

# Adolescent substance use and its association with risk and protective factors. An exploratory analysis of the large-scale school survey of Comunidades Que se Cuidan, Colombia

## *Uso de sustancias en adolescentes y su asociación con factores de riesgo y protección. Un análisis exploratorio de la encuesta escolar a gran escala de Comunidades Que se Cuidan, Colombia*

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### Abstract

*Communities That Care (CTC)* is a prevention system aimed at reducing antisocial behaviors in adolescents. In Colombia, this system has been developed and adapted under the name of *Comunidades Que se Cuidan (CQC)*. Successful implementation of CQC depends on valid associations between measured risk and protective factors (RPFs) for substance use and substance use outcomes. This study assessed these associations using large-scale, school-based surveys of Colombian youth. A cross-sectional analysis was performed. Data from 23 communities in Colombia were collected between 2012 and 2016 from young people ( $N = 50,946$ ) aged 10 to 19 years. Dichotomous alcohol, cigarette, cannabis, and other illegal drug use outcomes were assessed for past 30-day, past-year, and lifetime use. Logistic regression analyses, adjusting for age, gender, and age by RPF, and gender by RPF interactions, were performed for each RPF. All the associations of the 14 RPF evaluated were statistically significant ( $p < .001$ ). Regarding observed effect sizes, 3.0% were considered very small ( $0.70 \geq OR \leq 1.43$ ), 51.7% small ( $0.70 \geq OR \geq 1.43$ ), 42.6% medium ( $0.40 \geq OR \geq 2.48$ ) and 7.1% large ( $0.23 \geq OR \geq 4.27$ ). Significant main effects for age and gender, and their interactions with RPFs were found for most RPFs. Findings from this study demonstrate the viability of RPFs for adolescent substance use as focal points for intervention planning, development, and evaluation of community-based prevention systems like CQC that rely on epidemiologic data for local decision making.

**Keywords:** Risk factors; Substance use; Adolescents; Prevention.

### Resumen

*Communities That Care (CTC)* es un sistema preventivo que busca disminuir comportamientos problemáticos en adolescentes. En Colombia, este sistema ha sido adaptado bajo el nombre de *Comunidades Que se Cuidan (CQC)*. Este estudio validó las asociaciones entre los factores de riesgo y protección (FRP) para el uso de sustancias psicoactivas (SPA) medidos por CQC y las prevalencias de consumo de estas en adolescentes colombianos. Entre 2012 y 2016, se aplicó una encuesta a gran escala en jóvenes de 10 a 19 años ( $N = 50,946$ ) pertenecientes a 23 comunidades de Colombia. Se analizó de forma transversal la asociación entre los FRP con el consumo de alcohol, cigarrillo, marihuana y otras drogas ilegales en los últimos 30 días, año y alguna vez en la vida. Se realizaron regresiones logísticas, ajustando por edad, sexo y sus interacciones con cada FRP. Todas las asociaciones de los 14 FRP evaluados fueron significativas ( $p < .001$ ). De los efectos observados, 3,0% se consideraron efectos muy pequeños ( $0,70 \leq OR \leq 1,43$ ), 51,7% pequeños ( $0,70 \geq OR \geq 1,43$ ), 42,6% medianos ( $0,40 \geq OR \geq 2,48$ ) y 7,1% grandes ( $0,23 \geq OR \geq 4,27$ ). Se encontraron asociaciones significativas para edad, sexo y sus interacciones con los FRP para la mayoría de FRP. Los hallazgos demuestran la validez de los FRP estudiados para la planificación, el desarrollo y la evaluación futura de sistemas preventivos comunitarios como CQC, los cuales se basan en datos epidemiológicos para la toma de decisiones locales.

**Palabras clave:** Factores de riesgo; Consumo de SPA; Adolescentes; Prevención.

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Adolescence is a stage in which the vulnerability to engaging in high-risk behaviors, including the use of psychoactive substances (PAS) (Pérez & Scoppetta, 2009) is high. People at this life stage are still in a period of brain maturation; the use of PAS therefore implies an even greater risk (Gruber, Sagar, Dalhgren, Racine & Lukas, 2012; Scoppetta, Pérez & Lanziano, 2011). It has been found that adolescents are most vulnerable to the neurotoxic effects of alcohol and drugs, which produce negative consequences at the cognitive level (Guerri & Pascual, 2010; Zeigler et al., 2005). Similarly, alcohol abuse at a young age is linked to a lower volume in the hippocampus and in the pre-frontal cortex, which is associated with poor verbal, attentional and visuospatial performance (Bellis et al., 2000; Medina, Schweinsburg, Cohen-Zion, Nagel & Tapert, 2007). Given the attendant educational, legal, family, emotional and health problems, this phenomenon generates great concern (Espada, Griffin, Botvin & Méndez, 2003; Pérez & Scoppetta, 2009; Wills et al., 2013).

The latest study of PAS use among the Colombian school population conducted by the Ministry of Justice and Law, Ministry of National Education and Ministry of Health and Social Protection (2011) showed that the substance with the highest prevalence among young people is alcohol. Some of the core conclusions of this study are related to: (a) a concern about the early ages of onset of legal and illegal substance use found, (b) a need to take a preventive approach to reduce alcohol and tobacco use, and, (c) a need to increase effective strategies to prohibit the sale of alcohol to minors.

It is important to keep in mind that drug use is a heterogeneous phenomenon that changes over time (Glantz, Conway & Colliver, 2005; Sloboda, 2005; Scoppetta et al., 2011; Thatcher & Clark, 2008). Constant assessment of its prevalence and incidence, as well as of associated risk factors is therefore essential as it informs future prevention and intervention strategies to ensure their effectiveness (Clayton, 1992; Hawkins, Catalano & Miller, 1992; Sloboda, Glantz & Tarter, 2012). In Colombia, prevention initiatives have unfortunately not been guided by epidemiological data, nor have they included systematic methodologies in their assessment. Therefore, there is a pressing need to identify the risk and protective factors associated with PAS use in Colombian adolescents from a scientific perspective.

In the early 1990's in the United States, Richard F. Catalano and J. David Hawkins developed the preventive system known as Communities That Care (CTC) (Hawkins et al., 2008a). CTC's main objective is to provide tools for communities to generate and use their own epidemiological data on risk and protective factors for PAS use, prioritize them, and implement effective evidence-based interventions in answer to specific factors established as priorities (Arthur, Hawkins, Pollard, Catalano & Baglioni, 2002;

Hawkins, 2006). To determine the risk and protection profiles for communities, CTC developed the Communities That Care Youth Survey (CTCYS) instrument. This questionnaire allows a simple diagnostic assessment of the specific risk in adolescents (Arthur et al., 2002; Brown et al., 2009; Hawkins, 2006).

The original CTC youth survey assesses 25 risk factors and 13 protective factors in the domains: (a) community, (b) school, (c) family, and (d) individual and peers (Arthur et al., 2002; Hawkins, 2006). These risk factors respond to those which have been reported as predictors of various problematic behaviors, such as the use of PAS (Hawkins et al., 1992; Herrenkohl, Lee, Kosterman & Hawkins, 2012; Kenny & Schreiner, 2009; Kilpatrick et al., 2000). CTC has shown to be effective in reducing the incidence and prevalence of PAS use, violence and juvenile delinquency by addressing and reducing the associated factors of risk and protection (RPFs) (Feinberg, Greenberg, Osgood, Sartorius & Bontempo, 2007; Feinberg, Jones, Greenberg, Osgood & Bontempo, 2010; Hawkins et al., 2008a; Hawkins et al., 2008b; Hawkins, Oesterle, Brown, Abbott & Catalano, 2014; Hawkins et al., 2009; Hawkins et al. 2012; Oesterle et al., 2015). This has led to its implementation in other countries such as Germany, Chile, Croatia, Sweden, Australia and the Netherlands (Toumbourou, 1999; Jonkman et al., 2009).

For its part, Colombia began the process of adapting CTC under the name of Comunidades Que se Cuidan (CQC) (Pérez-Gómez, Mejía-Trujillo, Brown & Eisenberg, 2016) in 2012. The Nuevos Rumbos corporation was entrusted with implementing this task, and it has since been able to adapt the first Latin American instrument derived from CTC, which focuses on 18 risk factors and 8 protective factors, assessed by cut points specific to the country. As part of the implementation process it is necessary to carry out the validation of the associations between risk and protection factors (RPFs) for the use of PAS reported in the literature, and the prevalence of their use. For this reason, the present study aims to evaluate the association and the effect size between the RPFs measured by CQC and the use of PAS among Colombian adolescents in order to guarantee successful future adaptation and implementation of the CQC system.

## Method

### Participants

The sample consisted of students (N = 52,588) with low and middle socioeconomic backgrounds attending 6th through 11th grades (age range = 10 to 19 years) in 114 public and private schools in 23 communities of Colombia; all students at school on the day the questionnaire was administered were included in the sample. Of these, 52.8% were female and 48.2% male. Mean age was 14.2 years (SD

= 1.9, range 11 to 19). The level with most students participating was the sixth grade (19.9%), followed by seventh (19.1%), eighth (18.2%), ninth (15.7%), tenth (14.7%) and eleventh (12.4%).

### **Instrument**

We used the adaptation of the Communities That Care Youth Survey (CTCYS) by Arthur et al. (2002) for Spanish, called Encuesta para Jóvenes de Comunidades Que Se Cuidan (EJCQC) (Mejía-Trujillo, Pérez-Gómez & Reyes-Rodríguez, 2015). The instrument is aimed at people aged between 10 and 19, and is designed to be applied in the school environment. The first part of the questionnaire collects demographic information and the prevalence of the last-month, last-year and lifetime use of alcohol, cigarettes, marijuana and other illegal drugs (cocaine, coca paste and cocaine base, inhalants, ecstasy, mushroom, acids, tranquilizers, poppers, amphetamines, heroin and dick). In the second part, 18 of 25 risk factors and 8 of 11 protection factors covered by CTC are assessed (Mejía-Trujillo et al., 2015; Pérez-Gómez et al., 2016).

The questionnaire has shown acceptable sensitivity and specificity in the US population and in five ethnic groups, including the Latino population (Arthur et al, 2007), as well as good predictive validity (Briney, Brown, Hawkins & Arthur, 2012). Internal consistency is high for the complete questionnaire ( $\alpha = 0.82$ ) with the study population. In terms of the instrument's validity, Nuevos Rumbos corporation carried out a confirmatory factor analysis to assess construct validity, and the results have shown good and acceptable goodness of fit indices for most of the risk and protection factors (Mejía-Trujillo et al., 2015).

### **Procedure**

Authorization was obtained from the relevant education authorities of the 23 communities located in different areas of Colombia. Informed consent was then obtained from the school directors, and data confidentiality was agreed and guaranteed. The survey was completely anonymous and students were informed that their participation was voluntary and that they could stop responding at any time they wished.

Subsequently, data was collected during the period from 2012 to 2016. The questionnaire was administered during the school day by previously trained experts from the Nuevos Rumbos corporation. In order to include more measures of risk in the survey, we used the missing data methodology known as 3-Form Design (Graham, 2012; Little & Rhemtulla, 2013). This method allowed us to distribute all the RPFs across three different versions of the survey. In this way, the number of valid cases for each RPF varied according to the version. Although the RPFs did not all have the same number of observations, only those that presented at least 70% of the cases in the total sample ( $n > 36,800$ )

were included in the analysis. Given that the present study focused on validating the existing associations between RPFs and behaviors through the interpretation of adjusted odds ratios, and because the sample was large, it was not considered necessary to take missing data into account.

### **Data analysis**

The questionnaires were processed using optical readers, and the STATA 13 statistical package was used to perform a transversal analysis of the EJCQC. As part of the strategy to ensure the quality of the information, three questions were included in the instrument to identify answers of questionable validity. In this way, those students who reported the use of a fictitious drug were excluded from the sample, with the result that, of the 52,588 initial observations, 3.1% ( $n = 1,642$ ) were eliminated from the subsequent analyses, so that the final sample consisted of 96.9% ( $n = 50,946$ ) of the initial total.

The analysis was performed on 11 of the EJCQC's 18 risk factors and 3 of its 8 protective factors. This was because the factors not included were incorporated into the EJCQC after this analysis. The 14 RPFs (11 risk factors and 3 protective factors) were dichotomized (0 = low risk or low protection, 1 = high risk or high protection) using the cut-off points designed specifically for CQC and normalized for each school year (Mejía-Trujillo et al., 2015). Likewise, the means of each of the variables to be analyzed were centered in order to obtain a single measure of association for age, sex and their possible interactions and thereby facilitate the interpretation of the main effects. Logistic regression was used to assess the association between each RPF and the prevalence of alcohol, tobacco, marijuana and other illegal drug use in the last 30 days, last year and lifetime. Based on these considerations, in order to evaluate the individual association of each of the 12 prevalences of use and the 14 RPFs, the following logistic regression model was fitted:

$$\log [ p_i / (1 - p_i) ] = \beta_0 + \beta_1 FRPc + \beta_2 EDADc + \beta_3 SEXOc + \beta_4 FRPc \cdot EDADc + \beta_5 FRPc \cdot SEXOc$$

where  $p_i$  is equal to the probability of use of the substance in question of the  $i$ -th person,  $RPFc$  is the centered variable of the type of risk or protection according to the factor assessed,  $AGEc$  is the centered age variable in years and  $SEXc$  the sex variable.  $RPFc \cdot AGEc$  and  $RPFc \cdot SEXc$  correspond to the centered variable of the type of risk or protection depending on exposure and their respective interactions with the centered variables of age and sex. Given the number of hypothesis tests, the analysis was performed with  $p$ -values adjusted by the Bonferroni method.

The proposed analysis matched the overall concept of CTC, which considers that risk factors can independently influence substance use behavior (Arthur et al., 2007).

Therefore, it was considered that analyzing this association in models with multiple risk factors could lead to a situation of multicollinearity among the covariates. In addition, the aim of the study was not to understand the variability of the use of each substance but to assess the associations and their directionality, and understand their strength of association through the main effect sizes of each RPF.

### Ethical considerations

Informed consent was provided by the school directors, who informed the parents or legal representatives of the children using the passive consent method. Additionally, students gave their approval at the moment of survey administration. The consent and approval forms informed participants about the objectives of the study, its confidential, anonymous and voluntary nature, the procedures of anonymous data storage through codes, as well as the possible risks and benefits. Students were again informed in the classroom that the data provided in the survey were confidential, so they should not write any information that could identify them. It was also mentioned that participation was voluntary, so students could refuse to participate, withdraw at any time and/or request the destruction of the record if they did not wish it to be included in the study. The project has the endorsement of the Ethics Committee of the Nuevos Rumbos corporation, which guarantees compliance with the ethical principles of research enshrined in the law.

## Results

### Prevalences of use

Alcohol was the most frequently used substance (last 30 days 42.7%, last year 70.1%, and lifetime 73.7%), followed by cigarettes (last 30 days 10.5%, last year 21.3%, and lifetime 26.2%), marijuana (last 30 days 5.1%, last year 10.3%, and lifetime 12.1%) and the category of other illegal drugs (last 30 days 3.7%, last year 7.4%, and lifetime 10.3%). In general, men had higher prevalences of use than women, especially for cigarettes and marijuana (Table 1).

### Analysis of RPFs and prevalences of use

The association of 11 risk factors and 3 protection factors for each of the 12 PAS use prevalences was evaluated. Figure 1 shows the main effects between each individual

RPF and the prevalence of alcohol, cigarettes, marijuana and other illegal drugs (cocaine, basuco, inhalants, ecstasy, mushrooms, acids, tranquilizers, poppers, amphetamines, heroin and dick) in the time categories lifetime, year and month. The effect was reported in odds ratios (OR) adjusted for age, sex and their respective interactions for each RPF.

Figure 1 presents a categorization in grayscale (from white to black). The cells in dark gray scales and blank numerical values represent the possibilities of developing the associated risk behavior. Cells in light gray scales and numerical values in black indicate the buffering effects of the protective factors studied. The gray scales were determined through the conversion to OR of the cut points for the interpretation of the size of the effect (Cohen, 1988).

OR values from 0.71 to 1.42 were considered to be very small effects, as established by Sawilowsky (2009), and were thus not included in the color scales. This approach allowed us to observe and compare each of the 168 independent effects obtained for each substance and time category in terms of the specific strength of association of the effect. When the association was not statistically significant or the effect was considered very small, the OR value appears in white.

Although all 168 associations evaluated were highly significant ( $p < .05$ ), the intensities of the gray color varied only for only for 97% since five (3.0%) effects belonging to protective factors were considered very small according to the established criteria ( $OR = [0.71-0.99]$ ). It is important to note that these five effects are from associations with alcohol use (Figure 1). In terms of the observed effects, 3.0% were considered very small ( $0.70 \leq OR \leq 1.43$ ), 51.7% small ( $0.70 \geq OR \geq 1.43$ ), 42.6% medium ( $0.40 \geq OR \geq 2.48$ ) and 7.1% large ( $0.23 \geq OR \geq 4.27$ ). The domain with the highest odds ratios for the use of any substance was that of individual-peer, followed by family, school and community. In general, it was found that substance availability, low perception of substance use risk, favorable attitudes towards substance use, and substance use among friends were the most important predictors of PAS use.

### Associations in the community domain

At the community level, the effects on PAS use were analyzed for two risk factors: 1) substance availability; and

Table 1. Substance use prevalences by sex and time period

Substance	Last 30 days			Last 12 months			Lifetime		
	Female	Male	Both	Female	Male	Both	Female	Male	Both
Alcohol	41.9%	41.5%	41.7%	69.9%	70.3%	70.1%	73.3%	74.1%	73.7%
Cigarettes	8.6%	12.3%	10.5%	18.5%	24.0%	21.3%	23.3%	29.0%	26.2%
Marijuana	4.2%	6.0%	5.1%	8.8%	11.8%	10.3%	10.4%	13.7%	12.1%
Other illegal drugs	2.6%	2.8%	2.7%	7.0%	7.8%	7.4%	9.5%	11.2%	10.3%

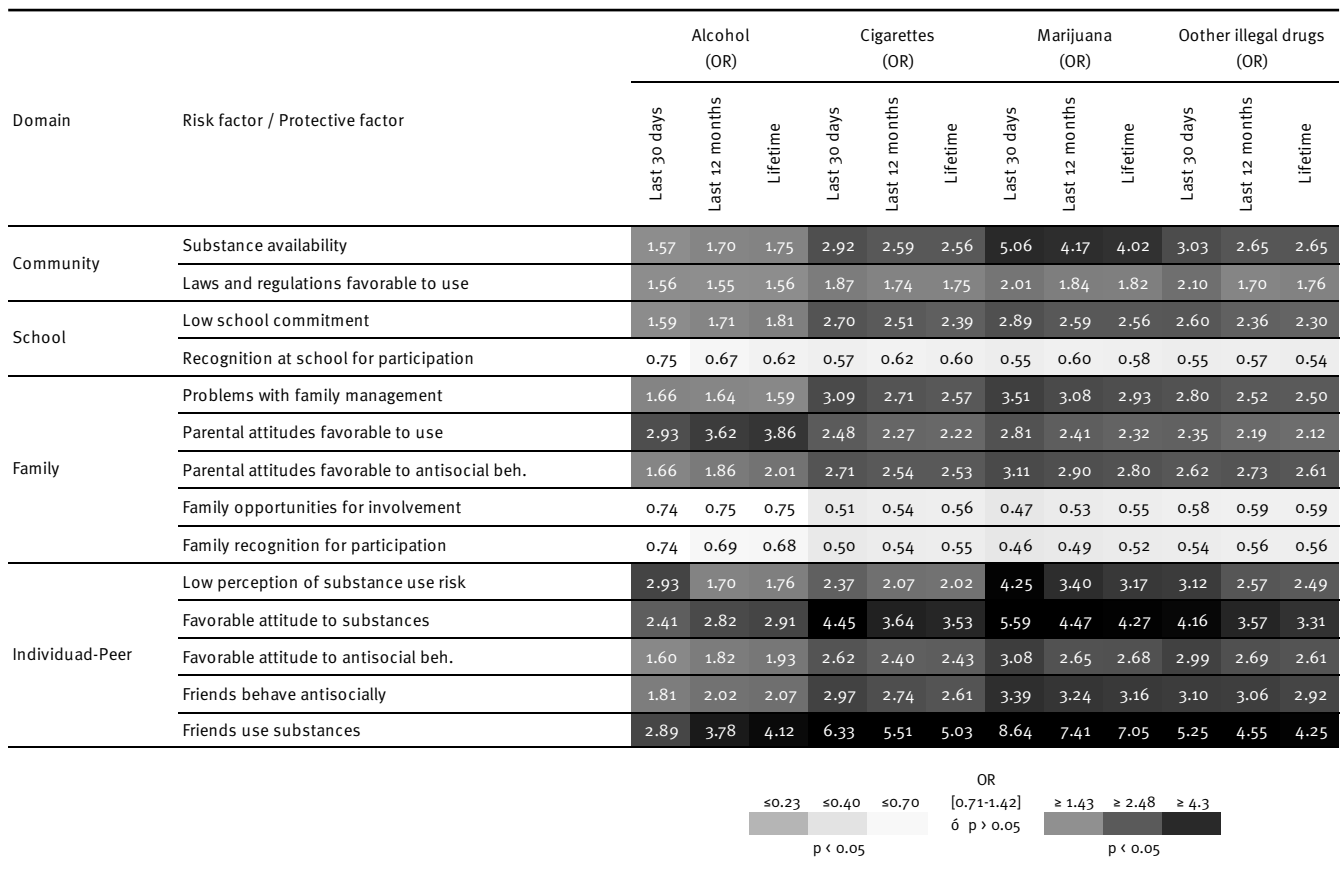


Figure 1. Heat map of adjusted odds ratios (OR) between risk and protective factors of the CQC youth survey by domain and use of alcohol, tobacco, marijuana and other illegal drugs for both sexes.

Note. OR: odds ratios adjusted by age, sex, age x [risk factor or protective factor], sex x [risk factor or protective factor].

2) laws and regulations favorable to use. In general, substance availability was a more important risk factor than laws and regulations favorable to consumption. A median effect size was observed in 66.7% of the associations between availability of drugs and the use of PAS among young people, especially for cigarettes, marijuana and other illegal drugs. In contrast, 100% of the effects between laws and rules favorable to PAS use were considered small. The association that presented the largest effect size was that between substance availability and marijuana use, which raised the probability of substance use in the last 30 days by up to five times (OR = 5.06, 95% CI: 4.46, 5.74) among those young people who perceived its availability as high.

The likelihood of marijuana use in the last year among young people who reported high availability was 4.17 times as high as those who did not (OR = 4.17, 95% CI: 3.84, 4.54) and 4.02 times higher for lifetime use compared to those who perceived low availability (OR = 4.02, 95% CI: 3.72, 4.35). As for the other PAS, the set of other illegal substances had larger effect sizes for their use compared

to the effect sizes observed for cigarettes and alcohol. No protective factors were included in this domain (Figure 1. Community Domain).

### Associations in the school domain

In the school domain, the effects on PAS use were analyzed for the risk factor: 1) low school commitment, and the protective factor: 2) favorable parental attitudes towards substance use. A median effect size was observed in 50.0% of the associations between low school commitment and PAS use among young people. The other 50.0% was considered low. The strongest associations were observed among young people who reported low school commitment with consumption of marijuana in the last 30 days (OR = 2.89, 95% CI: 2.59, 3.22), cigarettes (OR = 2.70, 95% CI: 2.51, 2.90) and other illegal drugs (OR = 2.60, 95% CI: 2.29, 2.95). On the other hand, the protective factor of school recognition for participation generally showed small effects. The strongest protective effect was observed in the 46% decrease in the lifetime use of illegal substances

(OR = 0.54, 95% CI: 0.50, 0.59), 45% reduction in the use of other illegal drugs in the last month (OR = 0.55, IC95%: 0.48, 0.64) and marijuana in the last month (OR = 0.55, IC95%: 0.49, 0.62). School recognition had the lowest protective effect on alcohol use, in particular in the last 30 days (OR = 0.75, 95% CI: 0.71, 0.78), which was the least favorably affected by the presence of this protective factor (Figure 1. School Domain)

### **Associations in the family domain**

Three risk factors were analyzed: 1) problems in family management; 2) favorable attitudes of parents towards the use of drugs; 3) favorable attitudes of parents toward problem behavior; and two protection factors: 1) family opportunities to get involved; 2) recognition in the family for participation. A median effect size was observed in 63.9% of the associations for the three risk factors and the use of PAS in the young. The other 36.1% was considered small. The most relevant associations were observed in young people who reported favorable attitudes of parents towards the use of drugs and alcohol consumption in the last year (OR = 3.86, 95% CI: 3.62, 4.11) and sometime in life (OR = 3.62; 95% CI: 3.42, 3.82). Another association to highlight was between family management problems and marijuana use in the last 30 days (OR = 3.51, 95% CI: 3.14, 3.93).

As for the protection factors, more than 83.3% were considered small and the remaining 16.7% was very small. The protection of individuals who reported family opportunities to engage in prosocial activities was considered as very low in the specific case of alcohol consumption. The same situation was observed for the association between family recognition of participation in prosocial activities and the consumption of alcohol in the last 30 days. The most relevant protective effects observed were the apparent decrease of 54.0% of the possibilities of marijuana use in the last 30 days (OR = 0.46, 95% CI: 0.42, 0.52) in young people with greater family opportunities and a 55.0% decrease (OR = 0.45, 95% CI: 0.41, 0.52) in the same type of consumption in young people who were recognized by their family given their involvement in prosocial activities (Figure 1. Family Domain)

### **Associations in the individual-peer domain**

The following risk factors were analyzed: 1) low perception of substance use risk; 2) favorable attitudes towards substance use; 3) favorable attitudes toward problematic behavior; 4) problematic behaviors among friends; 5) substance use among friends. As previously mentioned, this was the domain with most and largest effect sizes. Of the effects analyzed, 18.3% were considered large (OR  $\geq$  4.27), 60.0% medium (OR  $\geq$  2.48) and only 21.7% small (OR  $\geq$  1.43). The largest associations for all substances and time categories, with the exception of alcohol in the last month, were observed among young people who reported

substance use among friends and who had a favorable attitude toward their use. In particular, the highest ORs of all were observed between substance use among friends and the use of marijuana in the last month (OR = 8.64, 95% CI: 7.51, 9.24), year (OR = 7.41, 95% CI: 6.76, 8.11), and lifetime (OR = 7.05, 95% CI: 6.47, 7.68). The same risk factor was the most important in increasing the likelihood of cigarette smoking in the last month (OR = 6.33, 95% CI: 5.81, 6.90), year (OR = 5.51, 95% CI: 5.20, 5.82) and lifetime (OR = 5.03; 95% CI: 4.77, 5.30).

Other associations worth highlighting in connection with substance use among friends were the increases in the use of other illegal drugs in the last month (OR = 5.25, 95% CI: 4.53, 6.10), year (OR = 4.55, 95% CI: 4.17, 4.97) and lifetime (OR = 4.25, 95% CI: 3.95, 4.59). Regarding the other risk factors, the favorable attitude of young people towards substance use was highly associated with cigarette and marijuana use in the last month and the consumption of marijuana in the last year. It should be noted that problematic behavior among friends and a favorable attitude on the part of young people towards this type of behavior were in general weakly associated with alcohol use and averagely associated with the use of other substances (Figure 1. Individual-Peer Domain).

Table 2 shows the covariates that were observed as significant ( $p < .05$ ) for the association between each RPF and the lifetime use of alcohol, cigarettes, marijuana and other illegal substances. This assessment allowed us to confirm the expected association of each covariate with respect to the use of each substance. Of the covariates evaluated, age was associated with all substances. Thus, the probability of the lifetime use of any substance was higher among older students. Likewise, age had a synergistic interaction effect with the majority of RPFs for all PAS, which increased its main effect. On the other hand, sex was associated with cigarettes and all illegal substances (marijuana and other illegal substances), with males presenting the greatest likelihood of lifetime use. However, despite its relevance as a predictor of cigarette and illegal substance use, sex was not associated with alcohol use. The interaction of sex with each risk factor were most evident for cigarette smoking. With regard to protective factors, it should be noted that all interactions between sex and the protective factor were significant and synergistic for all substances except alcohol.

## **Discussion**

In line with the last national study of schoolchildren in Colombia, our research shows that the most frequently used substances were alcohol, cigarettes and marijuana. However, the prevalences of lifetime, last-year and last-month use of alcohol and cigarettes were higher than those at national level. In the specific case of marijuana, it was found that the use of this substance was twice the na-

tional average for the three prevalences (Ministry of Justice and Law, Ministry of National Education and Ministry of Health and Social Protection, 2011).

Perhaps the most important finding yielded by this study was the evidence in favor of the set of 14 selected RPFs in their four domains (family, community, school and individual-peer) as predictors of PAS use among Colombian adolescents, thereby concurrently validating the CQC RPFs with those of the present study and those validated in the literature in terms of directionality and strength (Arthur et al., 2007, Briney et al., 2012; Glaser, Van Horn, Arthur, Hawkins & Catalano, 2005; Hawkins et al., 1992). This finding provides relevant information for Latin America, since it allows us to assume that the RPFs for PAS use could be universal. This in turn implies that they are relevant and appropriate for the implementation of preventive-type initiatives aiming to reduce and monitor over time the prevalence of alcohol, cigarette, marijuana and other illegal substance use among adolescents.

In the community domain specifically, the risk factor substance availability was an appropriate predictor of high illegal substance use for both the last year and the last month; this is similar to the findings of the National Study of the Consumption of Psychoactive Substances in the School Population of Colombia, which reported that a greater perception of PAS being easy to obtain was linked to their use (Ministry of Justice and Law, Ministry of National Education, and Ministry of Health and Social Protection, 2011). This situation is of special interest in the Colombian context, since minors have a generalized perception that PAS are easily procured, which could be related to low controls

nationally over the sale to minors, as well as the long tradition of substances such as alcohol being acceptable from an early age, leading to a potential increase in the use of other substances such as tobacco or illegal substances.

Similarly, the relationship between the factors in the family domain and the use of PAS found in this study was also found in the National Study of Consumption of Psychoactive Substances in the School Population of Colombia (Ministry of Justice and Law, Ministry of National Education, and Ministry of Health and Social Protection, 2011). This confirms that working with families is fundamental for prevention. Hawkins, Catalano & Miller (1992) support the premise that parents need adequate family management based on the ability to establish rules and limits, to assert discipline through negotiation and to maintain good relationships with family members. Likewise, the relationship between the parents influences the use of PAS by children, so that good relationships and communication reflected in opportunities and recognition in the family act as protective factors reducing the risk of substance use (Plenum-Sanz, Iraurgi, Martínez & Cosgaya, 2006; Mallick 2009).

In the individual-peer domain, results showed that the three risk factors favorable attitudes towards substance use, favorable attitudes towards problematic behavior, and substance use among friends were strongly associated with the frequent PAS use. This corresponds to findings in other studies which reported that these factors are perhaps the best predictors for substance use and can be exemplified by the selection of friends for substance use (Dishion & Owen, 2002), peers offering PAS, and persuasion by friends and environments of use (Moral & Ovejero, 2008). Moreo-

Table 2. Statistically significant covariables and interactions ( $p < 0.001$ ) by RPF and lifetime PAS use

Risk factor / Protective factor	Alcohol	Cigarettes	Marijuana	Other illegal drugs
Substance availability	A	A, S, AxR	A, S, AxR, SxR	A, S
Laws and regulations favorable to use	A	A, S, AxR	A, S	A, S
Low school commitment	A, S, SxR	A, S, AxR	A, S	A, S
Recognition at school for participation	A	A, S	A, S	A, S
Problems with family management	A	A, S, SxR	A, S, SxR	A, S
Parental attitudes favorable to use	A	A, S	A, S	A, S
Parental attitudes favorable to antisocial beh.	A	A, S, SxR	A, S, SxR	A, S
Family opportunities for involvement	A	A, S, AxP, SxP	A, S, AxP	A, S, AxP
Family recognition for participation	A	A, S, SxP	A, S, AxP, SxP	A, S, AxP
Low perception of substance use risk	A	A, S, SxR	A, S	A
Favorable attitude to substances	A	A, S, AxR, SxR	A, S, AxR	A
Favorable attitude to antisocial beh.	A, SxR	A, S, SxR	A, S, SxR	A, S, SxR
Friends behave antisocially	A	A, S, SxR	A, S	A, S, SxR
Friends use substances	A	A, S	A, S	A, AxR

Note. † RFP= risk and protective factors; PAS=psychoactive substances; A=Age; S= Sex; AxR= Interaction of age and risk factor; AxP= Interaction of age and protective factor; SxR= Interaction of sex and risk factor; SxP= Interaction of sex and protection factor; beh.= behavior.

ver, drinking alcohol tends to begin with increasing age, as shown by Pérez and Scoppetta (2008), and could occur with the aim of exploring, seeking recognition and acceptance of a peer group (Cicua, Méndez & Muñoz, 2008). Given this evidence, the adoption of approaches such as those proposed by CTC and now by CQC in Colombia is essential for communities so that they can prioritize risk factors and intervene on them individually in order to prevent problematic behaviors among young people.

The great variability in the effect sizes observed at a general level can be explained by the dynamism and heterogeneity of the phenomenon of PAS use, which, as previously mentioned, has been reported as changing over time (Glantz et al., 2005; Sloboda, 2005; Thatcher & Clark, 2008; Scoppetta et al., 2011) and in the specific case of our study, is found to change across the domains studied. Given this situation, instruments such as the EJCQC, which not only measures the prevalence of PAS use but also the exposure to the main risk factors that explain its variability, make it a tool to be applied continuously at a national level at least every two years, according to the CTC recommendations (Hawkins, Catalano & Arthur, 2002).

### Limitations and recommendations

Finally, the main limitation of this study, in our opinion, is the type of design selected to evaluate associations, since its transversal nature implies a loss of explanatory power with regard to the relationships evaluated, and the inferences are subject to possible biases of reverse causality. However, given that these same factors have also been evaluated longitudinally in other contexts, we have assumed for the purposes of this paper that their proven universality also allows us to confirm the temporality of the relationship and therefore ignore the bias. Despite this, it is recommended to continue reporting future findings through the use of longitudinal measurements that allow a systematic, dynamic and continuous assessment of the communities, highlighting the changes or stability of the risk factors presented, and thereby making it possible to focus and implement prevention strategies even more effectively. Furthermore, it is important to mention that measurements were obtained by self-report of the subjects surveyed. However, thanks to the rigor with which the instruments were applied, it is considered that in this case the self-report was an adequate and direct method for the assessment of the cognitive responses and the subjective experiences of the individual.

### Conclusions

This research is one of the few of its kind to inform about the risk profiles and behavior associated with PAS use in Colombia using an epidemiological approach based on risk indicators reported in the evidence and now validated for our country.

The findings of this study have shown the validity of the RPFs studied as starting points for the planning, development and future assessment of interventions designed to reduce PAS use in Colombia. Likewise, the results highlight the importance of the use of preventive community systems such as CQC, which are based on epidemiological data for local decision making.

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### Conflicts of interest

There are no conflicts of interest.

### References

- Arthur, M. W., Briney, J. S., Hawkins, J. D., Abbot, R. D., Brooke-Weiss, B. L. & Catalano, R. F. (2007). Measuring risk and protection in communities using the Communities That Care Youth Survey. *Evaluation and Program Planning*, 30, 197–211. doi:10.1016/j.evalproplan.2007.01.009.
- Arthur, M. W., Hawkins, J. D., Pollard, J. A., Catalano, R. F. & Baglioni A. J., Jr. (2002). Measuring risk and protective factors for substance use, delinquency and other adolescent problems behaviors: The Communities That Care Youth Survey. *Evaluation Review*, 24, 575–601. doi:10.1177/019384102237850.
- De Bellis, M. D., Clark, D. B., Beers, S. R., Soloff, P. H., Boring, A. M., Hall, J., ... Keshavan, M. S. (2000). Hippocampal volume in adolescent-onset alcohol use disorders. *American Journal of Psychiatry*, 157, 737–744. doi:10.1176/appi.ajp.157.5.737.
- Briney, J. S., Brown, E. C., Hawkins, J. D. & Arthur, M. W. (2012). Predictive validity of established cut points for risk and protective factor scales from the Communities That Care Youth Survey. *Journal of Primary Prevention*, 33, 249–258. doi:10.1007/s10935-012-0280-1.
- Brown, E. C., Graham, J. W., Hawkins, J. D., Arthur, M. W., Baldwin, M. M., Oesterle, S. & Abbott, R. D. (2009). Design and analysis of the Community Youth Development Study longitudinal cohort sample. *Evaluation Review*, 33, 311–334.
- Clayton, R. R. (1992). Transitions in drug use: Risk and protective factors. In M. D. Glantz & R. W. Pickens (Eds.), *Vulnerability to drug abuse* (pp. 15–51). Washington, DC: American Psychological Association. doi:10.1037/10107-001.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd Ed.). Hillsdale, NJ: Erlbaum Associates.



- Crow, I., France, A., Hacking, S. & Hart, M. (2004). *Does Communities That Care work? An evaluation of a community-based risk prevention programme in three neighbourhoods*. York: Joseph Rowntree Foundation.
- Dishion, T. J. & Owen, L. D. (2002). A longitudinal analysis of friendships and substance use: Bidirectional influence from adolescence to adulthood. *Developmental Psychology*, 38, 480–491. doi:10.1037//0012-1649.38.4.480.
- Espada, J. P., Botvin, G. J., Griffin, K. W. & Méndez, X. (2003). Adolescencia: Consumo de alcohol y otras drogas. *Papeles del Psicólogo*, 23, 9–17.
- Feinberg, M. E., Greenberg, M. T., Osgood, D. W., Sartorius, J. & Bontempo, D. (2007). Effects of the Communities That Care model in Pennsylvania on youth risk and problem behaviors. *Prevention Science*, 8, 261–270.
- Feinberg, M. E., Jones, D., Greenberg, M. T., Osgood, D. W. & Bontempo, D. (2010). Effects of the Communities That Care model in Pennsylvania on change in adolescent risk and problem behaviors. *Prevention Science*, 11, 163–171.
- Glantz, M. D., Conway, K. P. & Colliver, J. D. (2005). Drug abuse heterogeneity and the search for subtypes. In Z. Sloboda (Ed.). *Epidemiology of drug abuse* (pp. 15–28). New York, NY: Springer.
- Glaser, R. R., Van Horn, M. L., Arthur, M. W., Hawkins, J. D. & Catalano, R. F. (2005). Measurement properties of the Communities That Care Youth Survey across demographic groups. *Journal of Quantitative Criminology*, 21, 73–102.
- Graham, J. W. (2012). *Missing data: Analysis and design*. New York, NY: Springer. doi:10.1007/978-1-46144018-5\_1
- Gruber, S. A., Sagar, K. A., Dahlgren, M. K., Racine, M. & Lukas, S. E. (2012). Age of onset of marijuana use and executive function. *Psychology of Addictive Behaviors*, 26, 496–506. doi:10.1037/a0026269.
- Guerri, C. & Pascual M. (2010). Mechanisms involved in the neurotoxic, cognitive, and neurobehavioral effects of alcohol consumption during adolescence. *Alcohol*, 44, 15–26. doi:10.1016/j.alcohol.2009.10.003.
- Hawkins, J. D. (2006). Science, social work, prevention: Finding the intersections. *Social Work Research*, 30, 137–152.
- Hawkins, J. D., Catalano, R. F. & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin*, 112, 64–105.
- Hawkins, J. D., Catalano, R. F. & Arthur, M. W. (2002). Promoting science-based prevention in communities. *Addictive Behaviors*, 27, 951–976.
- Hawkins, J. D., Catalano, R. F., Arthur, M. W., Egan, E., Brown, E. C., Abbott, R. D. & Murray, D. M. (2008a). Testing Communities That Care: The rationale, design and behavioral baseline equivalence of the Community Youth Development Study. *Prevention Science*, 9, 178–190.
- Hawkins, J. D., Brown, E. C., Oesterle, S., Arthur, M. W., Abbott, R. D. & Catalano, R. F. (2008b). Early effects of Communities That Care on targeted risks and initiation of delinquent behavior and substance use. *Journal of Adolescent Health*, 43, 15–22.
- Hawkins, J. D., Oesterle, S., Brown, E. C., Arthur, M. W., Abbott, R. D., Fagan, A. A. & Catalano, R. F. (2009). Results of a type 2 translational research trial to prevent adolescent drug use and delinquency: A test of Communities That Care. *Archives of Pediatrics and Adolescent Medicine*, 163, 789–798. doi:10.1001/archpediatrics.2009.141.
- Hawkins, J. D., Oesterle, S., Brown, E. C., Monahan, K. C., Abbott, R. D., Arthur, M. W. & Catalano, R. F. (2012). Sustained decreases in risk exposure and youth problem behaviors after installation of the Communities That Care prevention system in a randomized trial. *Archives of Pediatrics Adolescent Medicine*, 166, 141–148.
- Hawkins, J. D., Oesterle, S., Brown, E. C., Abbott, R. D. & Catalano, R. F. (2014). Youth problem behaviors 8 years after implementing the Communities That Care prevention system: A community-randomized trial. *JAMA Pediatrics*, 168, 122–129.
- Herrenkohl, T. I., Lee, J. O., Kosterman, R. & Hawkins, J. D. (2012) Family influences related to adult substance use and mental health problems: A developmental analysis of child and adolescent predictors. *Journal of Adolescence Health*, 51, 129–135. doi:10.1016/j.jadohealth.2011.11.003.
- Jonkman, H. B., Haggerty, K. P., Steketee, M., Fagan, A. A., Hanson, K. & Hawkins, J. D. (2009). Communities That Care, core elements and context: Research of implementation in two countries. *Social Developmental Issues*, 30, 42–57.
- Kenny, D. T. & Schreiner, I. (2009). Predictors of high-risk alcohol consumption in young offenders on community orders: Policy and treatment implications. *Psychology, Public Policy, and Law*, 15, 54–79. doi: 10.1037/a0015079.
- Kilpatrick, D. G., Acierno, R., Saunders, B., Resnick, H. S., Best, C. L. & Schnurr, P. P. (2000). Risk factors for adolescent substance abuse and dependence: Data from a national sample. *Journal of Consulting and Clinical Psychology*, 68, 19–30.
- Little, T. D., Rhemtulla, M., Gibson, K. & Schoemann, A. M. (2013). Why the items versus parcels controversy needn't be one. *Psychological Methods*, 18, 285–300.
- Mallick, J. (2009). Parent drug education: A participatory action research study into effective communication about drugs between parents and unrelated young people. *Drugs: Education, Prevention, and Policy*, 14, 247–260. doi:10.1080/09687630601022416.
- Medina, K., L. Schweinsburg, A. D., Cohen-Zion, M., Nagel, B. J. & Tapert, S. F. (2007). Effects of alcohol and combined marijuana and alcohol use during adolescence on hippocampal volume and asymmetry. *Neurotoxicology*, 29, 141–152.

- Mejía-Trujillo, J., Pérez-Gómez A. & Reyes-Rodríguez, M. (2015). Implementación y adaptación en Colombia del sistema preventivo Communities That Care. *Adicciones*, 27, 253–264.
- Ministerio de Justicia y del Derecho, Ministerio de Educación Nacional, y Ministerio de Salud y Protección Social. (2012). *Estudio Nacional de Consumo de Sustancias Psicoactivas en Población Escolar*. Retrieved at [http://www.unodc.org/documents/colombia/Documentostecnicos/Estudio\\_Consumo\\_Escolares.pdf](http://www.unodc.org/documents/colombia/Documentostecnicos/Estudio_Consumo_Escolares.pdf).
- Moral-Jiménez, M. d. I. V. & Ovejero, A. (2008). Experimentación con sustancias psicoactivas en adolescentes españoles: perfil de consumo en función de los niveles de edad. *Revista Latinoamericana de Psicología*, 41, 533–553.
- Navarro Cicua, D. C., Méndez, M. & Muñoz, L. (2008). Factores en el consumo de alcohol en adolescentes. *Pensamiento Psicológico*, 4, 115–134.
- Oesterle, S., Hawkins, J. D., Kuklinski, M. R., Fagan, A. A., Fleming, C., Rhew, I. C., ... Catalano, R. F. (2015). Effects of Communities That Care on males' and females' drug use and delinquency 9 years after baseline in a community-randomized trial. *American Journal of Community Psychology*, 56, 217–228.
- Pérez-Gómez, A., Mejía-Trujillo, J., Brown, E. C. & Eisenberg, N. (2016). Adaptation and implementation of a science-based prevention system in Colombia: Challenges and achievements. *Journal of Community Psychology*, 44, 538–545. doi:10.1002/jcop.21781.
- Pérez, A. & Scopetta, O. (2009). *Consumo de alcohol en menores de 18 años en Colombia 2008: Estudio en 7 capitales y dos municipios pequeños*. Bogotá: Nuevos Rumbos/Duplicadas.
- Sanz, M., Iraurgi, I., Martínez-Pampliega, A. & Cosgaya, L. (2006). Conflicto marital y consumo de drogas en los hijos. *Adicciones*, 18, 39–48.
- Sawilowsky, S. S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods*, 8, 467–474.
- Scopetta, O., Pérez-Gómez, A. & Molano, C. M. (2011). Perfiles asociados al consumo de alcohol en adolescentes escolarizados mediante análisis de correspondencias múltiples. *Acta Colombiana de Psicología*, 14, 139–146.
- Sloboda, Z., Glantz, M. D. & Tarter, R. E. (2012) Revisiting the concepts of risk and protective factors for understanding the etiology and development of substance use and substance use disorders: Implications for prevention. *Substance Use & Misuse*, 47, 944–962. doi:10.3109/10826084.2012.663280.
- Sloboda, Z. (2005). Implications of epidemiologic information for effective drug abuse prevention strategies. In Z. Sloboda (Ed.), *Epidemiology of Drug Abuse* (pp. 211–223). New York, NY: Springer.
- StataCorp. (2013). *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP.
- Thatcher, D. L. & Clark, D. B. (2008). Adolescents at risk for substance use disorders: Role of psychological dysregulation, endophenotypes, and environmental influences. *Alcohol Research and Health*, 31, 168–176.
- Toumbourou, J. W. (1999). Implementing Communities That Care in Australia: A community Mobilisation approach to crime prevention. *Trends & Issues in Crime and Criminal Justice*, 122, 1–6.
- Wills, T. A., Bantum, E. O., Pokhrel, P., Maddock, J. E., Ainette, M. G., Morehouse, E. & Fenster, B. (2013). A dual-process model for early substance use: Tests in two diverse populations of adolescents. *Health Psychology*, 32, 533–542. doi:10.1037/a0027634.
- Zeigler, D. W., Wang, C. C., Yoast, R. A., Dickinson, B. D., McCaffree, M. A., Robinowitz, C. B., ... Council on Scientific Affairs, American Medical Association. (2005). The neurocognitive effects of alcohol on adolescents and college students. *Preventive Medicine*, 40, 23–32. doi:10.1016/j.ypmed.2004.04.04.

