1 – person-year age groups; sex; education level; major depressive episode; broad bipolar disorder; number of anxiety disorders; and survey.

Transition 2 – Included all controls specified for Transition 1 as well as age tertile of commencing alcohol use[c].

Transition 3 – Included all controls specified for Transition 2 as well as drug abuse.

Transition 4 and 5 – Included all controls specified for Transition 2 as well as speed to transition from use to disorder[d] and years with disorder.

[b] Percentage (/10) of +/–5-yr specific cohort who had used the substance by the prior person year.

[c] Individuals' age of commencing drug use is split into survey-specific tertiles among all those who ever used illicit drugs.

[d] Individuals' speed of transition from drug use to disorder is split into survey-specific tertiles.

[e] Individuals with a missing age of onset of remission were excluded from the model (N=147 for remission from abuse and N=104 for remission from dependence).

[f] N = The total unweighted number of respondents included in model conditioning on initial stage.