Research Paper

Trends in cannabis or cocaine-related dependence and alcohol/drug treatment in Argentina, Chile, and Uruguay

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ABSTRACT

Background: In the context of changing cannabis and other drug policy and regulation, concerns may arise regarding drug treatment access and use. We assessed cannabis/cocaine-related dependence and treatment in Argentina, Chile, and Uruguay.

Methods: Nationally representative cross-sectional household surveys of people ages 15-64 in Argentina (4 surveys, 2006-2017), Chile (7 surveys, 2006-2018), and Uruguay (4 surveys, 2006-2018) were harmonized. We estimated weighted prevalences of cannabis or cocaine-related (cocaine or cocaine paste) dependence, based on meeting 3+ past-year ICD-10 dependence criteria. We estimated weighted prevalences of past-year alcohol/drug treatment use (Argentina, Chile) or use/seeking (Uruguay) among people with past-year cannabis/cocaine-related dependence. We tested model-based prevalence trends over time and described individual-level treatment correlates by country.

Results: Cannabis/cocaine dependence prevalence increased in the region starting in 2010-2011, driven by cannabis dependence. Adjusted cannabis dependence prevalence increased from 0.7% in 2010 to 1.5% in 2017 in Argentina (aPD=0.8, 95% CI= 0.3, 1.2), from 0.8% in 2010 to 2.8% in 2018 in Chile (aPD=2.0, 95% CI= 1.4, 2.6), and from 1.4% in 2011 to 2.4% in 2018 in Uruguay (aPD=0.9, 95% CI= 0.2, 1.6). Cocaine-related dependence increased in Uruguay, decreased in Argentina, and remained stable in Chile. Among people with past-year cannabis/cocaine dependence, average alcohol/drug treatment use prevalence was 15.3% in Argentina and 6.0% in Chile, while treatment use/seeking was 14.7% in Uruguay. Alcohol/drug treatment prevalence was lower among people with cannabis dependence than cocaine-related dependence. Treatment correlates included older ages in all countries and male sex in Argentina only.

Conclusion: Alcohol/drug treatment use among people with cannabis/cocaine-related dependence remained low, signaling an ongoing treatment gap in the context of growing cannabis dependence prevalence in the region. Additional resources may be needed to increase treatment access and uptake. Future studies should assess contributors of low treatment use, including perceived need, stigma, and service availability.

Introduction

Substance use disorders (SUDs) contribute to the global burden of disease (Degenhardt et al., 2016). Despite high rates of SUD-related morbidity and mortality, treatment access and use remains low globally (Borges et al., 2020; Degenhardt et al., 2017; Pan et al., 2020), including in Argentina, Chile, and Uruguay in the Southern Cone region of South America. In 2016-2018, between 1.4-2.3% of the general population in the Southern Cone met ICD-10 criteria for cannabis dependence, and 0.3-0.8% for cocaine-related dependence (Observatorio Chileno de

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Drogas & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA), 2017; Observatorio Uruguayo de Drogas & Junta Nacional de Drogas Uruguayo, 2020; Secretaria de Politicas Integrales Sobre Drogas de la Nacion Argentina (SEDRONAR), 2017a, 2017b). The age-adjusted incidence rate was 42.6 per 100,000 for cannabis use disorder and 18.7 per 100,000 for cocaine use disorder in the region in 2017 (Pan et al., 2020).

Cannabis use disorder and cocaine use disorder can lead to substantial impairments (Butler et al., 2017; Hasin, 2018). While many people may be able to use cannabis without severe adverse consequences, frequent cannabis use is associated with negative health outcomes, such as cannabis use disorder (Degenhardt & Hall, 2012), lower educational attainment (Fergusson et al., 2015; Hasin, 2018), worsening financial difficulties, and lower socioeconomic mobility (Cerdá et al., 2016). Cocaine use is associated with various negative health outcomes, including infectious diseases such as HIV and hepatitis C, mental health problems, and mortality, particularly among people with cocaine use disorder (Butler et al., 2017; Degenhardt & Hall, 2012; Degenhardt et al., 2011). Cocaine paste is a smokable intermediate product in the preparation of cocaine hydrochloride, and has become a public health concern among the socially and economically vulnerable in the Southern Cone (Pascale et al., 2014). Given the negative consequences associated with cannabis and cocaine use disorders, it is imperative to identify gaps in treatment to inform policy and lower the burden of disease in the region.

Cannabis, cocaine, and cocaine paste are among the top substances of concern among people who seek SUD treatment in the Southern Cone (SEDRONAR, 2017b). In Argentina, 36.9% of people who received treatment in 2017 met criteria for cocaine dependence and 36.8% met criteria for cannabis dependence (SEDRONAR, 2017b). In 2018, most substance use treatment admissions in Chile were cocaine-related (i.e., 36.4% cocaine paste, 21.7% cocaine hydrochloride) and 4.6% were for cannabis (SENDA & Ministerio de Salud (MINSAL),2019). Similar patterns were observed in Uruguay in 2016, with 51.6% of admissions involving cocaine paste or crack, 25.8% cocaine hydrochloride, and 7.3% cannabis (Junta Nacional de Drogas Uruguay & Observatorio Uruguayo de Drogas, 2019; Observatorio Uruguayo de Drogas & Junta Nacional de Drogas Uruguayo, 2017). In Uruguay, treatment seeking and use for cocaine has remained relatively stable around 24% since 2016 but the treatment seeking and use for smokable cocaine, including cocaine paste, increased from 55.5% in 2016 to 58.1% in 2018 (Junta Nacional de Drogas Uruguay & Observatorio Uruguayo de Drogas, 2019); cannabis treatment seeking and utilization was 7.3% in 2016 and 8.4% in 2018 (Junta Nacional de Drogas Uruguay & Observatorio Uruguayo de Drogas, 2019). Characterizing country-specific treatment patterns among people who may need treatment, such as people with cocaine or cannabis use disorder, could identify new or existing gaps in the region and inform clinical needs.

Available information suggests short-term changes in treatment use in the region, yet important gaps in knowledge remain, specifically how alcohol/drug treatment use trends have evolved in the longer term among people with cannabis or cocaine dependence. This is particularly important in the context of changing cannabis use policy, specifically cannabis legalization in Uruguay (Cerdá & Kilmer, 2017), as a better understanding of treatment trends can help identify systematic or growing gaps of care, substance-related treatment disparities, inform resource allocation and policy changes, and close treatment gaps in each of the countries as policies continue to evolve.

The purpose of this study was to assess trends in cannabis dependence and cocaine-related (i.e., cocaine and cocaine paste) dependence in Argentina, Chile, and Uruguay since 2006, as well as trends in alcohol/drug treatment among people with cannabis or cocaine-related dependence. Using harmonized repeated cross-sectional survey data, we estimated the prevalence of cannabis/cocaine-related dependence and alcohol/drug treatment, described trends over time within each country, and reported individual-level correlates of alcohol/drug treatment. We examined alcohol/drug treatment trends among people with cannabis,

cocaine, or cocaine paste dependence because they are key contributors to the health and drug-related social burdens in the region. By focusing on a broad treatment use measure that is not substance-specific, we are aiming to quantify changes in care engagement broadly among people with cannabis or cocaine-related dependence, who may be systematically marginalized and disengaged from services. Findings will provide insight into the treatment gap and identify gaps and opportunities in service engagement in the context of changing policy and growing healthcare needs.

Methods

Data source and sample

We used individual-level data from National Household Drug Surveys in Argentina, Chile, and Uruguay, which were nationally representative surveys of the urban population between 15 to 64 years of age. The three countries follow a three-stage random sample stratified by region. The primary sample were blocks, followed by a random sample of houses within each block, and then a random selection of individuals between 15-64 years of age per household using a Kish grid (Naciones Unidas Oficina contra la Droga y el Delito et al., 2008). The 30-45 minute surveys were administered in face-to-face interviews, with data collection and availability of measures differing by country. Overall response rates were 70-85% in Argentina (Observatorio Argentino de Drogas, 2021), 62-89% in Chile (Consejo Nacional para el Control de Estupefacientes & Ministerio del Interior Gobierno de Chile, 2007, 2009; Observatorio Chileno de Drogas & SENDA, 2017; Observatorio Chileno de Drogas & SENDA, 2011, 2013, 2015, 2019), and 27-72% in Uruguay (Observatorio Uruguayo de Drogas, 2021; Observatorio Uruguayo de Drogas & Junta Nacional de Drogas Uruguayo, 2016, 2020). The research protocol for the study was reviewed by the University of California Davis's and the Columbia University Mailman School of Public Health's Institutional Review Board and was considered not human subjects research as defined by Department of Health and Human Services.

Surveys administered between 2006-2018 in the region collected N=55,681 observations from Argentina (i.e., 2006, 2008, 2010, 2017), N=116,852 observations from Chile (i.e., 2006, 2008, 2010, 2012, 2014, 2016, 2018), and N=20,104 observations from Uruguay (i.e., 2006, 2011, 2014, 2018). Sample sizes reflect differences in population sizes in each country and number of years sampled. Surveys were representative of urban populations; Argentina included areas with 80,000+ inhabitants; Chile included all urban areas with 30,000+ inhabitants; and Uruguay included urban areas with 10,000+ inhabitants (Comisión Interamericana para el Control del Abuso de Drogas (CICAD) et al., 2019). Surveys captured ICD-10 drug dependence symptoms among people who used drugs, including cannabis, cocaine, and cocaine paste (COPOLAD II, 2019). We did not assess alcohol dependence because it was not measured consistently across surveys or countries. Alcohol/drug treatment estimates restricted to people ages 15-64 who met ICD-10 dependence criteria for cannabis or cocaine-related dependence in the past year and excluded people with missing education data (n=50 Chile, n=1 Argentina, n=0 Uruguay) because this was a covariate of interest (sex and age data were complete). Our final analytic sample of people with cannabis and/or cocaine-related dependence included 746 people in Argentina, 1637 in Chile, and 321 in Uruguay.

Measures

Cannabis dependence and/or cocaine-related dependence in the past year: Surveys included ICD-10 dependence questions for cannabis, cocaine, and cocaine paste. People who reported use of these substances in the past year were asked a 10-item questionnaire corresponding to the six ICD-10 drug dependence criteria (COPOLAD II, 2019). We created indicators of ICD dependence if respondents fulfilled three or more of the six ICD-10 criteria for cannabis dependence, cocaine dependence,

or cocaine paste dependence. An indicator of cannabis/cocaine-related dependence captured individuals who met dependence thresholds for either cannabis, cocaine, or cocaine paste dependence. Missing items counted as zero in the main analyses. We also created separate indicators by type of substance, including a cannabis dependence indicator, as well as a cocaine-related dependence indicator, which combined cocaine and/or cocaine paste dependence due to low cell counts.

Alcohol/drug treatment in the past year: In Chile and Argentina, individuals reported whether they received treatment for alcohol or drug use (i.e., treatment use) in the past year. In Uruguay, individuals reported whether they sought or received treatment for alcohol or drug use (i.e., treatment use/seeking) in the past year. Alcohol/drug treatment did not distinguish by type of substance treatment; see Supplemental Table 1 for original wording and the English translation.

Additional covariates: Age (15-24, 25-44, 45-64), sex (male, female), and education (primary or less, at least some secondary, at least some tertiary/college/post-graduate). Past-year substance use (i.e., alcohol, tobacco, cannabis, cocaine, or cocaine paste) were included for descriptive purposes only. Region was based on the country-specific survey regions used as part of the sampling design and included as a categorical variable. Indicator variables for survey year corresponded with the year each survey was administered.

Analytic approach

Data from each country were harmonized and surveys were concatenated, adding a survey year based on when the data were collected. Survey weights were divided by the number of years in each country to make estimates nationally representative. All analyses were stratified by country, controlled for region using fixed effects, and included person weights to derive national estimates.

We first calculated unadjusted prevalence of ICD-10 cannabis and/or cocaine-related dependence over time and described sample characteristics of participants with past-year dependence, both overall and by type of dependence. We fit a weighted generalized linear model with a Poisson distribution and log link to derive yearly model-based dependence prevalences that adjusted for individual characteristics (age, sex, education) and region. We used these prevalences to test for "knots" in time trends using the Joinpoint Regression Program Version 4.9.0.1 (Kim et al., 2000; National Cancer Institute, 2022). We used linear combinations of model-based marginal dependence probabilities to estimate adjusted prevalence differences overall and before/after inflection points.

Among people with cannabis and/or cocaine-related dependence, we estimated yearly person-weighted prevalences of alcohol/drug treatment use (Argentina, Chile) and alcohol/drug treatment use/seeking (Uruguay). We repeated joinpoint procedures to identify knots and used linear combinations to calculate model-based prevalence differences over time. We fit a weighted generalized linear model with a Poisson distribution and log link to estimate relative risk of treatment over time, adjusting for individual-level covariates and country region, and described individual level correlates of treatment among people with cannabis and/or cocaine-related dependence.

As sensitivity analyses, we re-ran our models with three additional continuous variables of ICD-10 dependence criteria counts as a marker of severity (i.e., a higher number of criteria met indicated greater severity). This allowed us to assess whether sociodemographic differences remained after controlling for severity indicators. We then examined the impact of missing ICD dependence items on our findings by including anyone who may have been excluded due to missingness. To this end, we created additional cannabis/cocaine-related dependence variables where missing items were counted as a positive response. We then generated a new variable to categorize individuals by whether they met dependence criteria from the imputed dependence items that had missingness considered as "yes". This allowed us to include the maximum number of people who may have met the criteria threshold for cannabis

or cocaine-related dependence. We re-ran models with the alternative drug dependence variable to determine whether our findings were sensitive to the missing data patterns, calculating the effect of the worst scenario of potential misclassification.

Results

Table 1 describes the characteristics of people with past-year ICD-10 cannabis and/or cocaine-related dependence in Argentina, Chile, and Uruguay, both overall and by type of dependence. Across countries, people with cannabis/cocaine-related dependence were predominantly men with at least some secondary education. Most of our sample met ICD-10 criteria for cannabis dependence (77.3% in Argentina, 84.3% in Chile, and 82.2% in Uruguay). Among people with either cannabis or cocaine-related dependence, co-occurring cannabis and cocaine-related dependence prevalence was 23.7% in Argentina, 10.3% in Chile, and 13.7% in Uruguay.

Trends in cannabis dependence and cocaine-related dependence

Fig. 1a describes cannabis/cocaine-related dependence prevalence over time in each country's surveyed population, with shaded 95% confidence intervals, unadjusted for individual covariates. Prevalences ranged between 0.9-2.4% in Argentina, 1.1-3.1% in Chile, and 1.3-2.9% in Uruguay. Dependence appeared to increase in Uruguay overall, but in Argentina and Chile, dependence appeared to decrease between 2006-2010, followed by steady increases until 2017-2018. Cannabis dependence prevalence (Fig. 1b) was substantially higher than cocaine-related dependence prevalence (Fig. 1c) in all three countries. Joinpoint analyses indicated a change in adjusted cannabis/cocaine-related dependence trends in 2010 for Chile only; there were no detected changes in any trends in Argentina or Uruguay over the period (Supplemental Figs. 1-3). Substance-specific analyses indicated that changes in Chile were driven by cannabis dependence, not cocaine-related dependence (Supplemental Fig. 2).

Table 2 reports the cannabis/cocaine-related dependence prevalences and differences over time by country, both overall and separately by type of dependence, adjusting for age, sex, and education. To avoid positivity violations, we collapsed the age categories in Uruguay to be binary (i.e., 15-24, 25 and older). Adjusted prevalence differences by countries before and after 2010-2011 accounted for the joinpoint-identified knot in Chile. All three countries had an increase in cannabis/cocaine-related dependence from 2010-2011 to 2017-2018 that were driven by increases in cannabis dependence. Adjusted cannabis dependence prevalence increased from 0.7% in 2010 to 1.5% in 2017 in Argentina (adjusted prevalence difference [aPD]= 0.8, 95% confidence interval [CI]= 0.3, 1.2), from 0.8% in 2010 to 2.8% in 2018 in Chile (aPD= 2.0, 95% CI= 1.4, 2.6), and from 1.4% in 2011 to 2.4% in 2018 in Uruguay (aPD=0.9, 95% CI= 0.2, 1.6). Chile and Uruguay also had overall increases in cannabis dependence from 2006 to 2018, but Argentina did not, due to decreases in cannabis dependence prevalence between 2006-2010 (aPD=-0.6, 95% CI= -0.9, -0.3). Cocaine-related dependence also decreased in Argentina from 1.1% in 2006 to 0.6% in 2017 (aPD= -0.5, 95% CI= -0.8, -0.2) and remained stable at 0.5-0.6% in Chile. In contrast, Uruguay was the only country with increases in cocaine-related dependence over time, from 0.4% in 2006 to 1.1% in 2018 (aPD=0.7, 95% CI=0.3, 1.1).

Trends in alcohol/drug treatment among people with cannabis/cocaine-related dependence

Across years, only a small minority of people with cannabis/cocaine-related dependence reported alcohol/drug treatment. On average, alcohol/drug treatment prevalence among people with a past-year ICD-10 cannabis/cocaine-related dependence was 15.3% in Argentina, 6.0% in Chile, and 14.7% in Uruguay (Table 1). Fig. 2a reports unadjusted alco-

Table 1

Characteristics of people with past-year cannabis/cocaine-related dependence in Argentina, Chile, and Uruguay.

Characteristic	Argentina n (col. %)			Chile n (col. %)			Uruguay n (col. %)		
	Cannabis/cocaine-related n=746	Cannabis n=599	Cocaine-related n=338	Cannabis/cocaine-related n=1,637	Cannabis n=1,351	Cocaine-related n=471	Cannabis/cocaine-related n=321	Cannabis n=265	Cocaine-related n=99
Sex									
Male	512 (73.1)	406 (71.4)	236 (75.7)	1216 (77.9)	992 (79.1)	371 (75.8)	225 (74.22)	184 (73.6)	74 (78.1)
Female	234 (26.9)	193 (28.6)	102 (24.3)	421 (22.1)	359 (20.9)	100 (24.2)	96 (25.8)	81 (26.4)	25 (21.9)
Age categories									
15-24 years old	314 (41.4)	264 (43.7)	132 (39.6)	744 (50.0)	668 (55.8)	117 (24.9)	180 (59.4)	159 (63.2)	45 (48.4)
25-44 years old	330 (47.6)	253 (45.7)	153 (47.6)	743 (41.1)	555 (36.5)	289 (61.5)	128 (38.1)	97 (34.8)	50 (48.9)
45-64 years old	102 (11.0)	82 (10.7)	53 (12.9)	150 (8.9)	108 (7.8)	65 (13.6)	13 (2.5)	9 (2.0)	4 (2.7)
Education									
Primary or less	229 (32.4)	180 (30.9)	121 (39.2)	258 (12.3)	184 (9.3)	119 (24.1)	142 (48.0)	118 (48.3)	37 (43.2)
At least some secondary	380 (49.5)	299 (48.3)	177 (52.4)	895 (53.1)	733 (53.1)	278 (59.2)	117 (33.4)	93 (32.0)	46 (41.9)
At least some tertiary	137 (18.1)	120 (20.8)	40 (8.4)	484 (34.7)	434 (37.6)	74 (16.7)	62 (18.6)	54 (19.7)	16 (14.9)
Substance use, past year									
Alcohol	699 (93.2)	564 (94.4)	313 (91.1)	1,536 (93.1)	1,267 (92.7)	452 (96.7)	305 (94.1)	251 (93.6)	97 (97.8)
Tobacco	601 (78.4)	480 (77.4)	288 (82.9)	1,340 (82.4)	1,084 (81.1)	424 (90.0)	250 (77.5)	205 (76.9)	82 (84.3)
Cannabis	683 (88.2)	599 (100.0)	275 (74.6)	1,465 (91.5)	1348 (99.9)	302 (67.7)	298 (94.0)	265 (100.0)	76 (81.1)
Cocaine	419 (57.3)	280 (46.1)	323 (95.6)	408 (25.9)	259 (18.6)	270 (66.0)	136 (42.9)	86 (32.3)	88 (89.8)
Cocaine paste	71 (10.5)	53 (10.1)	61 (20.6)	362 (17.4)	188 (11.1)	308 (56.4)	40 (11.7)	22 (7.9)	34 (32.6)
Past-year ICD-10 drug dependence									
Cannabis dependence	599 (77.3)	599 (100.0)	191 (51.0)	1,351 (84.3)	1,351 (100.0)	185 (39.7)	265 (82.2)	265 (100.0)	43 (43.5)
Cocaine-related dependence	338 (46.3)	191 (30.6)	338 (100.0)	471 (26.0)	185 (12.3)	471 (100.0)	99 (31.6)	43 (16.7)	99 (100.0)
Cocaine dependence	320 (44.1)	184 (29.2)	320 (95.1)	238 (15.4)	98 (7.4)	238 (59.3)	84 (27.5)	36 (14.2)	84 (87.0)
Cocaine paste dependence	49 (7.6)	34 (7.3)	49 (16.4)	288 (13.6)	125 (7.1)	288 (52.4)	26 (7.1)	11 (3.8)	26 (22.6)
Alcohol/drug treatment									
Any in the past year	116 (15.3)	79 (12.2)	76 (22.6)	131 (6.0)	73 (3.5)	91 (16.5)	54 (14.7)	33 (10.5)	33 (28.5)
Survey year									
2006	304 (36.6)	248 (38.1)	153 (41.0)	225 (11.9)	179 (11.1)	84 (16.4)	76 (14.5)	68 (15.7)	21 (13.6)
2008	106 (18.1)	80 (16.6)	55 (22.1)	230 (13.2)	184 (12.7)	77 (17.8)	–	–	–
2010	107 (13.7)	85 (12.6)	46 (14.7)	108 (6.5)	79 (6.3)	43 (8.5)	–	–	–
2011	–	–	–	–	–	–	69 (22.1)	50 (20.0)	29 (27.8)
2012	–	–	–	183 (11.4)	147 (11.2)	57 (14.7)	–	–	–
2014	–	–	–	248 (13.9)	205 (14.1)	78 (14.8)	63 (23.4)	55 (25.6)	15 (16.4)
2016	–	–	–	280 (18.8)	244 (19.2)	51 (13.1)	–	–	–
2017	229 (31.7)	186 (32.7)	84 (22.2)	–	–	–	–	–	–
2018	–	–	–	363 (24.3)	313 (25.5)	81 (14.9)	113 (39.9)	92 (38.7)	34 (42.2)

Note: col. %= weighted column percentages. Sample included people who met 3+ ICD-10 symptoms for cannabis, cocaine, or cocaine paste dependence. "Cocaine-related dependence" combined cocaine and cocaine paste measures. Substance-related treatment indicated any past-year treatment use (Argentina, Chile) or use/seeking (Uruguay). Sample sizes are unweighted, and percentages are survey weighted.
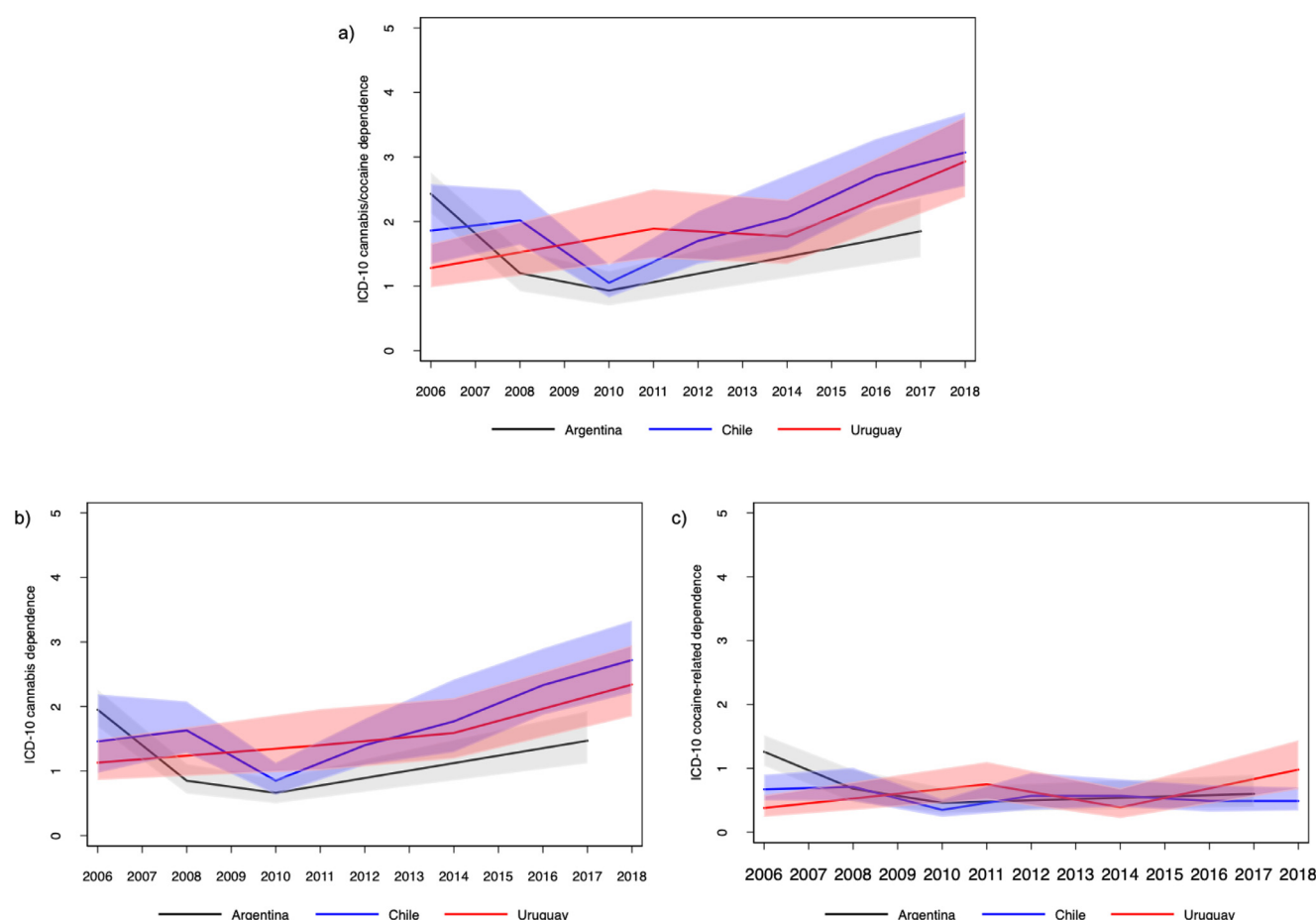
Fig. 1. Prevalence of past-year ICD-10 (a) cannabis/cocaine-related dependence, (b) cannabis dependence, or (c) cocaine-related dependence among people ages 15-64 in Argentina, Chile, and Uruguay.

Note: Prevalence estimates and shaded 95% confidence intervals are survey-weighted and use linear interpolation between survey years.

Table 2

Model-based adjusted trends in cannabis/cocaine-related dependence prevalence in Argentina, Chile, and Uruguay.

Country	Dependence Prevalence (95% CI)			Prevalence Difference (95% CI)		
Argentina	*2006*	*2010*	*2017*	*2017-2006*	*2010-2006*	*2017-2010*
Cannabis/cocaine-related	2.32 (2.00, 2.64)	0.98 (0.71, 1.26)	1.85 (1.40, 2.30)	-0.47 (-1.01, 0.08)	**-1.33 (-1.77, -0.90)**	**0.86 (0.34, 1.39)**
Cannabis	1.92 (1.63, 2.22)	0.70 (0.50, 0.90)	1.46 (1.06, 1.85)	-0.47 (-0.95, 0.01)	**-1.23 (-1.59, -0.87)**	**0.76 (0.32, 1.20)**
Cocaine-related	1.11 (0.89, 1.33)	0.50 (0.29, 0.70)	0.62 (0.38, 0.87)	**-0.49 (-0.82, -0.16)**	**-0.61 (-0.93, -0.30)**	0.13 (-0.19, 0.45)
Chile	*2006*	*2010*	*2018*	*2018-2006*	*2010-2006*	*2018-2010*
Cannabis/cocaine-related	1.68 (1.12, 2.23)	1.05 (0.79, 1.31)	3.22 (2.68, 3.79)	**1.54 (0.71, 2.37)**	**-0.62, (-1.24, -0.01)**	**2.16 (2.53, 2.79)**
Cannabis	1.36 (0.81, 1.92)	0.84 (0.60, 1.09)	2.83 (2.26, 3.39)	**1.46 (0.64, 2.28)**	-0.52 (-1.12, 0.08)	**1.98 (1.37, 2.60)**
Cocaine-related	0.53 (0.38, 0.68)	0.37 (0.23, 0.51)	0.55 (0.36, 0.75)	0.02 (-0.23, 0.28)	-0.16 (-0.37, 0.05)	0.18 (-0.06, 0.42)
Uruguay	*2006*	*2011*	*2018*	*2018-2006*	*2011-2006*	*2018-2011*
Cannabis/cocaine-related	1.26 (0.96, 1.56)	1.95 (1.40, 2.50)	2.97 (2.32, 3.60)	**1.71 (1.00, 2.42)**	**0.69 (0.09, 1.29)**	**1.02 (0.19, 1.85)**
Cannabis	1.11 (0.83, 1.39)	1.44 (0.95, 1.92)	2.35 (1.80, 2.90)	**1.24 (0.61, 1.87)**	0.32 (-0.21, 0.86)	**0.91 (0.18, 1.64)**
Cocaine-related	0.36 (0.21, 0.51)	0.74 (0.44, 1.05)	1.07 (0.67, 1.47)	**0.71 (0.28, 1.13)**	**0.38 (0.06, 0.71)**	0.32 (-0.16, 0.81)

Notes: Predicted probabilities derived from weighted regressions stratified by country, controlling for sex, age, education, region, and year. Age was categorical in Argentina and Chile (15-24, 25-44, 45-64) and binary in Uruguay (15-24, 25+) to avoid positivity violations in Uruguay. Cannabis/cocaine-related dependence included people who met 3 or more ICD-10 dependence criteria in the past year for cannabis, cocaine, or cocaine paste dependence. Bold indicates p-value<0.05.

hol/drug treatment prevalence by year among people meeting past-year ICD-10 cannabis/cocaine-related dependence criteria, with shaded 95% confidence intervals for each country, as well as stratified by cannabis dependence (Fig. 2b) and cocaine-related dependence (Fig. 2c). Alcohol/drug treatment prevalence among people with cannabis dependence was generally lower than among people with cocaine-related dependence. Sub-analyses by type of dependence had large confidence intervals due to small sample sizes within country-year. Joinpoint analyses indicated no inflections in alcohol/drug treatment trends in Argentina, Chile, or Uruguay; alcohol/drug treatment among people with cannabis/cocaine-related dependence remained low over the entire study period (Supplemental Fig. 4).
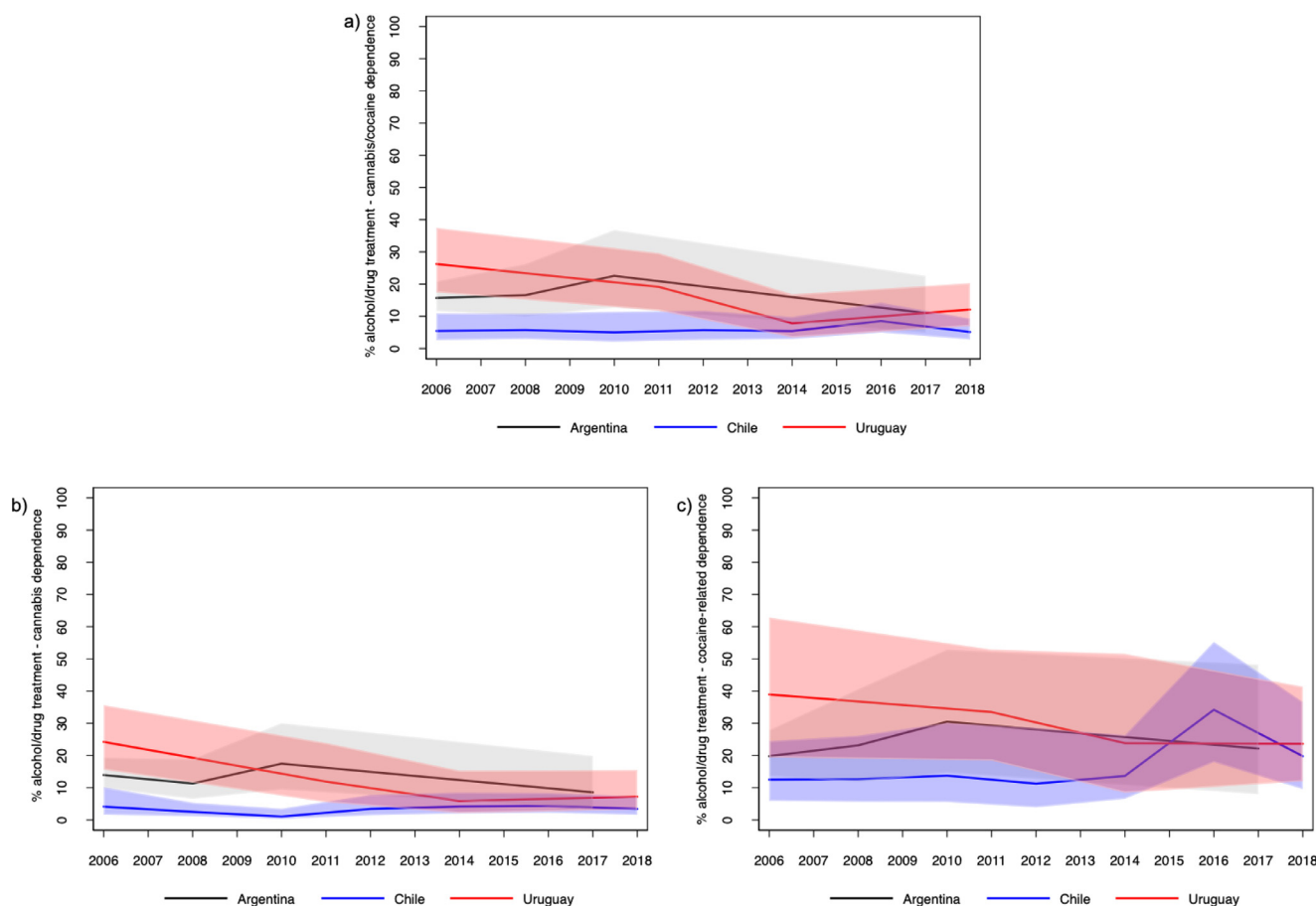
Fig. 2. Prevalence of past-year alcohol/drug treatment among people with ICD-10 (a) cannabis/cocaine-related dependence, (b) cannabis dependence, or (c) cocaine-related dependence in Argentina, Chile, and Uruguay.
Note: Prevalence estimates and shaded 95% confidence intervals are survey-weighted and use linear interpolation between survey years. Prevalences reflect alcohol/drug treatment use in Argentina and Chile, and alcohol/drug treatment use/seeking in Uruguay.

Table 3 reports the model-based alcohol/drug treatment prevalence by country adjusted for covariates, as well as the adjusted change in prevalences over time overall and by dependence type. Adjusted prevalence difference estimates had wide confidence intervals that crossed the null, indicating no statistical difference in alcohol/drug treatment over time. For example, in Argentina, adjusted increases in alcohol/drug treatment use among people with cannabis/cocaine-related dependence in 2006-2010 (i.e., from 16.9% to 21.6%) were offset by decreases in treatment use by 2017 (i.e., 11.5%) (adjusted prevalence difference [aPD] from 2006 to 2017= -5.5, 95% CI= -15.2, 4.3). Adjusted alcohol/drug treatment prevalence among people with cannabis/cocaine-related dependence in Chile remained low at around 5.0-6.0% throughout the study period. Adjusted alcohol/drug treatment use/seeking among people with cannabis/cocaine-related dependence in Uruguay was 31.7% in 2006 and 19.8% in 2018 (aPD= -11.9, 95% CI= -28.5, 4.7). Changes in prevalence accounting for demographics were not significantly different from zero, indicating that alcohol/drug treatment among people with cannabis/cocaine-related dependence remained low in the region between 2006-2018.

While there no overall changes over time in Chile, alcohol/drug treatment use among people with cannabis dependence increased from 0.9% in 2010 to 3.6% in 2018 (aPD=2.8, 95% CI=0.2, 5.3). This contrasted decreases in alcohol/drug treatment use of similar magnitude between 2006-2010 in Chile, as well as decreasing alcohol/drug treatment trends in Argentina and Uruguay over time among people with cannabis dependence. Wide confidence intervals for alcohol/drug treat-

ment among people with cocaine-related dependence hindered our ability to detect changes over time.

Table 4 presents individual-level correlates of alcohol/drug treatment by country and dependence type. Among people with cannabis/cocaine-related dependence, older age was associated with past-year alcohol/drug treatment across countries. For example, in Chile, people ages 45-64 were twice as likely to report alcohol/drug treatment than ages 15-24 (aRR=2.4, 95% CI=1.3, 4.3). In contrast, sex and education were inconsistently associated with alcohol/drug treatment. For example, the sex disparity in Argentina was not observed in other countries. Specifically, female participants in Argentina with cannabis/cocaine-related dependence had a 54% lower likelihood of treatment use than male participants (95% CI= 0.3, 0.8) after accounting for other characteristics. Individual correlates of alcohol/drug treatment stratified by cannabis dependence or cocaine-related dependence were consistent with overall estimates except for age, which was not significantly associated with alcohol/drug treatment among people with cannabis dependence (Table 4).

Sensitivity analyses

Sociodemographic differences in alcohol/drug treatment use remained in Argentina after controlling for ICD-10 cannabis, cocaine, or cocaine paste dependence symptom counts (Supplemental Table 2). In Chile, controlling for severity substantially attenuated both age and education associations, and in Uruguay, education differences were also

Table 3
Model-based adjusted trends in alcohol/drug treatment prevalence among people with past-year cannabis/cocaine-related dependence in Argentina, Chile, and Uruguay.

Country	Alcohol/drug Treatment Prevalence (95% CI)			Prevalence Difference (95% CI)		
Argentina	*2006*	*2010*	*2017*	*2017-2006*	*2010-2006*	*2017-2010*
Cannabis/cocaine	16.92 (11.49, 22.35)	21.56 (9.19, 33.93)	11.45 (3.47, 19.43)	-5.47 (-15.22, 4.28)	4.64 (-9.13, 18.41)	-10.11 (-24.66, 4.43)
Cannabis	16.49 (10.82, 22.17)	15.75 (6.53, 24.98)	7.98 (1.21, 14.76)	-8.51 (-17.49, 0.47)	-0.74 (-11.20, 9.72)	-7.77 (-18.52, 2.99)
Cocaine-related	22.55 (14.11, 30.98)	29.32 (8.58, 50.06)	23.04 (4.75, 41.33)	0.49 (-19.54, 20.52)	6.78 (-16.26, 29.81)	-6.28 (-34.58, 22.01)
Chile	*2006*	*2010*	*2018*	*2018-2006*	*2010-2006*	*2018-2010*
Cannabis/cocaine	5.01 (1.03, 9.00)	4.82 (0.52, 9.11)	5.54 (2.34, 8.74)	0.52 (-4.29, 5.33)	-0.20 (-5.64, 5.24)	0.72 (-4.44, 5.87)
Cannabis	3.71 (-0.13, 7.56)	0.86 (-0.25, 1.98)	3.62 (1.30, 5.95)	-0.09 (-4.53, 4.35)	-2.85 (-6.74, 1.04)	**2.76 (0.24, 5.29)**
Cocaine-related	9.74 (0.96, 18.53)	11.34 (0.64, 22.05)	15.10 (4.79, 25.42)	5.36 (-7.06, 17.78)	1.60 (-11.04, 14.25)	3.76 (-10.02, 17.54)
Uruguay	*2006*	*2011*	*2018*	*2018-2006*	*2011-2006*	*2018-2011*
Cannabis/cocaine	31.71 (15.23, 48.19)	19.99 (9.78, 30.21)	19.81 (6.68, 32.94)	-11.90 (-28.53, 4.74)	-11.72 (-29.02, 5.59)	-0.18 (-15.54, 15.18)
Cannabis	26.18 (9.34, 43.02)	11.72 (2.55, 20.90)	10.51 (-0.39, 21.41)	**-15.67 (-31.19, -0.15)**	-14.46 (-31.08, 2.17)	-1.21 (-13.66, 11.23)
Cocaine	37.97 (8.48, 67.45)	30.54 (11.76, 49.32)	30.98 (10.53, 51.42)	-6.99 (-40.14, 26.16)	-7.43 (-38.74, 23.88)	0.44 (-25.46, 26.33)

Notes: Predicted probabilities derived from weighted regressions stratified by country, controlling for sex, age, education, region, and year. Age was categorical in Argentina and Chile (15-24, 25-44, 45-64) and binary in Uruguay (15-24, 25+) to avoid positivity violations in Uruguay. Sample included people who met 3 or more ICD-10 dependence criteria in the past year for cannabis/cocaine-related dependence (Argentina N=746; Chile; N=1,637; Uruguay N=321), cannabis dependence (Argentina N=599; Chile N=1,351; Uruguay N=265) or for cocaine-related dependence (Argentina N=338; Chile N=471; Uruguay N=99). *Treatment prevalence* captured substance-related treatment use (Argentina, Chile) or use/seeking (Uruguay) in the past year. Bold indicates p-value<0.05.

Table 4
Sociodemographic correlates of alcohol/drug treatment among people with past-year cannabis/cocaine-related dependence in Argentina, Chile, and Uruguay.

Individual Correlates	Treatment use in Argentina		Treatment use in Chile		Treatment use/seeking in Uruguay	
	RR (95% CI)	aRR (95% CI)	RR (95% CI)	aRR (95% CI)	RR (95% CI)	aRR (95% CI)
Cannabis or cocaine-related dependence						
Sex						
Male	Reference	Reference	Reference	Reference	Reference	Reference
Female	**0.48 (0.29, 0.80)**	**0.46 (0.28, 0.75)**	1.16 (0.65, 2.07)	1.08 (0.65, 1.79)	1.00 (0.54, 1.86)	1.13 (0.59, 2.17)
Age						
15-24	Reference	Reference	Reference	Reference	Reference	Reference
25-44	1.46 (0.80, 2.65)	1.40 (0.76, 2.59)	**1.95 (1.14, 3.31)**	**1.81 (1.06, 3.09)**	–	–
45-64	**2.13 (1.16, 3.91)**	**2.35 (1.28, 4.29)**	1.76 (0.73, 4.26)	1.35 (0.62, 2.90)	–	–
25+	–	–	–	–	**1.79 (1.04, 3.10)**	**1.84 (1.08, 3.14)**
Education						
Primary or less	Reference	Reference	Reference	Reference	Reference	Reference
Some secondary	1.14 (0.67, 1.96)	1.21 (0.71, 2.06)	**0.43 (0.24, 0.79)**	**0.47 (0.26, 0.83)**	**2.56 (1.17, 5.62)**	**2.46 (1.15, 5.27)**
Some tertiary	1.00 (0.47, 2.11)	1.05 (0.50, 2.19)	**0.21 (0.09, 0.49)**	**0.23 (0.10, 0.51)**	1.08 (0.35, 3.26)	0.94 (0.30, 2.94)
Cannabis dependence						
Sex						
Male	Reference	Reference	Reference	Reference	Reference	Reference
Female	**0.47 (0.25, 0.87)**	**0.41 (0.22, 0.78)**	0.85 (0.39, 1.84)	0.81 (0.38, 1.73)	0.93 (0.38, 2.27)	1.03 (0.41, 2.56)
Age						
15-24	Reference	Reference	Reference	Reference	Reference	Reference
25-44	0.96 (0.48, 1.94)	0.89 (0.44, 1.82)	1.18 (0.58, 2.40)	1.17 (0.58, 2.36)	–	–
45-64	1.68 (0.86, 3.27)	1.72 (0.88, 3.39)	1.17 (0.38, 3.63)	1.04 (0.36, 3.06)	–	–
25+	–	–	–	–	1.42 (0.67, 2.98)	1.46 (0.74, 2.87)
Education						
Primary or less	Reference	Reference	Reference	Reference	Reference	Reference
Some secondary	1.70 (0.96, 3.02)	1.79 (1.00, 3.20)	0.48 (0.22, 1.06)	0.47 (0.21, 1.07)	2.11 (0.75, 5.92)	1.98 (0.71, 5.56)
Some tertiary	1.59 (0.71, 3.56)	1.79 (0.79, 4.05)	**0.21 (0.07, 0.65)**	**0.21 (0.07, 0.63)**	0.89 (0.20, 3.96)	0.79 (0.17, 3.49)
Cocaine-related dependence						
Sex						
Male	Reference	Reference	Reference	Reference	Reference	Reference
Female	**0.51 (0.28, 0.95)**	**0.41 (0.22, 0.79)**	1.05 (0.53, 2.07)	1.08 (0.59, 1.99)	0.96 (0.46, 2.01)	1.05 (0.51, 2.18)
Age						
15-24	Reference	Reference	Reference	Reference	Reference	Reference
25-44	1.75 (0.81, 3.79)	1.61 (0.74, 3.50)	1.42 (0.69, 2.91)	1.32 (0.64, 2.71)	–	–
45-64	2.21 (0.96, 5.13)	**2.39 (1.03, 5.58)**	1.20 (0.46, 3.17)	0.94 (0.37, 2.38)	–	–
25+	–	–	–	–	1.60 (0.83, 3.10)	1.67 (0.86, 3.23)
Education						
Primary or less	Reference	Reference	Reference	Reference	Reference	Reference
Some secondary	1.11 (0.60, 2.05)	1.18 (0.64, 2.17)	0.68 (0.38, 1.22)	0.67 (0.37, 1.20)	2.22 (0.87, 5.66)	2.30 (0.97, 5.46)
Some tertiary	1.49 (0.70, 3.19)	1.74 (0.80, 3.81)	0.46 (0.18, 1.18)	0.45 (0.17, 1.18)	1.11 (0.27, 4.47)	1.13 (0.27, 4.77)

Note: Sample included people who met 3+ ICD-10 symptoms for cannabis/cocaine-related dependence (Argentina N=746; Chile; N=1,637; Uruguay N=321), cannabis dependence (Argentina N=599; Chile N=1,351; Uruguay N=265) or for cocaine-related dependence (Argentina N=338; Chile N=471; Uruguay N=99). All survey-weighted models were stratified by country and controlled for region and survey year. Bold indicates p-value<0.05.

attenuated. In analyses including individuals who had three or more dependence criteria after imputing missing items as positive, sociodemographic correlates of alcohol/drug treatment were generally consistent with our main analyses (See Supplemental Table 3). Changes over time were consistent with the main analyses, with additional indications of reductions in alcohol/drug treatment use among people with cannabis/cocaine-related dependence in Argentina between 2006-2017 (aPD= -8.7, 95% CI= -15.9, -1.4) (See Supplemental Table 4).

Discussion

In this study, we estimated trends in cannabis/cocaine-related dependence prevalence among people ages 15-65 in Argentina, Chile, and Uruguay, and prevalence of alcohol/drug treatment among those with cannabis/cocaine-related dependence over time. We observed significant population-level prevalence increases in cannabis dependence between 2010-2011 and 2017-2018 in all three countries, and overall increases compared to 2006 in Chile and Uruguay. Increases in cocaine-related dependence in Uruguay between 2006-2018 contrasted with decreases in Argentina between 2006-2017. Most people meeting cannabis and/or cocaine-related dependence criteria did not report any past-year alcohol/drug treatment; treatment was particularly low among people with cannabis dependence. As our outcome included any alcohol/drug treatment, the treatment gap for cannabis or cocaine dependence specifically is likely larger in Argentina, Chile, and Uruguay.

Our findings are in line with reported increases in incident cocaine or cannabis use disorder in the region between 1990-2017 (Pan et al., 2020), signaling a growing need for cannabis or cocaine-related treatment. When disaggregating by substance, trends differed for cannabis and cocaine. Increases in cannabis/cocaine-related dependence prevalence in Chile were driven by cannabis dependence, while cocaine-related dependence estimates were stable over time. Both cannabis dependence and cocaine-related dependence increased in Uruguay in 2006-2018, but decreased in Argentina 2006-2010, followed by increases in cannabis dependence only. Our treatment outcome measure was not substance-specific, which allowed us to estimate prevalence of contact with the treatment system more broadly. People with cannabis dependence may have different clinical needs than people with cocaine-related dependence, which in turn may differ from needs among people with other types of alcohol or drug dependence. Our findings indicate that additional supports may be needed to identify and engage people in appropriate services when clinically indicated.

Despite observed increases in cannabis/cocaine-related dependence, especially after 2010, alcohol/drug treatment was low in these community-based cross-sectional surveys. Adjusted estimates of alcohol/drug treatment use/seeking in Uruguay were higher than those of treatment use in Chile and Argentina, as the former captured both alcohol/drug treatment seeking and use. Findings support calls for additional efforts to facilitate drug treatment uptake (Cia et al., 2018). Low treatment could be due to low perceived treatment need, which is positively associated with treatment seeking (Mojtabai et al., 2002), stigma (Dannatt et al., 2021; Yang et al., 2017), and other structural barriers, such as scarce service availability or high costs. Addressing both attitudinal (e.g., perceived need, problem recognition) and structural (e.g., available services) barriers is needed to increase treatment coverage in the region (Degenhardt et al., 2017).

While our study assessed country-specific trends in alcohol/drug treatment among people with cannabis/cocaine-related dependence at the individual level, service availability and access are structural level drivers of treatment use. There are currently no pharmacological treatments for cocaine or cannabis use disorder. Certain evidence-based therapeutic approaches, like cognitive behavioral therapy and motivational interviewing, have a substantial evidence base to treat either cannabis or cocaine dependence (Calomarde-Gómez et al., 2021; Kampman, 2019; Magill & Ray, 2009). Other therapeutic approaches, like contingency management (Bentzley et al., 2021; Brezing & Levin, 2018; Gates et al.,

2016), may be particularly effective to treat stimulant dependence including cocaine or cocaine paste. In the Southern Cone, self-help groups are commonly reported and freely available (Junta Nacional de Drogas Uruguayo et al., 2016; SEDRONAR, 2017b). Treatment settings in the region include specialty treatment centers, hospitals, outpatient or residential programs, or therapeutic communities. All three counties reported government funding as the most significant financing mechanism for drug treatment in the WHO ATLAS survey on substance use-related resources; while Argentina reported funding data for rehabilitation services only, Chile and Uruguay reported government funding for outpatient/inpatient treatment, rehabilitation, and detoxification (World Health Organization, 2022). In Chile, the public system treats about 70% of people with substance-related problems (SENDA & MINSAL, 2019). In Uruguay, a third of treatment locations in 2017 were public providers and half were private non-profit organizations (Junta Nacional de Drogas Uruguayo et al., 2016). However, reporting any treatment use does not mean that the services are adequate. For example, while 37% of adults with substance use disorders in Argentina in 2015 perceived a need for treatment, only 4.2% received minimally adequate treatment, based on number of visits (i.e., 4+ visits with a medically trained professional or 6+ visits with non-medically trained professionals) (Degenhardt et al., 2017). In the context of an ongoing treatment gap in the region, it is likely that the gap in receiving minimally adequate treatment is even larger. Future studies should examine within- and between-country structural drivers of treatment use availability, accessibility, acceptability, and adequacy across rural and urban regions, in line with international standards for drug use disorder treatment (WHO & United Nations Office on Drugs and Crime (UNODC), 2020).

Individual-level characteristics associated with alcohol/drug treatment included age, education, and sex. Alcohol/drug treatment use was less likely in the youngest age groups of adolescents and young adults, consistent with past literature (Blanco et al., 2015; Cia et al., 2018). However, when restricting to people with cannabis dependence, age was no longer associated with alcohol/drug treatment. These findings were observed in the context of a growing number of adolescents reporting low perceived harm of cannabis, a weakening relationship between risk perceptions and cannabis use in the Southern cone (Schleimer et al., 2019), and strong period effects of cannabis use that were not explained by age or cohort in Chile and Argentina (Castillo-Carniglia et al., 2020). In sensitivity analyses, symptom severity explained age differences in Chile, but differences remained in Argentina or Uruguay, suggesting that additional supports may be needed to engage younger people or increase services tailored for youth, especially those who may need cocaine-related treatment. Findings of lower alcohol/drug treatment in Chile among people with higher education are consistent with findings from the US, where other indicators of low socioeconomic position have been associated with treatment (Blanco et al., 2015). While a recent study found lower mental health or substance use treatment among adults with lower education in Argentina (Cia et al., 2018), we did not find associations between education and alcohol/drug treatment after adjusting for other characteristics in our sample. The mixed association between education and alcohol/drug treatment use across countries merits further attention (Cia et al., 2018).

Associations between sex and alcohol/drug treatment differed by country (i.e., lower among females in Argentina but not in other countries), which was consistent with country-specific reports (Observatorio Uruguayo de Drogas & Junta Nacional de Drogas Uruguayo, 2016; SEDRONAR, 2017b). In a 2017 report from Argentina, men who used drugs in the past year were more likely than women to seek treatment related to cannabis (46.4% vs. 8.9%), cocaine (37.7% vs. 9.5%) or cocaine paste (17.6% vs. 3.7%) (SEDRONAR, 2017b). Our sensitivity analyses indicated that sex differences in Argentina were not explained by severity, which may indicate the need for sex-tailored programs. In a recent US-based study, while alcohol/drug treatment use was low overall among adults with substance use disorders, certain in-

tersecting gender and sexual minority subgroups (e.g., bisexual women) were more likely than their heterosexual counterparts to receive or perceive a need for treatment (Krasnova et al., 2021). Future studies should examine treatment use among gender and sexual minority individuals in the Southern Cone to ensure equitable access in the region.

With changing drug policy in the region, planners should monitor changes in dependence and treatment indicators to adequately allocate resources. Cannabis dependence increased in each country after 2010-2011, but only Chile had increases in alcohol/drug treatment among people with cannabis dependence. While beyond the scope of this study, these findings could indicate limited impacts of the policies in the short term. Future studies should estimate the effect of the cannabis policy change on cannabis-specific treatment in Uruguay, and contrast substance-specific treatment trends in the region in the longer term.

Methodological differences in country-level treatment measures and survey administration timing impeded cross-country comparisons. Specifically, Uruguay's treatment measure included both alcohol/drug treatment use and treatment seeking in the past year, which would overestimate the prevalence of treatment use if people who sought treatment did not receive it. We would expect this to be the case, based on a 2017 report from Argentina stating that approximately one third of people who sought cocaine or cannabis treatment did not receive services (SEDRONAR, 2017b). This could explain why model-based treatment use/seeking estimates in Uruguay appeared to be higher than model-based treatment use estimates in Argentina and Chile. Future studies should assess changes in treatment seeking, treatment receipt, or both using separate measures by substance to better characterize the treatment gap. Another difference is survey frequency discrepancies; surveys were conducted in different time intervals across countries, with only Chile having more than four surveys since 2006. Having few data years limited our ability to detect inflections in Argentina and Uruguay country-level prevalences using empirical methods. Nonetheless, we were able to use data from Chile to test whether neighboring countries had similar substantive changes in dependence prevalence over time before and after 2010, and observed dependence increases in all three counties after 2010.

While we found low alcohol/drug treatment prevalence since 2006, alcohol/drug treatment use and access is likely to decrease in the context of the ongoing COVID-19 pandemic, which has impacted treatment services globally (Radfar et al., 2021). The 2021 World Drug Report called to maintain improvements in treatment access and coverage (e.g., telemedicine) that emerged as a result of the global pandemic (UNODC, 2021). However, stigma towards SUDs could contribute to addiction services not being prioritized in the context of competing healthcare priorities (Dannatt et al., 2021). Research examining drug treatment access and use during and after the pandemic is needed (Blanco et al., 2021).

Study findings should be interpreted considering certain limitations. While surveys were conducted across countries over a similar overall timeframe, our study was limited by discrepant survey sampling and frequency, because each country directed its own survey efforts. We stratified analyses by country to avoid direct statistical country comparisons due to these methodological differences, and thus were unable to empirically compare country trends. We included person weights to derive nationally representative trends and controlled for characteristics that contributed to survey design, including age and country region. However, as our analyses could not control for different strata or clusters used in the design, the standard errors may be under-estimated. While we used multiple years of cross-sectional survey data across countries, our sample sizes were substantially smaller in the sample with cannabis/cocaine-related dependence, limiting our power to detect changes in alcohol/drug treatment trends over time. Smaller sample sizes in Uruguay specifically limited our ability to examine more nuanced age differences. General population surveys may underestimate substance use prevalence and related outcomes, especially for self-reported behaviors that are highly stigmatized and rare

(Midgette et al., 2021; Radhakrishnan, 2021; Reuter et al., 2021). This could have led to underestimated dependence or treatment prevalences in our study. While surveys were representative of urban populations (CICAD et al., 2019), we were not able to capture treatment needs in rural settings, where treatment gaps may be larger due to limited access to treatment services. Findings may not generalize to marginalized groups who are systematically excluded from surveys, including people in rural areas, correctional settings, or people who were unstably housed. While we estimated alcohol/drug treatment among people with cannabis/cocaine-related dependence, our outcome measure could not distinguish substance-specific treatment. We would therefore expect gaps in substance-specific treatment among people with cannabis dependence or cocaine-related dependence to be even larger. Future studies should aim to replicate these findings as more years of data become available and as surveys collect disaggregated measures of treatment use and seeking to estimate substance-specific treatment gaps.

In conclusion, cannabis/cocaine-related dependence prevalence increased since 2010 in Argentina and Chile and since 2006 in Uruguay, but alcohol/drug treatment among people with cannabis/cocaine-related dependence remained low in all three countries. Gaps were even more substantial for young people in the region, calling for interventions to engage this group in tailored services when clinically indicated. Findings raise concerns of continuing drug treatment declines in the context of the COVID-19 global pandemic. Multi-level interventions and resources may be needed to increase treatment availability, accessibility, and uptake in the region.

Ethics approval

The authors declare that they have obtained ethics approval from an appropriately constituted ethics committee/institutional review board where the research entailed animal or human participation.

The research protocol for this study was reviewed by the University of California Davis's and the Columbia University Mailman School of Public Health's Institutional Review Board and was considered not human subjects research as defined by Department of Health and Human Services.

Declarations of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Pia M. Mauro: Conceptualization, Methodology, Software, Formal analysis, Visualization, Writing – original draft, Supervision. **Sarah Gutkind:** Software, Formal analysis, Writing – original draft. **Ariadne Rivera-Aguirre:** Data curation, Software, Writing – review & editing. **Dahsan Gary:** Software, Formal analysis. **Magdalena Cerda:** Writing – review & editing, Funding acquisition. **Erica Chavez Santos:** Writing – original draft. **Alvaro Castillo-Carniglia:** Writing – review & editing. **Silvia S. Martins:** Writing – review & editing.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.drugpo.2022.103810.

References

Bentzley, B. S., Han, S. S., Neuner, S., Humphreys, K., Kampman, K. M., & Halpern, C. H. (2021). Comparison of treatments for cocaine use disorder among adults: A systematic review and meta-analysis. *JAMA Network Open, 4*(5), Article e218049 -e218049.

Blanco, C., Compton, W. M., & Volkow, N. D. (2021). Opportunities for research on the treatment of substance use disorders in the context of COVID-19. *JAMA Psychiatry, 78*(4), 357–358.

Blanco, C., Iza, M., Rodríguez-Fernández, J. M., Baca-García, E., Wang, S., & Olfson, M. (2015). Probability and predictors of treatment-seeking for substance use disorders in the US. *Drug and Alcohol Dependence, 149*, 136–144.

Borges, G., Aguilar-Gaxiola, S., Andrade, L., Benjet, C., Cia, A., Kessler, R. C., Orozco, R., Sampson, N., Stagnaro, JC, Torres, Y., Viana, M. C., & Medina-Mora, M. E. (2020). Twelve-month mental health service use in six countries of the Americas: A regional report from the World Mental Health Surveys. *Epidemiology and Psychiatric Sciences, 29*, e53 PMID: 31452485; PMCID: PMC8061239. 10.1017/S2045796019000477.

Brezing, C. A., & Levin, F. R. (2018). The current state of pharmacological treatments for cannabis use disorder and withdrawal. *Neuropsychopharmacology, 43*(1), 173–194.

Butler, A. J., Rehm, J., & Fischer, B. (2017). Health outcomes associated with crack-cocaine use: Systematic review and meta-analyses. *Drug and Alcohol Dependence, 180*, 401–416.

Calomarde-Gómez, C., Jiménez-Fernández, B., Balcells-Oliveró, M., Gual, A., & López-Pelayo, H. (2021). Motivational interviewing for cannabis use disorders: A systematic review and meta-analysis. *European Addiction Research, 27*(6), 413–427 Epub 2021 May 7. PMID: 33965941. 10.1159/000515667.

Castillo-Carniglia, A., Rivera-Aguirre, A., Calvo, E., Queirolo, R., Keyes, K. M., & Cerdá, M. (2020). Trends in marijuana use in two Latin American countries: An age, period and cohort study. *Addiction, 115*(11), 2089–2097.

Cerdá, M., & Kilmer, B. (2017). Uruguay's middle-ground approach to cannabis legalization. *International Journal of Drug Policy, 42*, 118.

Cerdá, M., Moffitt, T. E., Meier, M. H., Harrington, H., Houts, R., Ramrakha, S., Hogan, S., Poulton, R., & Caspi, A. (2016). Persistent cannabis dependence and alcohol dependence represent risks for midlife economic and social problems: A longitudinal cohort study. *Clinical Psychological Science, 4*(6), 1028–1046.

Cia, A. H., Stagnaro, J. C., Aguilar-Gaxiola, S., Sustas, S., Serfaty, E., Nemirovsky, M., Kessler, R. C., & Benjet, C. (2018). Twelve-month utilization rates and adequacy of treatment for mental health and substance use disorders in Argentina. *Brazilian Journal of Psychiatry, 41*, 238–244.

Comisión Interamericana para el Control del Abuso de Drogas (CICAD), Secretaría de Seguridad Multidimensional (SSM), & Organización de los Estados Americanos (OEA). (2019). *Informe sobre el consumo de drogas en las Américas, 2019 /Comisión Interamericana para el Control del Abuso de Drogas*. http://www.cicad.oas.org/main/pubs/Informe%20sobre%20el%20consumo%20de%20drogas%20en%20las%20Am%C3%A9ricas%202019.pdf

Consejo Nacional para el Control de Estupefacientes (CONACE), & Ministerio del Interior Gobierno de Chile. (2007). Séptimo Estudio Nacional de Drogas en Población General De Chile, 2006.

Consejo Nacional para el Control de Estupefacientes (CONACE), & Ministerio del Interior Gobierno de Chile. (2009). Octavo Estudio Nacional de Drogas en Población General de Chile, 2008.

COPOLAD II: Cooperation Programme between Latin America the Caribbean and the European Union on Drugs Policies. (2019). Designing studies to evaluate and validate scales and indicators of problem drug use. http://sisco.copolad.eu/web/uploads/documentos/1.4_COPOLAD_EN_Designing_Studies_to_Evaluate_and_Validate_Indicators_of_Problematic_Drug_Use_c30lvtml52ju.pdf

Dannatt, L., Ransing, R., Calvey, T., Scheibein, F., Saad, N. A., Shirasaka, T., Ramalho, R., Pant, S., Vadivel, R., & Siste, K. (2021). The impact of stigma on treatment services for people with substance use disorders during the COVID-19 pandemic—Perspectives of NECPAM members. *Frontiers in Psychiatry, 12*, 223.

Degenhardt, L., Charlson, F., Stanaway, J., Larney, S., Alexander, L. T., Hickman, M., Cowie, B., Hall, W. D., Strang, J., & Whiteford, H. (2016). Estimating the burden of disease attributable to injecting drug use as a risk factor for HIV, hepatitis C, and hepatitis B: Findings from the Global Burden of Disease Study 2013. *The Lancet Infectious Diseases, 16*(12), 1385–1398.

Degenhardt, L., Glantz, M., Evans-Lacko, S., Sadikova, E., Sampson, N., Thornicroft, G., Aguilar-Gaxiola, S., Al-Hamzawi, A., Alonso, J., & Helena Andrade, L. (2017). Estimating treatment coverage for people with substance use disorders: An analysis of data from the World Mental Health Surveys. *World Psychiatry, 16*(3), 299–307.

Degenhardt, L., & Hall, W. (2012). Extent of illicit drug use and dependence, and their contribution to the global burden of disease. *The Lancet, 379*(9810), 55–70.

Degenhardt, L., Singleton, J., Calabria, B., McLaren, J., Kerr, T., Mehta, S., Kirk, G., & Hall, W. D. (2011). Mortality among cocaine users: A systematic review of cohort studies. *Drug and Alcohol Dependence, 113*(2-3), 88–95.

Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2015). Psychosocial sequelae of cannabis use and implications for policy: Findings from the Christchurch Health and Development Study. *Social Psychiatry and Psychiatric Epidemiology, 50*(9), 1317–1326.

Gates, P. J., Sabioni, P., Copeland, J., Le Foll, B., & Gowing, L. (2016). Psychosocial interventions for cannabis use disorder. *Cochrane Database of Systematic Reviews, 2016*(5), CD005336 PMID: 27149547; PMCID: PMC4914383. 10.1002/14651858.CD005336.pub4.

Hasin, D. S. (2018). US epidemiology of cannabis use and associated problems. *Neuropsychopharmacology, 43*(1), 195–212.

Junta Nacional de Drogas Uruguay, & Observatorio Uruguayo de Drogas. (2019). Monitoreo y evaluación de ley 19.172: Principales indicadores del mercado de cannabis en Uruguay. https://www.gub.uy/junta-nacional-drogas/sites/junta-nacional-drogas/files/documentos/noticias/Principales_Indicadores_Cannabis_OUD_HectorSuarez_0.pdf

Junta Nacional de Drogas Uruguayo, Obervatorios Uruguayo de Drogas, Organizacion de los Estados Americanos (OEA), & & Comisión Interamericana para el Control del Abuso de Drogas (CICAD). (2016). Proyecto sobre Cocaínas Fumables en Argentina, Brasil, Chile, Paraguay y Uruguay La oferta de Atención y Tratamiento para personas con uso problemático de drogas en Uruguay: Alcance, Caracter ísticas y Guía de Recursos. https://www.gub.uy/junta-nacional-drogas/sites/junta-nacional-drogas/files/2018-01/Oferta_tratamiento_Uruguay_OUD_2015.pdf

Kampman, K. M. (2019). The treatment of cocaine use disorder. *Science Advances, 5*(10), eaax1532.

Kim, H. J., Fay, M. P., Feuer, E. J., & Midthune, D. N. (2000). Permutation tests for joinpoint regression with applications to cancer rates. *Statistics in Medicine, 19*, 335–351.

Krasnova, A., Diaz, J. E., Philbin, M. M., & Mauro, P. M. (2021). Disparities in substance use disorder treatment use and perceived need by sexual identity and gender among adults in the United States. *Drug and Alcohol Dependence, 226*, Article 108828 Epub 2021 Jun 24. PMID: 34325282; PMCID: PMC8477369. 10.1016/j.drugalcdep.2021.108828.

Magill, M., & Ray, L. A. (2009). Cognitive-behavioral treatment with adult alcohol and illicit drug users: A meta-analysis of randomized controlled trials. *Journal of Studies on Alcohol and Drugs, 70*(4), 516–527.

Midgette, G., Caulkins, J. P., & Reuter, P. (2021). Pathways to drug prevalence estimation: Synthesizing three comments on triangulation. *Addiction, 116*(10), 2615–2616. 10.1111/add.15607.

Mojtabai, R., Olfson, M., & Mechanic, D. (2002). Perceived need and help-seeking in adults with mood, anxiety, or substance use disorders. *Archives of General Psychiatry, 59*(1), 77–84.

Naciones Unidas Oficina contra la Droga y el Delito (ONUDD), Comisión Interamericana para el Control del Abuso de Drogas (CICAD/OEA), Secretaria de Programación para la Prevención de la Drogadicción y la Lucha contra el Narcotráfico (SEDRONAR), Consejo Nacional de Control de Estupefacientes (CONACE), Viceministerio de Defensa Social, S. T. C., Consejo Nacional de Control de Sustancias Estupefacientes y Psicotrópicas (CONSEP), Comisión Nacional para el Desarrollo y Vida Sin Drogas (DEVIDA), & Junta Nacional de Drogas (JND). (2008). Elementos Orientadores Para Las Politicas Publicas Sobre Drogas en la Subregion: Primer Estudio Comparativo Sobre Consumo de Drogas y Factores Asociados en Poblacion de 15 a 64 Años. http://www.cicad.oas.org/oid/NEW/Research/comparativo_subregional-2008-06.pdf

National Cancer Institute, Statistical methodology and applications branch, surveillance research program (2022). *Joinpoint Regression Program, Version 4.9.1.0*.

Observatorio Argentino de Drogas. (2021). Household response rates, 2006, 2008, 2010, 2017. https://www.argentina.gob.ar/sedronar/investigacion-y-estadisticas

Observatorio Chileno de Drogas, & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA). (2017). Décimo Segundo Estudio Nacional de Drogas en Población General de Chile, 2016.

Observatorio Chileno de Drogas, & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA). (2011). Noveno Estudio Nacional de Drogas en Población General de Chile, 2010.

Observatorio Chileno de Drogas, & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA). (2013). Décimo Estudio Nacional de Drogas en Población General de Chile, 2012.

Observatorio Chileno de Drogas, & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA). (2015). Décimo Primer Estudio Nacional de Drogas en Población General de Chile, 2014.

Observatorio Chileno de Drogas, & Servicio Nacional para la Prevención y Rehabilitación del Consumo de Drogas y Alcohol (SENDA). (2019). Décimo Tercer Estudio Nacional de Drogas en Población General de Chile, 2018. https://www.senda.gob.cl/wp-content/uploads/2020/02/ENPEG-2018.pdf

Observatorio Uruguayo de Drogas. (2021). Household Response Rates 2006, 2011. https://www.gub.uy/junta-nacional-drogas/institucional/estructura-del-organismo/observatorio-uruguayo-drogas

Observatorio Uruguayo de Drogas, & Junta Nacional de Drogas Uruguayo. (2016). VI Encuesta Nacional En Hogares Sobre Consumo de Drogas, 2016. https://www.gub.uy/junta-nacional-drogas/sites/junta-nacional-drogas/files/documentos/publicaciones/201609_VI_encuesta_hogares_OUD_ultima_rev.pdf

Observatorio Uruguayo de Drogas, & Junta Nacional de Drogas Uruguayo. (2017). La Atención y Tratamiento de Usuarios Problemáticos de Cocaínas Fumables En Uruguay: Situación y Perspectivas (978-9974-742-13-0). https://www.gub.uy/junta-nacional-drogas/sites/junta-nacional-drogas/files/documentos/publicaciones/JND_cocainas_fumables_web.pdf

Observatorio Uruguayo de Drogas, & Junta Nacional de Drogas Uruguayo. (2020). VII Encuesta Nacional En Hogares Sobre Consumo de Drogas, 2018. https://www.gub.uy/junta-nacional-drogas/comunicacion/publicaciones/vii-encuesta-nacional-sobre-consumo-drogas-poblacion-general-2018

Pan, Z., Zhang, J., Cheng, H., Bu, Q., Li, N., Deng, Y., Zhou, L., Dai, Z., & Lyu, J. (2020). Trends of the incidence of drug use disorders from 1990 to 2017: An analysis based on the Global Burden of Disease 2017 data. *Epidemiology and Psychiatric Sciences, 29*, e148 PMID: 32746958; PMCID: PMC7443796. 10.1017/S2045796020000657.

Pascale, A., Hynes, M., Cumsille, F., & Bares, C. (2014). *Cocaine base paste consumption in South America: A review of epidemiological and medical toxicological aspects.* http://www.cicad.oas.org/oid/pubs/pbc_EPI_2014_ENG.pdf

Radfar, S. R., De Jong, C. A., Farhoudian, A., Ebrahimi, M., Rafei, P., Vahidi, M., Yunesian, M., Kouimtsidis, C., Arunogiri, S., & Massah, O. (2021). Reorganization of substance use treatment and harm reduction services during the COVID-19 pandemic: A global survey. *Frontiers in Psychiatry, 12,* 349.

Radhakrishnan, K. (2021). Significance of integration and use of multiple data sources for understanding substance use and mental health disorders. *Addiction, 116*(10), 2611–2613. 10.1111/add.15562.

Reuter, P., Caulkins, J. P., & Midgette, G. (2021). Heroin use cannot be measured adequately with a general population survey. *Addiction, 116*(10), 2600–2609. 10.1111/add.15458.

Schleimer, J. P., Rivera-Aguirre, A. E., Castillo-Carniglia, A., Laqueur, H. S., Rudolph, K. E., Suárez, H., Ramírez, J., Cadenas, N., Somoza, M., & Brasesco, M. V. (2019). Investigating how perceived risk and availability of marijuana relate to marijuana use among adolescents in Argentina, Chile, and Uruguay over time. *Drug and Alcohol Dependence, 201*, 115–126.

Secretaria de Politicas Integrales Sobre Drogas de la Nacion Argentina (SEDRONAR). (2017a). *Estudio Nacional en Población de 12 a 65 Años Sobre Consume de Sustancias Psicoactivas. Marihuana: Intensidad del Consumo.* https://www.argentina.gob.ar/sites/default/files/2020/10/oad_2017._marihuana_intensidad_del_consumo_estudio_nacional_en_poblacion_sobre_consumo_de_sustancias_psicoactivas.pdf

Secretaria de Politicas Integrales Sobre Drogas de la Nacion Argentina (SEDRONAR). (2017b). Estudio Nacional en Población de 12 a 65 Años Sobre Consumo de Sustancias Psicoactivas. Informe de Los Principales Resultados Sobre Demanda de Tratamiento. https://www.argentina.gob.ar/sites/default/files/2020/10/oad_2017_estudio_nacional_en_poblacion_sobre_consumo_de_sustancias_psicoactivas_resultados_sobre_demanda_de_tratamiento.pdf

Servicio Nactional de Prevencion y Rehabilitacion de Drogas y Alcohol (SENDA), & Ministerio de Salud (MINSAL). (2019). Programa Planes de Tratamiento y Rehabilitación De Personas Con Problemas Derivados Del Consumo de Drogas Ilícitas u Otras Sustancias Estupefacientes o Psicotrópicas, Informe Anual 2018 (A-311243). https://www.senda.gob.cl/wp-content/uploads/2019/04/Informe-Técnico-Final-Técnico-LV-2018.pdf

United Nations Office on Drugs and Crime (UNODC). (2021). World Drug Report 20201. Executive summary: Policy implications (E.21.XI.8). https://www.unodc.org/res/wdr2021/field/WDR21_Booklet_1.pdf

World Health Organization. (2022). *Global Health Observatory: Financing methods for treatment for drug use disorders* https://www.who.int/data/gho/data/indicators/indicator-details/GHO/financing-methods-for-treatment-for-drug-use-disorders

World Health Organization (WHO) and United Nations Office on Drugs and Crime (UNODC). (2020). International standards for the treatment of drug use disorders: Revised edition incorporating results of field-testing. Geneva (CC BY-NC-SA 3.0 IGO), Retrieved from https://apps.who.int/iris/handle/10665/331635

Yang, L., Wong, L. Y., Grivel, M. M., & Hasin, D. S. (2017). Stigma and substance use disorders: An international phenomenon. *Current Opinion in Psychiatry, 30*(5), 378.