

# Relationship between substance use and schizotypal traits in school-aged adolescents

## *Relación entre consumo de sustancias y rasgos esquizotípicos en adolescentes escolarizados*

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### Abstract

**Goal:** The main goal of the present study was to analyze the relationship between substance use (tobacco, alcohol, cannabis) and schizotypal traits in a representative sample of school-aged adolescents from the general population. **Method:** cross-sectional, descriptive survey 1,588 students ( $M = 16.13$  years,  $SD = 1.36$ ), 739 male (46.5%), selected by random stratified cluster sampling, participated in the study. The instruments administered were the Oviedo Questionnaire for Schizotypy Assessment, the Modified Substance Use Questionnaire, the Strengths and Difficulties Questionnaire, the Penn Matrix Reasoning Test, the Family Affluence Scale-II, and the Oviedo Infrequency Scale. **Results:** Controlling for the effects of multiple covariates (gender, age, IQ, socio-economic level, psychopathology and consumption), the results showed that, compared with non-users, alcohol drinkers reported higher average scores in the Social Disorganization dimension. Cigarette smokers, differentiated by frequency, reported higher average scores in the Anhedonia and Social Disorganization dimensions than non-smokers. No statistically significant differences between users and non-users of cannabis were found in terms of schizotypal traits. **Conclusion:** controlling for the effects of multiple covariates, adolescents who use tobacco and alcohol reported higher scores – depending on frequency of use – in schizotypal traits. Future studies should continue to analyze the role of substance use in individuals at risk of psychosis and determine its role in the transition to serious mental disorders, like psychosis, using new methodologies such as ambulatory assessment.

**Keywords:** Adolescence; Substance consumption; Drugs; Schizotypy; Schizotypal traits.

### Resumen

**Objetivo:** analizar la posible relación entre el consumo de sustancias psicoactivas (en concreto, tabaco, alcohol y cannabis) y los rasgos esquizotípicos en una muestra representativa de adolescentes escolarizados de la población general. **Método:** diseño transversal descriptivo tipo encuesta. La muestra se compuso por 1.588 estudiantes ( $M = 16,13$  años;  $DT = 1,36$ ; 739 varones, 46,5%), seleccionados mediante muestreo aleatorio estratificado por conglomerados. Los instrumentos administrados fueron el Cuestionario Oviedo para la Evaluación de la Esquizotipia, el Cuestionario de Consumo de Sustancias Modificado, el Cuestionario de Capacidades y Dificultades, el *Penn Matrix Reasoning Test*, la *Family Affluence Scale-II* y la Escala Oviedo de Infrecuencia de Respuesta. **Resultados:** una vez controlado el efecto de múltiples covariables (género, edad, cociente intelectual, nivel socio-económico, psicopatología previa y consumo de sustancias), los consumidores de alcohol, comparados con los no consumidores, informaron de mayores puntuaciones medias en la dimensión Desorganización Social. Los consumidores de tabaco, comparados con los no consumidores, informaron de mayores puntuaciones medias en las dimensiones de esquizotipia de Anhedonia y Desorganización Social. Con respecto al consumo de cannabis, no se hallaron diferencias estadísticamente significativas entre consumidores y no consumidores en las dimensiones esquizotípicas. **Conclusiones:** controlando el efecto de múltiples variables de confundido, los adolescentes consumidores de tabaco y alcohol –según su frecuencia– informaron de mayores puntuaciones en rasgos esquizotípicos. Futuros estudios podrían continuar analizando el papel del consumo de sustancias en la aparición de trastornos mentales, como la psicosis, mediante nuevas metodologías como la evaluación ambulatoria.

**Palabras clave:** Adolescencia; Consumo sustancias; Drogas; Esquizotipia; Rasgos esquizotípicos.

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Schizotypy is defined as the latent predisposition to schizophrenia-spectrum disorders (Meehl, 1962). Most current etiological models consider that this vulnerability to psychosis is expressed along a severity continuum ranging from non-clinical expression (schizotypal features, psychotic-like experiences) through a subthreshold level (attenuated psychotic symptoms) to a clinical level of psychosis and the need for treatment (Barrantes-Vidal, Grant & Kwapil, 2015; Fonseca-Pedrero, 2018; Fonseca-Pedrero & Debbané, 2017; Fumero, Marrero & Fonseca-Pedrero, 2018). Psychotic-like experiences and schizotypal traits are normally distributed in the general population, without necessarily being associated with distress, impairment, and/or disability (Linscott & Van Os, 2013; Van Os, Linscott, Myin-Germeys, Delepaul & Krabbendam, 2009). For example, the prevalence rates of attenuated psychotic experiences among children are 17% for 9 to 12-year-olds and 7.5% for adolescents between 13 and 18 (Kelleher, Connor & Clarke, 2012). In addition, both psychotic-like experiences and schizotypal traits are seen as markers of vulnerability to psychotic spectrum disorders in general and to schizophrenia in particular (Debbané et al., 2015). An analysis of these phenomena may allow us to understand the possible etiological mechanisms involved in the transition to a psychotic disorder in order to establish preventive treatments (Fonseca-Pedrero & Inchausti, 2018).

In the proneness-persistence-impairment model of psychosis (Van Os et al., 2009), schizotypal traits or psychotic-like experiences may reflect underlying behavioural vulnerability, which increases the risk of psychotic disorder (Ericson, Tuvblad, Raine, Young-Wolff & Baker, 2011; Morton et al., 2017; Shakoor et al., 2016). This may be influenced by factors such as, for example, childhood trauma (Abajobir et al., 2017; Arseneault et al., 2011), self-harm and suicidal behaviour, negative affective states (Fonseca-Pedrero & Debbané, 2017; Najolia, Buckner & Cohen, 2012), and/or the use of substances such as cannabis (Hides et al., 2009; Malone, Hill & Rubino, 2010; Saha et al., 2011; Schubart et al., 2011). Genetic factors could determine the specific sensitivity of each individual to different environmental (e.g., obstetric complications, cannabis use, trauma experiences), and/or psychological risk factors (e.g., dysfunctional cognitive schemes, hyper-reflexivity), so that the most vulnerable individuals would be more at risk of developing psychosis or some of its symptoms when exposed to one or more risk factors. Likewise, multiple environmental impacts at different time points could lead to psychotic-like experiences and schizotypal traits, becoming persistent in vulnerable people and exceed the clinical threshold, leading to disability and the need for treatment (Fonseca-Pedrero, 2018; Linscott & Van Os, 2013).

Recent decades have seen a considerable increase in research examining the relationship between drug use and mental health problems (Casajuana Kögel, López-Pelayo, Balcells-Olivero, Colom & Gual, 2018; Cohn, Johnson, Ehlke & Villanti, 2016; Gonzalvo, Barral & Roncero, 2011; Rial et al., 2018). One of the groups of mental disorders attracting most attention has been the spectrum of psychosis. Various meta-analyses or reviews confirm the relationship between cannabis use and the clinical and subclinical psychosis phenotype (Fonseca-Pedrero, Lucas-Molina, Pérez-Albéniz, Inchausti & Ortuño-Sierra, 2020; Kraan et al., 2016; Large, Sharma, Compton, Slade & Nielssen, 2011; Marconi, Di Forti, Lewis Murray & Vassos, 2016; Moore et al., 2007; Szoke et al., 2014). For example, Marconi et al. (2016) found that high levels of cannabis use increased the risk of psychosis, confirming a dose-response relationship between the level of use and the risk of psychosis. In another study, Saha et al. (2011) revealed that, at an early age (16 years or younger), cannabis users were approximately ten times more likely to have delusional-like experiences than non-users.

Previous research has analyzed the relationship between cannabis use and schizotypal traits, suggesting that greater use of cannabis is linked to higher scores in the positive dimension (reality distortion) (Cohen, Buckner, Najolia & Stewart, 2011; Hides et al., 2009; Schubart et al., 2011), although it is true that there are also studies which have not found a statistically significant association (Barkus, 2008; Van Gastel et al., 2012). What is more, results for the negative dimension are not convincing: some studies have found an association between greater use and higher scores in anhedonia (Cohen et al., 2011; Schubart et al., 2011; Verdoux & Van Os, 2002), while such an association was not reported in other studies (Hides et al., 2009; Najolia et al., 2012; Schubart et al., 2011). For example, Najolia et al. (2012), in their study with young non-clinical adults, revealed that cannabis use was associated with higher rates of positive and disorganized schizotypal traits, but not with negative schizotypal traits.

A further concern is that polydrug use is rather common among drug users; its adverse effects impact cognitive, affective, and behavioural aspects in a way that increases the risk of social and mental health problems (Moreno, 2018). Alcohol and cigarettes are considered the “gateway” to other illegal drugs (Vázquez & Becoña, 2000). The literature also notes that young people who engage in heavy alcohol consumption are more likely to be involved in risky behaviours such as violence, unplanned sexual activity, truancy, dangerous driving (Maturana, 2011), attempting or committing suicide (Pérez Gálvez, 2015), and binge drinking (Sendino et al., 2016). Thus, several studies have concluded that adolescents who are more vulnerable to alcohol, cigarettes, and cannabis, could be subject to greater clinical risk (Auther et al., 2012; Buchy, Perkins, Woods,

Liu & Addington, 2014; Fonseca-Pedrero, Ortuño-Sierra, Paino & Muñiz, 2016; Fumero, Santamaría & Navarrete, 2009). For instance, in a sample of students, it was corroborated that schizotypal scores correlated positively with the consumption of alcohol and cannabis (García Montes, Zaldívar Basurto, Moreno Montoya & Flores Cubos, 2013). Analyzing schizotypal traits and smoking, it was found that individuals with schizotypy were twice as likely to smoke, and smokers reported more severe symptoms of disorganization and less serious negative schizotypal symptoms (Stewart, Cohen & Copeland, 2010).

In addition, as shown by the Spanish national survey on drug use in secondary education (ESTUDES 2016-17), 75.6% of these high-school students had drunk alcohol, 34.7% had smoked cigarettes, and 26.3% had used cannabis in the previous year. In this survey, a significant finding was that there was a delay in the average age of onset of these substances until the age of 14. Recent data indicate that the percentage of problematic cannabis users stands at 13.3% (Moreno, 2018). The prevalence of tobacco, alcohol, and cannabis use among young people is already high and is associated with morbidity and mortality, as well as multiple costs at personal and social health levels.

Substance use is a risk factor and/or a marker of vulnerability which can precipitate the development of clinical and subclinical psychotic experiences (Hall & Degenhardt, 2008). Given the accepted complex relationship between the risk of psychosis and substance use in young people and the negative impact they can cause during this period of human development, new studies are needed to understand their association in order to implement measures promoting emotional well-being and the prevention of mental disorders.

To date, there have not been many studies attempting to analyze the relationship between substance use and risk of psychosis (as estimated by the schizotypy construct) in representative samples of the adolescent population internationally, and more particularly in Spain. In addition, few previous studies have analyzed this relationship while controlling for the effects of multiple confounding variables (e.g., IQ, socio-economic level) with assessment instruments specifically designed for this sector of the population.

Within this research context, the main objective of the study was to explore the relationship between substance use, specifically alcohol, tobacco and cannabis, and schizotypal features in a sample of Spanish secondary school students, and controlling for the effect of multiple confounding variables. It is hypothesized that, in line with the literature, those adolescents who report greater use of substances will have higher scores on schizotypal personality traits.

## Method

### Participants

The study is of a survey-type descriptive cross-sectional design. Random stratified cluster sampling was performed at the classroom level in a population of approximately 15,000 selected students from the Autonomous Community of La Rioja. The students came from a range of schools (public and publicly-funded private) and vocational training courses (basic, middle and upper). The strata were created according to school type (public/private) and stage (compulsory secondary, higher secondary and vocational training), where the likelihood of being selected depended on the number of students in the school.

The initial sample comprised 1,881 students. Those scoring high on the Oviedo Infrequency Response Scale (3 points or higher) ( $n = 104$ ), aged over 19 ( $n = 113$ ) or not completing the test ( $n = 76$ ) were excluded. A final total of 1,588 students, 739 male (46.5%) and 849 female (53.5%), from 34 schools and 98 classrooms participated in the study. The average age was 16.13 years ( $SD = 1.36$ ), ranging from 14 to 19 (14,  $n = 213$ ; 15,  $n = 337$ ; 16,  $n = 400$ ; 17,  $n = 382$ , 18,  $n = 180$ ; 19,  $n = 76$ ).

The distribution of participant nationalities was as follows: 89.9% Spanish, 3.7% Latin American (Bolivia, Argentina, Colombia and Ecuador), 0.7% Portuguese, 2.4% Romanian, 1% Moroccan, 0.7% Pakistani, and 2% other nationalities.

### Instruments

**Oviedo Schizotypy Assessment Questionnaire-Revised (ESQUIZO-Q)** (Fonseca-Pedrero, Lemos, Muñiz, Paino & Villazón, 2010). This is a self-report measure composed of 62 items developed for the assessment of schizotypal traits in adolescents, which can also be used for epidemiological purposes. The items of the ESQUIZO-Q were selected from an exhaustive review of the schizotypal personality literature, with a 5-point Likert-type response format (from 1 'completely disagree' to 5 'completely agree'). The self-report consists of a total of 10 subscales derived empirically by exploratory factor analysis, which, in turn, are grouped into three general dimensions: Positive (which includes the Referential Ideation, Magical Thought, Unusual Perceptual Experiences and Paranoid Ideation subscales); Anhedonia (Physical Anhedonia and Social Anhedonia); and Social Disorganization (Odd Thought and Language, Odd Behavior, Lack of Intimate Friends and Excessive Social Anxiety).

The psychometric properties of the ESQUIZO-Q have been widely analyzed in previous studies (Fonseca-Pedrero, Lemos-Giráldez, Paino, Sierra-Baigrie, Santarén-Rosell & Muñiz, 2011; Fonseca-Pedrero, Paino, Lemos-Giráldez & Muñiz, 2011).

**Modified Substance Use Questionnaire** (Fonseca-Pedrero et al., 2020). The substance use questionnaire used in this research is an abbreviated modification of the World Health Organization's *Alcohol, Smoking and Substance Involvement Screening Test* (ASSIST v3.0) (WHO Assist Working Group, 2002). ASSIST is an interview-format screening tool developed by the World Health Organization for the identification of drug users. It consists of different items which assess, among other aspects, the frequency with which different substances (alcohol, tobacco, cannabis, cocaine, etc.) are used in the three months prior to the completion of the questionnaire.

In this study, we used two of the ASSIST questions, which were applied in a self-report format. Item 1 asked: "In your life, which of the following substances have you ever used?" Participants responded in a dichotomous response format Yes/No for the following substances: a) tobacco (cigarettes, cigars, chewing tobacco, pipe, etc.); b) alcoholic drinks (beer, wine, liquors, spirits, etc.); c) cannabis (marijuana, pot, grass, hashish, etc.); and d) others (e.g., cocaine, amphetamines, inhalants, hallucinogens, opiates, etc.). In the case of an affirmative answer to any substances in Item 1, participants were asked in Item 2 about the frequency of use in the last three months (0 = "Never"; 1 = "Once or twice"; 2 = "Every month"; 3 = "Every week"; 4 = "Daily or almost daily").

ASSIST has been translated and validated in Spanish (Soto-Brandt et al., 2014), and its modified version has been used with Spanish adolescents (Fonseca-Pedrero et al., 2020).

**Strengths and Difficulties Questionnaire - Self-Report version** (SDQ-SR) (Goodman, 1997). The SDQ is a measurement instrument used for the detection of behavioural and emotional difficulties, as well as for the assessment of prosocial skills (Fonseca-Pedrero et al., 2011). It has also been used as a screening tool and for the epidemiological analysis of mental health status in children and adolescents (Ortuño-Sierra, Fonseca-Pedrero, Inchausti & Sastre i Riba, 2016).

The SDQ comprises 25 items using a Likert-type response format with three options (0 = "No, never"; 1 = "Sometimes"; 2 = "Yes, always"). The items are grouped into five dimensions (with five items each): Emotional Symptoms, Behavioural Problems, Hyperactivity, Peer Problems, and Prosocial Behaviour. The first four subscales form a Total Difficulties score. The higher the score, the greater the level of emotional and behavioural difficulties, except for the Prosocial Behaviour subscale, where a lower score corresponds to worse adjustment.

The psychometric properties of the SDQ have been analyzed in previous national studies (Ortuño-Sierra et al., 2016; Ortuño-Sierra, Fonseca-Pedrero, Paino, Sastre I Riba & Muñiz, 2015).

**Penn Matrix Reasoning Test** (PMRT) (Gur et al., 2012; Moore, Reise, Gur, Hakonarson & Gur, 2015). This is one of the tasks on the children's version of the Penn Computerized Neurocognitive Battery, and was developed to measure nonverbal reasoning (using matrix reasoning problems as used in the Raven Progressive Matrices Test). This task, comprising 20 elements, can be considered an indirect estimate of IQ. The test has been used in previous studies with Spanish adolescents (Fonseca-Pedrero et al., 2020).

**Family Affluence Scale-II** (FAS-II) (Boyce, Torsheim, Currie & Zambon, 2006). The FAS-II provides an indirect estimation of socioeconomic level through four items with a Likert-type response format. It has proven useful in adolescent populations. Previous international studies have shown its satisfactory psychometric properties (Boyce, Torsheim, Currie & Zambon, 2006). The FAS-II, in its Spanish version has, been used in previous studies (Fonseca-Pedrero et al., 2020).

**Oviedo Infrequency Response Scale** (INF-OV) (Fonseca-Pedrero, Paino-Piñeiro, Lemos-Giraldez, Villazón-García & Muñiz, 2009). The INF-OV was developed to detect participants who respond in a random, pseudo-random or untruthful way to the measurement instruments used. The INF-OV is a self-report type assessment tool comprising 12 items in a Likert-type format with five categories showing the degree of adherence (from 1 = "Completely disagree" to 5 = "Strongly agree"). Once the items have been dichotomized, students scoring more than two items of the INF-OV incorrectly are eliminated from the study. The INF-OV has been used in previous studies (Fonseca-Pedrero et al., 2011; Fonseca-Pedrero et al., 2009)

### Procedure

The present research was approved by the General Directorate of Education of the Government of La Rioja and the Clinical Research Ethics Committee of La Rioja (CEICLAR). Contact with schools was made by telephone, e-mail or by regular post. The initial contact with a school was with the director, the head of studies or the orientation department.

In order to standardize the administration process, all the researchers were given a protocol and guidelines to be carried out before, during, and after the administration of the measurement instruments. Questionnaires were administered by computer and collectively in groups of between 10 and 30 participants.

Participants were informed at all times that their responses would remain confidential, and that participation was voluntary; collaboration in the study was not remunerated in any way. Since many of the participants were minors, parental consent was requested to authorize the participation of the adolescent in the investigation. This

study is part of a larger project on the early detection of mental health problems.

### Data analysis

The following analyses were carried out to investigate the proposed objectives.

First, we analyzed the percentage of participants who reported substance use, specifically tobacco, alcohol, and cannabis.

Secondly, to examine the relationship between substance use and the three dimensions of schizotypal traits (Positive, Anhedonia and Social Disorganization), various Multivariate Analyses of Covariance (MANCOVA) were performed. The schizotypy dimensions were considered as dependent variables, and substance use (tobacco, alcohol and cannabis) as a fixed factor. Each MANCOVA initially analyzed the effect at the level of lifetime prevalence (having used the substance at some time in their life) followed by the frequency level. Given that gender, age, socio-economic level, IQ, and/or emotional and behavioural problems may affect the expression of the relationship between schizotypal traits and substance use, these factors were considered as covariables. Substance use was also taken as a covariate, depending on the type of substance in question. Thus, when analyzing the effect of cannabis on schizotypal dimensions, the effects of alcohol and cigarettes use was controlled for. When analyzing the effect of cigarette smoking on the schizotypal dimensions, the effects of alcohol and cannabis use was controlled for. When analyzing the effect of alcohol on the schizotypal dimensions, the effect of cannabis use and cigarette smoking was controlled for. The partial squared eta statistic (partial  $\eta^2$ ) was used to calculate the effect size.

The data analyses were performed with the SPSS v22 statistical package (IBM Corp Released, 2013).

## Results

### Prevalence of substance use

Lifetime prevalence (having used the substance at some time in their life) was 40.6% for cigarettes, 79.4% for alcohol and 23.6% for cannabis. Drinking alcohol every week was reported by 15.7% of the sample. In addition, 2.9% of the participants reported a frequency of monthly cannabis use, while 2% presented a pattern of weekly use. Table 1 shows the prevalence rates of substance use; in addition, data on the frequency of use of the three substances over the last three months are also provided.

### Relationship between alcohol consumption and schizotypal traits

First, we analyzed the relationship between the lifetime prevalence of alcohol use and the ESQUIZO-Q scores, and then between the frequency of use and ESQUIZO-Q scores. The effects of gender, age, IQ, socio-economic level, psychopathology, and cannabis and tobacco use were controlled for.

Based on the lifetime prevalence of alcohol use, MANCOVA did not reveal the existence of statistically significant differences ( $\lambda = 0.998$ ;  $F_{(3,1577)} = 1.110$ ,  $p = 0.334$ ). Compared with non-users, alcohol drinkers did not report higher mean scores in any of the ESQUIZO-Q dimensions. Table 2 shows the mean scores for the two groups.

Based on the frequency of alcohol use (in the last 3 months), MANCOVA revealed the existence of statistically significant differences ( $\lambda = 0.985$ ;  $F(12, 3783) = 1.842$ ,  $p = 0.037$ ). Those who reported more frequent drinking, compared with non-users, also reported higher average scores in the Social Disorganization dimension. Statistically significant differences were found in particular between group 1 ("once or twice") and 3 ("every week"). Mean scores for the groups are shown in Table 3.

Table 1. Prevalence and frequency of substance use in the total sample.

		Alcohol		Cigarettes		Cannabis	
		n	%	n	%	n	%
<b>Prevalence</b>	No	327	20.6	947	59.6	1211	76.3
	Yes	1261	79.4	641	40.4	377	23.7
<b>Frequency</b>	Never (0)	208	13.1	783	49.3	1047	65.9
	Once or twice (1)	494	31.1	312	19.6	239	15.1
	Each month (2)	478	30.1	77	4.8	46	2.9
	Each week (3)	250	15.7	61	3.8	29	1.8
	Daily or almost daily (4)	14	0.9	163	10.3	29	1.8
	Total	1444	90.9	1396	87.9	1390	87.5
	No answer	144	9.1	192	12.1	198	12.5

Note. Prevalence: indication by participants whether or not they have used the substances at some time in their life.

Table 2. Relationship between alcohol use (lifetime prevalence) and schizotypal traits.

Dimension	Non-use		Use		F	p	partial $\eta^2$
	M	SD	M	SD			
Positive	33.51	11.69	34.65	11.91	0.4	0.527	0
Negative	34.52	7.33	33.44	6.54	1.99	0.159	0.001
Disorganization	57.47	15.81	58.85	15.23	0.554	0.457	0

Table 3. Relationship between alcohol use (frequency) and schizotypal traits.

Dimension	0		1		2		3		4		F	p	partial $\eta^2$
	M	SD	M	SD	M	SD	M	SD	M	SD			
Positive	33.80	11.19	34.50	11.90	34.50	11.28	35.06	12.19	40.50	24.42	0.718	0.579	0.002
Negative	34.02	7.26	33.59	6.75	32.92	6.24	33.90	6.54	34.29	7.34	0.494	0.74	0.001
Disorganization	57.38	15.73	59.92	15.31	58.26	14.71	57.87	14.87	57.50	26.39	2.676	0.031	0.007

Note. Never = 0; Once or twice = 1; Each month = 2; Each week = 3; Daily or almost daily = 4.

### Relationship between cigarette smoking and schizotypal traits

The MANCOVA used to analyze the relationship between the use or non-use of tobacco (lifetime prevalence) and ESQUIZO-Q scores, controlling for the effect of gender, age, IQ, socio-economic level, psychopathology, and cannabis and alcohol use, revealed the existence of statistically significant differences ( $\lambda = 0.991$ ;  $F_{(3,1577)} = 4.995$ ,  $p = 0.002$ ), particularly in the Anhedonia and Social Disorganization dimensions. Compared with non-smokers, cigarette smokers reported higher mean scores in these two ESQUIZO-Q dimensions. The mean scores for the two groups are shown in Table 4.

Next, a new MANCOVA was performed taking the frequency variable of smoking into account as a fixed factor,

the ESQUIZO-Q dimensions as dependent variables, and controlling for the effects of the same covariates. In this case, MANCOVA revealed the existence of statistically significant differences ( $\lambda = 0.973$ ;  $F_{(12,3656)} = 3.143$ ,  $p < 0.001$ ). Compared with non-smokers, cigarette smokers, differentiated by frequency, reported higher average scores in the Anhedonia and Social Disorganization dimensions of the ESQUIZO-Q. Statistically significant differences were found specifically between group 0 and 1 in Anhedonia, and between groups 0-1, 0-4 and 2-4 (where never = 0, once or twice = 1, every month = 2; every week = 3; daily or almost daily = 4) in the schizotypal factor of Disorganization. The mean scores for smoking frequency groups are shown in Table 5.

Table 4. Relationship between cigarette smoking (lifetime prevalence) and schizotypal traits.

Dimension	Non-use		Use		F	p	partial $\eta^2$
	M	SD	M	SD			
Positive	33.81	11.54	35.31	12.30	1.132	0.287	0.001
Negative	33.95	6.87	33.24	6.47	5.707	0.017	0.004
Disorganization	58.14	15.26	59.20	15.49	11.93	0.001	0.007

Table 5. Relationship between cigarette smoking (frequency) and schizotypal traits.

Dimension	0		1		2		3		4		F	p	partial $\eta^2$
	M	SD	M	SD	M	SD	M	SD	M	SD			
Positive	34.14	11.68	34.40	11.46	36.32	12.14	36.84	11.02	35.61	13.49	1.638	0.162	0.005
Negative	33.74	6.78	32.66	6.33	32.16	6.12	33.77	6.95	34.24	6.53	2.888	0.021	0.008
Disorganization	58.31	15.14	58.63	14.52	60.06	13.78	60.97	16.76	58.86	16.87	6.444	<0.001	0.018

Note. Never = 0; Once or twice = 1; Each month = 2; Each week = 3; Daily or almost daily = 4.

**Relationship between cannabis use and schizotypal traits**

The MANCOVA analyzing the relationship between lifetime prevalence of cannabis use and the schizotypy dimensions, while controlling for the effects of gender, age, IQ, socio-economic level, psychopathology, and alcohol and tobacco use covariates, did not reveal the existence of statistically significant differences ( $\lambda = 0.998$ ;  $F_{(3,1577)} = 1.146$ ,  $p = 0.329$ ). Cannabis users, compared with non-users, did

not report higher average scores in any of the ESQUIZO-Q dimensions. The results are presented in Table 6.

Looking at frequency of use, the MANCOVA performed, which considered the variable frequency of cannabis use as a fixed factor and the ESQUIZO-Q scores as dependent variables, and controlled for the effects of the same covariates, did not reveal the existence of statistically significant differences ( $\lambda = 0.991$ ;  $F_{(12, 3640)} = 1.014$ ,  $p = 0.433$ ). Table 7 shows the mean scores for the different cannabis use frequency groups.

Table 6. Relationship between cannabis use (lifetime prevalence) and schizotypal traits.

Dimension	Non-use		Use		F	p	partial $\eta^2$
	M	SD	M	SD			
Positive	33.79	11.43	36.43	13.01	1.743	0.187	0.001
Negative	33.57	6.73	33.95	6.70	1.377	0.241	0.001
Disorganization	58.03	15.16	60.29	15.88	0.042	0.838	0

Table 7. Relationship between cannabis use (frequency) and schizotypal traits.

Dimension	0		1		2		3		4		F	p	partial $\eta^2$
	M	SD	M	SD	M	SD	M	SD	M	SD			
Positive	33.99	11.41	36.04	12.77	37.22	11.50	35.31	12.04	38.55	17.82	0.788	0.533	0.002
Negative	33.31	6.66	33.31	6.38	35.09	8.28	35.31	5.50	35.14	6.96	0.43	0.787	0.001
Disorganization	58.07	14.96	59.67	15.50	62.70	15.54	59.86	16.36	59.76	20.12	1.266	0.0281	0.004

Note. Never = 0; Once or twice = 1; Each month = 2; Each week = 3; Daily or almost daily = 4.

**Discussion**

The main aim of this study was to analyze the relationship between substance use (tobacco, alcohol and cannabis) and the risk of psychosis, estimated by schizotypal traits, in a representative sample of Spanish school-aged adolescents.

Firstly, lifetime prevalence rates of alcohol, tobacco, and cannabis use were analyzed. The results show a lifetime prevalence of 40.4% for tobacco, 79.4% for alcohol and 23.7% for cannabis. These results are similar to those obtained in the Spanish national survey on drug use in secondary education, ESTUDES 16-17 (34.7% for tobacco, 76.9% alcohol, and 31.1% for cannabis). Of the sample, 10.3% of adolescents reported that they smoked cigarettes every day or almost daily; according to the Spanish Observatory on Drugs, 8.8% of young people reported smoking cigarettes daily (Moreno, 2018). Alcohol was drunk by 30.1% every month, data similar to high school students (ESTUDES 16-17). Three out of four youths admit to having drunk alcohol in the last 30 days. Finally, 2.9% reported smoking cannabis monthly, a figure that differs from that of secondary education students aged 14 to 18 (ESTUDES 16-17) where cannabis use of 18.3% in the last 30 days is

confirmed. Data from a recent study reveal that the percentage of adolescents who smoke cigarettes and cannabis is higher nowadays than that of cigarettes only (12.7% vs. 10.5%), and that this not only implies a greater probability of using other illegal substances, but also of developing a pattern of risky alcohol use (Rial et al., 2018). According to a variety of studies, young people are not aware of the risky behaviours that lead to drug use because of the low perception of risk; they consider sporadic use as harmless, which makes them more vulnerable (Barrett & Bradley, 2016; López-Quintero & Neumark, 2010; Rowe, Santos, Behar & Coffin, 2016).

Secondly, the schizotypy dimensions (Positive, Negative and Disorganization) were analyzed in terms of use - at the levels of lifetime prevalence and frequency - controlling for the effect of the covariates (gender, age, IQ, socio-economic level, psychopathology, and use of other substances). Compared with non-users, alcohol users reported higher scores in the Social Disorganization dimension, findings which concur with a current review of the effects of binge drinking in young people, which links such use to neurocognitive deficits (diminished sustained attention and visuospatial working memory; deficits in decision-making, cognitive flexibility and executive functions) (López-Cane-

da et al., 2014). The Positive and Anhedonia schizotypal dimensions did not show statistically significant differences when the effects of these covariates were controlled for. Along similar lines to our research, Auther et al. (2012) stated that adolescents with early onset (aged 17 or less) of alcohol use were significantly more likely to have schizotypal experiences. However, the pattern of association between alcohol use, dependency disorder and schizotypal traits was less consistent when adjusted for the presence of other substance use disorders, even though more severe symptoms are also associated with higher levels of substance use.

Cigarette smokers reported higher scores on the Anhedonia and Social Disorganization dimensions. The results of the present study reflect that both the presence (yes/no) and the frequency of cigarette smoking are associated with higher scores in negative traits and social disorganization. Anhedonia is linked to the habit of smoking to relieve these effects (Leventhal et al., 2013), and is considered a risk marker for psychosis (Docherty & Sponheim, 2014; Meehl, 1962). Several prospective studies link smoking to psychotic symptoms (Gurillo et al., 2015; Munafò, Larsson Lönn, Sundquist, Sundquist & Kendler, 2016; Riala, Hakko, Isohanni, Pouta & Räsänen, 2005; Zammit et al., 2003). For example, Gurillo et al., (2015) emphasize that daily smoking is associated with an increased risk of psychosis in case-control studies, and also indicate that smoking is linked to earlier onset of psychotic disorder. Similarly, Weiser et al. (2004) state that the rate of cigarette smoking in male adolescents was significantly linked to the risk of schizophrenia. However, the possibility of a causal link between tobacco use and psychosis merits a more detailed examination.

Regarding the influence of cannabis, no statistically significant differences were found, either in terms of prevalence or frequency of use in the schizotypal dimensions, when the effect of confounding variables was controlled for. The results yielded do not reveal a statistically significant link, after adjustment for confounding values, which suggests the possible existence of underlying factors that can better explain the association. However, a study in Spain found that patients who had a first episode of psychosis (average age 15.5 years) had a higher rate of positive symptoms and fewer negative symptoms if they were cannabis users, compared with those who did not use cannabis (Baeza et al., 2009). The association between cannabis use and psychosis has been analyzed in a large number of previous studies (Fergusson, Horwood & Ridder, 2005; Fonseca-Pedrero, Ortuño-Sierra, Paino & Muñiz, 2016; Gage, Hickman & Zammit, 2016; Hides et al., 2009; Kelleher et al., 2012; Marconi et al., 2016; Moore et al., 2007). In general, research in the field of schizotypy indicates that the relationships established with cannabis use are complex and bidirectional, with different variables possi-

bly playing a mediating or moderating role (Fonseca-Pedrero et al., 2020). For example, Schubart et al. (2011), analyzed the association between onset age and level of cannabis use and psychotic experiences in three symptom dimensions (positive, negative and depressive) in a sample of the Dutch population comprising more than 17,500 participants, with an average age of 21. This study revealed that the onset age of cannabis use is strongly associated with current psychotic experiences, and that the level of cannabis use is similarly related to positive, negative, and depressive symptoms.

There is copious literature linking substance use to psychosis, although establishing causality from these investigations is problematic. As Minozzi et al. (2009) claim, reverse causality and residual confounding cannot be excluded. The interaction with other environmental and genetic factors is difficult to determine. This should not alter the public health message that cannabis can be harmful and that dependence on cannabis should be avoided (Gage et al., 2016). In fact, perhaps an interesting line of action in the field of psychosis may lie, rather than reducing the risk of psychosis or latent vulnerability in itself, in preventing or reducing relevant risk factors which are closely related to the etiology of psychosis, such as, for example, cannabis use or trauma experiences (Radua et al., 2018).

When interpreting the results obtained in the present work, some limitations need to be borne in mind. First, the conclusions are limited by the measurement instruments used, of the self-report type, with the corresponding corollaries of this type of tool (possible lack of comprehension, misinterpretation of the items, or response biases). The multi-informant system would have been particularly relevant in the assessment of the study variables. Second, the sample comes from a Spanish Autonomous Community (La Rioja), an aspect which, despite random stratified cluster sampling, partially limits the generalizability of results to the whole of Spain. Third, it is a cross-sectional study, so that cause-and-effect relationships cannot be established. Fourth, no information on possible psychiatric morbidity was collected, either from participants or from close relatives, which could affect the study's results.

In conclusion, during adolescence schizotypal traits were associated with tobacco and alcohol use, but not cannabis. This study aimed to shed light on the link between experiences of substance use and schizotypal traits in adolescence. It is necessary to identify the mechanisms underlying this association in vulnerable groups of at-risk young people if prevention strategies are to be improved. Future research could continue to analyze the role of risk and protective factors related to the transition to different psychological problems in longitudinal and gene-environment interaction studies. In the same way, it would be extremely interesting to incorporate new assessment and measurement techniques, such as the experience-sampling meth-

od, which allows a more ecological, contextual, etiological, personalized, and accurate analysis of human behaviour.

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### Conflict of interests

The authors declare no conflicts of interest.

### References

- Abajobir, A. A., Kisely, S., Scott, J. G., Williams, G., Clavarino, A., Strathearn, L. & Najman, J. M. (2017). Childhood maltreatment and young adulthood hallucinations, delusional experiences, and psychosis: a longitudinal study. *Schizophrenia Bulletin*, *43*, 1045–1055. doi:10.1093/schbul/sbw175.
- Arseneault, L., Cannon, M., Fisher, H. L., Polanczyk, G., Moffitt, T. E. & Caspi, A. (2011). Childhood trauma and children’s emerging psychotic symptoms: a genetically sensitive longitudinal cohort study. *American Journal of Psychiatry*, *168*, 65–72. doi:10.1176/appi.ajp.2010.10040567.
- Auther, A. M., McLaughlin, D., Carrión, R. E., Nagachandran, P., Correll, C. U. & Cornblatt, B. A. (2012). Prospective study of cannabis use in adolescents at clinical high risk for psychosis: impact on conversion to psychosis and functional outcome. *Psychological Medicine*, *42*, 2485–2497. doi:10.1017/S0033291712000803.
- Baeza, I., Graell, M., Moreno, D., Castro-Fornieles, J., Parellada, M., González-Pinto, A., ... Arango, C. (2009). Cannabis use in children and adolescents with first episode psychosis: influence on psychopathology and short-term outcome (CAFEPS study). *Schizophrenia Research*, *113*, 129–137. doi:10.1016/j.schres.2009.04.005.
- Barkus, E. (2008). Personality and cannabis use. *Advances in Schizophrenia and Clinical Psychiatry*, *3*, 84–89.
- Barrantes-Vidal, N., Grant, P. & Kwapil, T. R. (2015). The role of schizotypy in the study of the etiology of schizophrenia spectrum disorders. *Schizophrenia Bulletin*, *41*, 408–416. doi:10.1093/schbul/sbu191.
- Barrett, P. & Bradley, C. (2016). Attitudes and perceived risk of cannabis use in Irish adolescents. *Irish Journal of Medical Science*, *185*, 643–647. doi:10.1007/s11845-015-1325-2.
- Boyce, W., Torsheim, T., Currie, C. & Zambon, A. (2006). The Family Affluence Scale as a measure of national wealth: validation of an adolescent self-report measure. *Social Indicators Research*, *78*, 473–487. doi:10.1007/s11205-005-1607-6.
- Buchy, L., Perkins, D., Woods, S. W., Liu, L. & Addington, J. (2014). Impact of substance use on conversion to psychosis in youth at clinical high risk of psychosis. *Schizophrenia Research*, *156*, 277–280. doi:10.1016/j.schres.2014.04.021.
- Casajuana Kögel, C., López-Pelayo, H., Balcells-Olivero, M. M., Colom, J. & Gual, A. (2018). Psychoactive constituents of cannabis and their clinical implications: a systematic review constituyentes psicoactivos del cannabis & sus implicaciones clínicas: una revisión sistemática. *Adicciones*, *30*, 140–151. doi:10.20882/adicciones.858.
- Cohen, A. S., Buckner, J. D., Najolia, G. M. & Stewart, D. W. (2011). Cannabis and psychometrically-defined schizotypy: use, problems and treatment considerations. *Journal of Psychiatric Research*, *45*, 548–554. doi:10.1016/j.jpsychires.2010.08.013.
- Cohn, A., Johnson, A., Ehlike, S. & Villanti, A. C. (2016). Characterizing substance use and mental health profiles of cigar, blunt, and non-blunt marijuana users from the National Survey of Drug Use and Health. *Drug and Alcohol Dependence*, *160*, 105–111. doi:10.1016/j.drugalcdep.2015.12.017.
- Debbané, M., Eliez, S., Badoud, D., Conus, P., Fluckiger, R. & Schultze-Lutter, F. (2015). Developing psychosis and its risk states through the lens of schizotypy. *Schizophrenia Bulletin*, *41*, 396–407. doi:10.1093/schbul/sbu176.
- Ericson, M., Tuvblad, C., Raine, A., Young-Wolff, K. & Baker, L. A. (2011). Heritability and longitudinal stability of schizotypal traits during adolescence. *Behavior Genetics*, *41*, 499–511. doi:10.1007/s10519-010-9401-x.
- Fergusson, D. M., Horwood, L. J. & Ridder, E. M. (2005). Tests of causal linkage between cannabis use and psychotic symptoms. *Addiction*, *100*, 354–366. doi:10.1111/j.1360-0443.2005.001001.x.
- Fonseca-Pedrero, E., Lemos, S., Muñoz, J., Paino, M. & Villazón, U. (2010). ESQUIZO-Q. Cuestionario Oviedo para la Evaluación de la Esquizotipia. Madrid: TEA Ediciones.
- Fonseca-Pedrero, E. (coord). (2018). Evaluación de los trastornos del espectro psicótico. Madrid: Pirámide.
- Fonseca-Pedrero, E. & Debbané, M. (2017). Schizotypal traits and psychotic-like experiences during adolescence: an update. *Psicothema*, *29*, 5–17. doi:10.7334/psicothema2016.209.
- Fonseca-Pedrero, E. e Inchausti, F. (2018). Update on the prevention of psychotic spectrum disorders. *Papeles del Psicólogo*, *39*, 127–139. doi:10.23923/pap.psicol2018.2860.

- Fonseca-Pedrero, E., Lucas-Molina, B., Pérez-Albéniz, A., Inchausti, F. & Ortuño-Sierra, J. (2020). Psychotic-like experiences and cannabis use in adolescents from the general population. *Adicciones*, *32*, 41-51. doi:10.20882/adicciones.1149.
- Fonseca-Pedrero, E., Ortuño-Sierra, J., Paino, M. & Muñiz, J. (2016). Psychotic-like experiences and substance use in college students. *Adicciones*, *28*, 144-153. doi:10.20882/adicciones.781.
- Fonseca-Pedrero, E., Paino-Piñeiro, M., Lemos-Giráldez, S., Villazón-García, U. & Muñiz, J. (2009). Validation of the Schizotypal Personality Questionnaire-Brief form in adolescents. *Schizophrenia Research*, *111*, 53-60. doi:10.1016/j.schres.2009.03.006.
- Fonseca-Pedrero, E., Paino, M., Lemos-Giráldez, S. & Muñiz, J. (2011a). Prevalencia de la sintomatología emocional y comportamental en adolescentes Españoles a través del Strengths and Difficulties Questionnaire (SDQ). *Revista de Psicopatología y Psicología Clínica*, *16*, 15-25. doi:10.5944/rppc.vol.16.num.1.2011.10348.
- Fonseca-Pedrero, E., Paino, M., Lemos-Giráldez, S. & Muñiz, J. (2011b). Schizotypal traits and depressive symptoms in nonclinical adolescents. *Comprehensive Psychiatry*, *52*, 293-300. doi:10.1016/j.comppsy.2010.07.001.
- Fonseca-Pedrero, E., Paino, M., Lemos-Giráldez, S., Sierra-Baigrie, S., Ordóñez-Cambor, N. & Muñiz, J. (2011). Early psychopathological features in Spanish adolescents. *Psicothema*, *23*, 87-93.
- Fumero, A., Marrero, R. J. & Fonseca-Pedrero, E. (2018). Well-being in schizotypy: the effect of subclinical psychotic experiences. *Psicothema*, *30*, 177-182. doi:10.7334/psicothema2017.100.
- Fumero A., Santamaría, C. & Navarrete, G. (2009). Predisposición al consumo de alcohol y drogas en personas vulnerables a la esquizofrenia. *Revista de Neurología*, *49*, 8-12. doi:10.33588/rn.4901.2008672.
- Gage, S. H., Hickman, M. & Zammit, S. (2016). Association between cannabis and psychosis: epidemiologic evidence. *Biological Psychiatry*, *79*, 549-556. doi:10.1016/j.biopsych.2015.08.001.
- García Montes, J. M., Zaldívar Basurto, F., Moreno Montoya, M. & Flores Cubos, P. (2013). Relaciones entre el consumo de drogas y variables de riesgo psicopatológicas en jóvenes universitarios. *Psicothema*, *25*, 433-439. doi:10.7334/psicothema2013.20.
- Gonzalvo, B., Barral, C. & Roncero, O. E. C. (2011). Comorbilidad psiquiátrica en adolescentes consumidores de cannabis. *Trastornos Adictivos*, *13*, 109-112. doi:10.1016/S1575-0973(11)70023-X.
- Goodman, R. (1997). The Strengths and Difficulties Questionnaire: a research note. *Journal of Child Psychology and Psychiatry*, *38*, 581-6. doi:10.1111/j.1469-7610.1997.tb01545.x.
- Gur, R. C., Richard, J., Calkins, M. E., Chiavacci, R., Hansen, J. A., Bilker, W. B., ... Gur, R. E. (2012). Age group and sex differences in performance on a computerized neurocognitive battery in children age 8-21. *Neuropsychology*, *26*, 251-265. doi:10.1037/a0026712.
- Gurillo, P., Jauhar, S., Murray, R. M. & MacCabe, J. H. (2015). Does tobacco use cause psychosis? Systematic review and meta-analysis. *Lancet Psychiatry*, *2*, 718-725. doi:10.1016/S2215-0366(15)00152-2.
- Hall, W. & Degenhardt, L. (2008). Cannabis use and the risk of developing a psychotic disorder. *World Psychiatry*, *7*, 68-71.
- Hides, L., Lubman, D. I., Buckby, J., Yuen, H. P., Cosgrave, E., Baker, K. & Yung, A. R. (2009). The association between early cannabis use and psychotic-like experiences in a community adolescent sample. *Schizophrenia Research*, *112*, 130-135. doi:10.1016/j.schres.2009.04.001.
- IBM Corp Released. (2013). *IBM SPSS Statistics for Windows, Version 22.0*. Armonk, NY: IBM Corp.
- Kelleher, I., Connor, D. & Clarke, M. C. (2012). Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychological Medicine*, *42*, 1857-1863. doi:10.1017/S0033291711002960.
- Kraan, T., Velthorst, E., Koenders, L., Zwaart, K., Ising, H. K., van den Berg, D., ... Van der Gaag, M. (2016). Cannabis use and transition to psychosis in individuals at ultra-high risk: review and meta-analysis. *Psychological Medicine*, *46*, 673-681. doi:10.1017/S0033291715002329.
- Large, M., Sharma, S., Compton, M. T., Slade, T. & Nielsen, O. (2011). Cannabis use and earlier onset of psychosis: a systematic meta-analysis. *Archives of General Psychiatry*, *68*, 555-561. doi:10.1001/archgenpsychiatry.2011.5.
- Leventhal, A. M., Greenberg, J. B., Trujillo, M. A., Ameringer, K. J., Lisha, N. E., Pang, R. D. & Monterosso, J. (2013). Positive and negative affect as predictors of urge to smoke: temporal factors and mediational pathways. *Psychology of Addictive Behaviors*, *27*, 262-267. doi:10.1037/a0031579.
- Linscott, R. J. & Van Os, J. (2013). An updated and conservative systematic review and meta-analysis of epidemiological evidence on psychotic experiences in children and adults: on the pathway from proneness to persistence to dimensional expression across mental disorders. *Psychological Medicine*, *43*, 1133-1149. doi:10.1017/S0033291712001626.
- López-Caneda, E., Mota, N., Crego, A., Velásquez, T., Corral, M., Holguín, S. R. & Cadaveira, F. (2014). Anomalías neurocognitivas asociadas al consumo intensivo de alcohol (binge drinking) en jóvenes y adolescentes: Una revisión. *Adicciones*, *26*, 334-359. doi:10.20882/adicciones.39.
- López-Quintero, C. & Neumark, Y. (2010). Effects of risk perception of marijuana use on marijuana use and in-

- tentions to use among adolescents in Bogotá, Colombia. *Drug and Alcohol Dependence*, 109, 65–72. doi:10.1016/j.drugalcdep.2009.12.011.
- Malone, D. T., Hill, M. N. & Rubino, T. (2010). Adolescent cannabis use and psychosis: epidemiology and neurodevelopmental models. *British Journal of Pharmacology*, 160, 511–522. doi:10.1111/j.1476-5381.2010.00721.x.
- Marconi, A., Di Forti, M., Lewis, C. M., Murray, R. M. & Vassos, E. (2016). Meta-analysis of the association between the level of cannabis use and risk of psychosis. *Schizophrenia Bulletin*, 42, 1262–1269. doi:10.1093/schbul/sbw003.
- Maturana, A. (2011). Consumo de alcohol y drogas en adolescentes. *Revista Médica Clínica Las Condes*, 22, 98–109. doi:10.1016/S0716-8640(11)70397-2.
- Meehl, P. E. (1962). Schizotaxia, schizotypy, schizophrenia. *American Psychologist*, 17, 827–838. doi:10.1037/h0041029.
- Minozzi, S., Davoli, M., Bargagli, A. M., Amato, L., Vecchi, S. & Perucci, C. A. (2009). An overview of systematic reviews on cannabis and psychosis: discussing apparently conflicting results. *Drug and Alcohol Review*, 29, 304–317. doi:10.1111/j.1465-3362.2009.00132.x.
- Moore, T. H. M., Zammit, S., Lingford-Hughes, A., Barnes, T. R. E., Jones, P. B., Burke, M. & Lewis, G. (2007). Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *Lancet*, 370, 319–28. doi:10.1016/S0140-6736(07)61162-3.
- Moore, T. M., Reise, S. P., Gur, R. E., Hakonarson, H. & Gur, R. C. (2015). Psychometric properties of the penn computerized neurocognitive battery. *Neuropsychology*, 29, 235–246. doi:10.1037/neu0000093.
- Moreno, L. M. (2018). Informe ESTUDES 2018: Alcohol, tabaco y drogas ilegales en España.
- Morton, S. E., O'Hare, K. J. M., Maha, J. L. K., Nicolson, M. P., Machado, L., Topless, R., ... Linscott, R. J. (2017). Testing the validity of taxonic schizotypy using genetic and environmental risk variables. *Schizophrenia Bulletin*, 43, 633–643. doi:10.1093/schbul/sbw108.
- Munafò, M. R., Larsson Lönn, S., Sundquist, J., Sundquist, K. & Kendler, K. (2016). Snus use and risk of schizophrenia and non-affective psychosis. *Drug and Alcohol Dependence*, 164, 179–182. doi:10.1016/j.drugalcdep.2016.04.035.
- Najolia, G. M., Buckner, J. D. & Cohen, A. S. (2012). Cannabis use and schizotypy: The role of social anxiety and other negative affective states. *Psychiatry Research*, 200, 660–668. doi:10.1016/j.psychres.2012.07.042.
- Ortuño-Sierra, J., Fonseca-Pedrero, E., Inchausti, F. & Sastre I Riba, S. (2016). Evaluación de dificultades emocionales y comportamentales en población infanto-juvenil: el cuestionario de capacidades y dificultades (SDQ). *Papeles del Psicólogo*, 37, 14–26.
- Ortuño-Sierra, J., Fonseca-Pedrero, E., Paino, M., Sastre I Riba, S. & Muñoz, J. (2015). Screening mental health problems during adolescence: psychometric properties of the Spanish version of the strengths and difficulties Questionnaire. *Journal of Adolescence*, 38, 49–56. doi:10.1016/j.adolescence.2014.11.001.
- Pérez Gálvez, M. (2015). Prevención e intervención de la conducta suicida en personas consumidoras de alcohol. En Andoni Aseán (ed.), *Manual de prevención, intervención y postvención de la conducta suicida* (pp. 611–630). Madrid: Fundación Salud Mental España.
- Radua, J., Ramella-Cravaro, V., Ioannidis, J. P. A., Reichenberg, A., Phipphothatsanee, N., Amir, T., ... Fusar-Poli, P. (2018). What causes psychosis? An umbrella review of risk and protective factors. *World Psychiatry*, 17, 49–66. doi:10.1002/wps.20490.
- Rial, A., Burkhart, G., Isorna, M., Barreiro, C., Varela, J. & Golpe, S. (2018). Cannabis use among adolescents: Risk pattern, implications and possible explanatory variables. *Adicciones*, 31, 64–77. doi:10.20882/adicciones.1212.
- Riala, K., Hakko, H., Isohanni, M., Pouta, A. & Räsänen, P. (2005). Is initiation of smoking associated with the prodromal phase of schizophrenia? *Journal of Psychiatry y Neuroscience*, 30, 26–32. doi:10.1016/j.psychres.2005.07.014.
- Rowe, C., Santos, G.-M., Behar, E. & Coffin, P. O. (2016). Correlates of overdose risk perception among illicit opioid users. *Drug and Alcohol Dependence*, 159, 234–239. doi:10.1016/j.drugalcdep.2015.12.018.
- Saha, S., Scott, J. G., Varghese, D., Degenhardt, L., Slade, T. & McGrath, J. J. (2011). The association between delusional-like experiences, and tobacco, alcohol or cannabis use: a nationwide population-based survey. *BMC Psychiatry*, 11, 202. doi:10.1186/1471-244X-11-202.
- Schubart, C. D., Van Gastel, W. A., Breetvelt, E. J., Beetz, S. L., Ophoff, R. A., Sommer, I. E. C., ... Boks, M. P. M. (2011). Cannabis use at a young age is associated with psychotic experiences. *Psychological Medicine*, 41, 1301–1310. doi:10.1017/S003329171000187X.
- Sendino, R., Álvares, E., Brime, B., Llorens, N., Ruiz, A. & Sánchez, E. (2016). Informe 2016: alcohol, tabaco y drogas ilegales en España. *Observatorio Español de La Droga y Las Toxicomanías. Ministerio de Sanidad y Servicios Sociales*, 72. doi:10.1007/s13398-014-0173-7.2.
- Shakoor, S., Zavos, H. M. S., Haworth, C. M. A., McGuire, P., Cardno, A. G., Freeman, D. & Ronald, A. (2016). Association between stressful life events and psychotic experiences in adolescence: evidence for gene-environment correlations. *British Journal of Psychiatry*, 208, 532–538. doi:10.1192/bjp.bp.114.159079.
- Soto-Brandt, G., Portilla Huidobro, R., Huepe Artigas, D., Rivera-Rei, A., Escobar, M. J., Salas Guzman, N., ... Castillo-Carniglia, A. (2014). Validity evidence of the Al-

- cohol, Smoking and Substance Involvement Screening Test (ASSIST) in Chile. *Adicciones*, 26, 291–302.
- Stewart, D. W., Cohen, A. S. & Copeland, A. L. (2010). Cigarette smoking across the schizotypy spectrum. *Psychiatry Research*, 179, 113–115. doi:10.1016/J.PSYCHRES.2010.04.038.
- Szoke, A., Galliot, A. M., Richard, J. R., Ferchiou, A., Baudin, G., Leboyer, M. & Schürhoff, F. (2014). Association between cannabis use and schizotypal dimensions - A meta-analysis of cross-sectional studies. *Psychiatry Research*, 219, 58–66. doi:10.1016/j.psychres.2014.05.008.
- Van Gastel, W. A., Wigman, J. T. W., Monshouwer, K., Kahn, R. S., Van Os, J., Boks, M. P. M. & Vollebergh, W. A. M. (2012). Cannabis use and subclinical positive psychotic experiences in early adolescence: findings from a Dutch survey. *Addiction*, 107, 381–387. doi:10.1111/j.1360-0443.2011.03626.x.
- Van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P. & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: evidence for a psychosis proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine*, 39, 179–195. doi:10.1017/S0033291708003814.
- Vázquez, F. & Becoña, E. (2000). Factores de riesgo y escalada cannabinoide. *Adicciones*, 12 (Suppl. 2), 175–184. doi:10.20882/adicciones.680.
- Verdoux, H. & Van Os, J. (2002). Psychotic symptoms in non-clinical populations and the continuum of psychosis. *Schizophrenia Research*, 54, 59–65. doi:10.1016/S0920-9964(01)00401-7.
- Weiser, M., Reichenberg, A., Grotto, I., Yasvitzky, R., Rabinowitz, J., Lubin, G., ... Davidson, M. (2004). Higher rates of cigarette smoking in male adolescents before the onset of schizophrenia: a historical-prospective cohort study. *American Journal of Psychiatry*, 161, 1219–1223. doi:10.1176/appi.ajp.161.7.1219.
- WHO Assist Working Group. (2002). The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): development, reliability and feasibility. *Addiction*, 97, 1183–1194. doi:10.1046/j.1360-0443.2002.00185.x.
- Zammit, S., Allebeck, P., Dalman, C., Lundberg, I., Hemmingsson, T. & Lewis, G. (2003). Investigating the association between cigarette smoking and schizophrenia in a cohort study. *American Journal of Psychiatry*, 160, 2216–2221. doi:10.1176/appi.ajp.160.12.2216.