

## Adverse childhood experiences and consumption of alcohol, tobacco and illicit drugs among adolescents of a Brazilian birth cohort

Experiências adversas na infância e consumo de álcool, fumo e drogas ilícitas entre adolescentes de uma coorte brasileira

Experiencias adversas en la infancia y consumo de alcohol, tabaco y drogas ilícitas entre adolescentes de una cohorte brasileña

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### Abstract

*The objective of this study was to investigate the association between adverse childhood experiences (ACEs) and the use of alcohol, tobacco and illicit drugs among adolescents from a Brazilian cohort. The occurrence of five ACEs, the use of alcohol and tobacco and trying illicit drugs were investigated in the 1993 Pelotas birth cohort at the age of 15 (n = 4,230). A score was created for the ACEs and their association with the use of substances was evaluated. Around 25% of adolescents consumed alcohol, 6% smoked and 2.1% reported having used drugs at least once in their lives. The ACEs were associated with the use of alcohol, tobacco and illicit drugs. A dose-response relation between the number of ACEs and the substance use was found, particularly with regard to illicit drugs. The occurrence of ACEs was positively associated with the use of alcohol, tobacco and illicit drugs among adolescents and the risk may be different for men and women. These results point to the fact that strategies for preventing the use of substances should include interventions both among adolescents and within the family environment.*

*Substance-Related Disorders; Smoking; Alcohol Drinking; Street Drugs; Adolescent*

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## Introduction

Experimentation and use of alcohol, tobacco, and illicit drugs typically begin in adolescence and the consumption of these substances is considered a relevant public health issue<sup>1,2</sup>. According to the *Brazilian National Survey of Student Health (Pesquisa Nacional de Saúde do Escolar – PeNSE)*, carried out in 2012, 26.1% and 5.1% of adolescents between the ages of 13 and 15 had consumed alcohol or tobacco, respectively, in the 30 days prior to the interview, whilst 7.3% had tried some type of illicit drug at least once in their lives<sup>3</sup>. Substance use in adolescence is associated with substance use in adulthood, and it is a predictor of the future burden of substance-related diseases<sup>1,4,5</sup>. The consumption of alcohol, tobacco and illicit drugs has been associated with several short- and long-term health problems, such as injuries, unprotected sex, cognitive deficits, mental health problems and premature death, caused mainly by traffic accidents, homicides and suicides<sup>5,6,7,8</sup>. Furthermore, it is related to social and economic problems for both users and society, like interpersonal violence and higher costs from medical treatment for the family and health system<sup>6,9</sup>.

Numerous social, economic, demographic and family-related factors are associated with substance use in adolescence<sup>4,10</sup>. Although life experiences during childhood are not the only factors responsible for the greater risk for substance use, they can play a key role that deserves to be studied<sup>11,12,13,14,15</sup>. The occurrence of adverse childhood experiences (ACEs) has been related to a higher risk of substance use among adolescents and adults<sup>11,12,13,14,15,16,17</sup>. The ACEs are sources of stress that people may experience early in life, usually before the age of 18, which include multiple types of abuse (physical, sexual, and psychological), neglect, and several sorts of family dysfunction<sup>18,19</sup>. Many types of ACEs have been described to be associated with the beginning and continued consumption of alcohol, tobacco and illicit drugs during adolescence<sup>2,4,11,12,13,14,15,16,17,20,21</sup>. Some evidence for higher risk of substance use has been found for parental divorce, neglect, domestic violence, physical abuse, sexual abuse, a poor relationship or lack of communication with parents, family background of drug addiction, and unstructured families<sup>2,4,11,12,13,14,15,16,17,20,21</sup>. The association between ACEs and substance use can differ according to gender<sup>13,22</sup>, and females may have a higher risk than males<sup>13</sup>.

However, it is known that ACEs do not occur independently, and the likelihood of having several ACEs is higher once a single ACE is reported<sup>18,23</sup>.

Nevertheless, only a few studies, all outside of Brazil, have assessed the relationship between the occurrence of multiple types of ACEs simultaneously and substance use, showing that a higher number of adversities during childhood is related to alcohol, tobacco and illicit drugs consumption<sup>12,15,17,18,21</sup>. Thus, the aim of this study was to assess the association between multiple ACEs and consumption of alcohol, tobacco and illicit drugs among 15-year-old adolescents from a medium-sized city in southern Brazil.

## Methods

In 1993, all children born alive in hospitals whose mothers lived in the urban area of the city of Pelotas, Rio Grande do Sul, Brazil (N = 5,249) were interviewed. More details on the methodology applied can be found in other publications<sup>24,25</sup>. In the 11-year follow-up, 4,452 adolescents took part in the study (87.5% follow-up rate), whilst 4,325 were interviewed in the 15-year follow-up (85.7% follow-up rate)<sup>25</sup>, 4,230 of whom answered the confidential questionnaire.

The ACEs assessed were physical abuse, sexual abuse, physical neglect, emotional neglect, and domestic violence. Physical abuse was evaluated by the question: "Has an adult from your family or someone who was looking after you hit you in a way that left you hurt or bruised?". Sexual abuse was assessed with the question: "Has anyone ever tried to do sexual things to you against your will, threatening or hurting you?". Physical neglect was assessed by "Have you ever not had enough food at home or had to wear dirty or worn clothes because you had no others?". Emotional neglect was considered as a positive response to at least one of the following questions: "Have you ever thought or felt that your parents did not want you to have been born?" or "Have you ever thought or felt that someone in your family hates you?". Domestic violence was evaluated by: "Have there ever been fights with physical assault in your household between adults or has an adult ever assaulted a child or adolescent?". These data were obtained in the 15-year follow-up through a self-applied questionnaire, with the adolescents being identified only by a numeric code. The questionnaire was handed out to the adolescents, answered in a reserved place, and placed in a sealed envelope upon completion. A score was generated for the occurrence of ACEs where each affirmative answer was worth one point, varying from zero to five points. For the analyses, this score was categorized into 0, 1, 2, and 3 or more ACEs.

The outcomes assessed were: use of alcohol, tobacco and illicit drugs. The use of alcohol and

tobacco was assessed by the following questions: “How many days did you smoke in the last 30 days?” and “How many days did you drink alcohol in the last 30 days?”. If the adolescents had smoked or had drunk alcohol at least once within the prior 30 days, they were considered as user of tobacco or alcohol, respectively. The experimentation of illicit drugs was assessed by the following question: “Have you ever tried any of these?” followed by these options: shoemaker’s glue, solvent or thinner, cocaine, and marijuana. These data were also obtained in the 15-year follow-up through a self-applied and confidential questionnaire. Illicit drug use was considered when the interviewee reported having used at least one of the drugs investigated.

The covariates, used as potential confounders, were collected in the perinatal and 11-year follow-up. At the perinatal visit, information on gender (male/female) and skin color (white/non-white) was collected. At age 11 the following information was gathered: economic level, measured by the assets index, constructed based on principal components analysis of the ownership of a series of domestic goods and characteristics of the residence<sup>24</sup> (in quintiles); mother’s schooling (0-4, 5-8, 9-11, and 12 or more years); maternal smoking (never smoked, former smoker, current smoker); maternal alcohol intake (use in the 30 days prior to the interview – yes/no); adolescent’s tobacco use (use in the 30 days prior to the interview – yes/no), alcohol intake (use in the 30 days prior to the interview – yes/no), and drug experimentation (yes/no); mother’s mental health, measured using the short-version of the *Self-Reporting Questionnaire* – SRQ-20<sup>26</sup>; and adolescent’s mental health, measured using the *Strengths and Difficulties Questionnaire* – SDQ<sup>27</sup>. The cut-off point in the SRQ-20 was set at 7/8 and the mothers were divided into two groups: no common mental disorder (a score less than or equal to seven) and common mental disorder (a score equal to or greater than eight)<sup>26</sup>. For the SDQ, the adolescents’ behavior was divided into three groups: normal (score 0-15), borderline (score 16-19) and abnormal (score 20-40)<sup>27</sup>.

The analyses were performed using the software Stata 13.1 (StataCorp LP, College Station, USA). First, a descriptive analysis of the data was carried out, reporting the proportions of the independent variables and outcomes, and their respective 95% confidence intervals (95%CI). Then a bivariate analysis was conducted using chi-squared test. For crude and adjusted analyses, Poisson regression with robust variance adjustment was used to estimate prevalence ratios (PR) and their respective 95%CI, and a Wald test

was used to test the associations. The adjusted model included all the covariates defined above. All the analyses were stratified by gender.

The study was approved by the Ethics Research Committee of the Medical School of the Federal University of Pelotas under protocol 40600026. After accepting taking part in the study, the mothers (or caretakers) and adolescents signed the term of free and informed consent.

## Results

The description of the sample according to the socioeconomic, demographic, behavioral and health characteristics of the adolescents and their mothers is presented in Table 1. More than half of the adolescents were female and two thirds reported white skin color. Concerning the mothers, nearly 70% had up to eight years of schooling, 31.7% were smokers, and 45.4% reported alcohol intake. At 11 years old, 1.4% of the adolescents reported tobacco use and 6% reported alcohol use, whilst about 0.5% had ever tried some type of illicit drug. Alcohol and drug use was higher among males than among females (at the threshold of statistical significance). Regarding mental health, 30.9% of the mothers had a common mental disorder, and about 14% of the adolescents had abnormal behavior; this prevalence was higher among males than females.

Figure 1 shows the prevalence of each childhood adversity and the ACE score. The most commonly reported ACE was emotional neglect (20.2%), followed by domestic violence (10.4%) and physical abuse (7.1%). All the ACEs but physical neglect were more reported by females. Nearly 30% of the adolescents had at least one ACE, and 10.2% reported two or more ACEs. Females were more likely to report a higher number of ACEs than males.

The prevalence of alcohol and tobacco use, and illicit drugs experimentation at 15 years old is presented in Figure 2. Approximately 25% of the adolescents reported alcohol consumption, 6% reported tobacco use, and 2.1% reported illicit drugs experimentation. The prevalence of illicit drugs experimentation was similar across gender. However, alcohol and tobacco use were higher among females than males.

Table 2 shows the prevalence of substance use according to the ACE score, and the crude and adjusted prevalence ratios of the relationship between number of ACEs and consumption of alcohol, tobacco and illicit drugs, stratified by gender. After adjusting for potential confounding variables, a dose-response relation was observed between ACE score and almost all types of sub-

Table 1

Socioeconomic, demographic, behavioral and health characteristics of the participants. 1993 Pelotas (Brazil) Birth Cohort, follow-up at 11 years old.

Variables	Total (N = 4,230) n (%)	Male (n = 2,056) %	Female (n = 2,174) %	p-value *
Skin color				0.551
White	2,712 (66.6)	67.1	66.2	
Non-white	1,359 (33.4)	32.9	33.8	
Assets index **				0.484
1 <sup>st</sup> quintile (lowest)	791 (19.7)	20.4	18.9	
2 <sup>nd</sup> quintile	794 (19.7)	19.4	20.0	
3 <sup>rd</sup> quintile	816 (20.2)	19.4	21.0	
4 <sup>th</sup> quintile	816 (20.2)	20.0	20.5	
5 <sup>th</sup> quintile (highest)	816 (20.2)	20.8	19.6	
Mother's schooling (years)				0.813
0-4	1,043 (25.1)	25.5	24.8	
5-8	1,800 (43.4)	42.6	44.1	
9-11	898 (21.7)	21.9	21.4	
12 or more	406 (9.8)	10.0	9.6	
Maternal smoking				0.523
Never smoked	1,914 (46.1)	46.9	45.3	
Former smoker	922 (22.2)	21.6	22.8	
Current smoker	1,319 (31.7)	31.6	31.9	
Maternal alcohol intake ***				0.574
No	2,268 (54.6)	55.0	54.2	
Yes	1,888 (45.4)	45.0	45.9	
Tobacco use at 11 years ***				0.373
No	4,077 (98.6)	98.4	98.8	
Yes	57 (1.4)	1.6	1.2	
Alcohol intake at 11 years ***				0.048
No	3,883 (94.0)	93.3	94.7	
Yes	245 (6.0)	6.7	5.3	
Drug experimentation at 11 years				0.045
No	4,168 (99.5)	99.3	99.8	
Yes	19 (0.5)	0.7	0.2	
Mother's mental health (SRQ-20)				0.317
No common mental disorders	3,042 (69.1)	68.6	70.1	
Common mental disorders	1,360 (30.9)	31.4	29.9	
Adolescent's mental health (SDQ)				< 0.001
Normal	2,985 (69.7)	67.0	72.9	
Borderline	702 (16.4)	17.8	14.8	
Abnormal	598 (13.9)	15.2	12.3	

SDQ: *Strengths and Difficulties Questionnaire*; SRQ-20: *Self-Reporting Questionnaire*.

\* Chi-squared heterogeneity test;

\*\* Highest number of missing information: 197;

\*\*\* Use in the 30 days prior to the interview.

stance, particularly illicit drugs. A higher prevalence of alcohol, tobacco and illicit drugs use was observed among those who have had more ACEs.

The higher number of ACEs was associated with tobacco use only among females, and the risk for illicit drug experimentation differed according

Figure 1

Prevalence of adverse childhood experiences (ACEs) among participants. 1993 Pelotas (Brazil) Birth Cohort, follow-up at 15 years old.

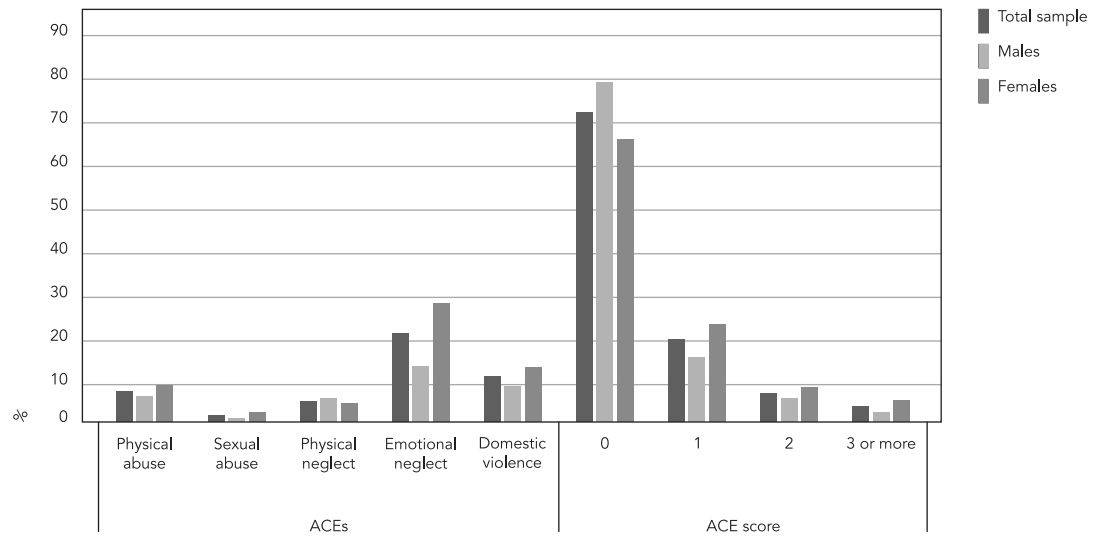


Figure 2

Prevalence of alcohol, tobacco, and illicit drug consumption by adolescents. 1993 Pelotas (Brazil) Birth Cohort, follow-up at 15 years old.

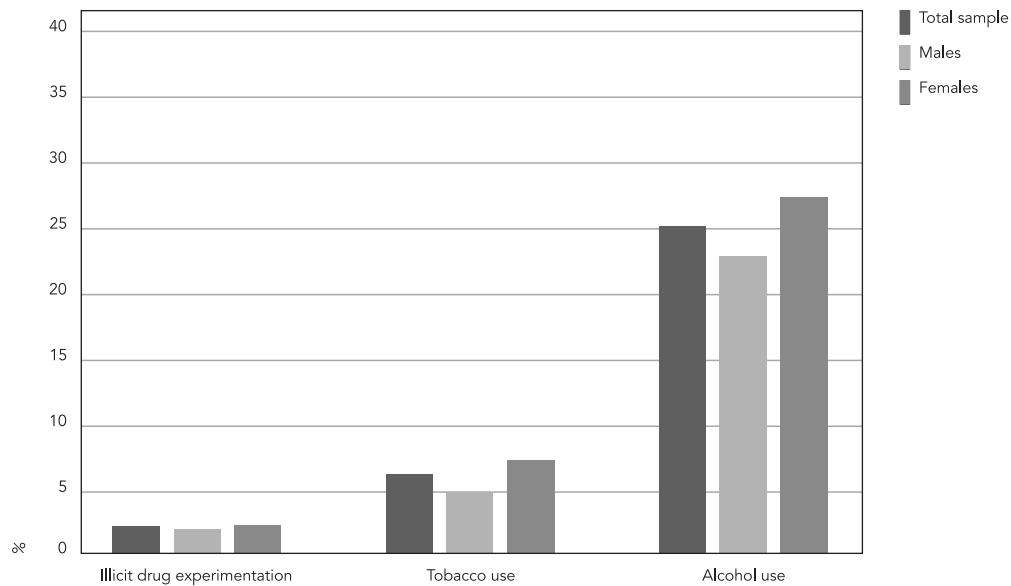


Table 2

Crude and adjusted prevalence ratios for substance use according to adverse childhood experience (ACE) score, stratified by gender. 1993 Pelotas (Brazil) Birth Cohort.

ACE score	Tobacco		Alcohol		Illicit drugs	
	Crude PR (95%CI)	Adjusted PR * (95%CI)	Crude PR (95%CI)	Adjusted PR * (95%CI)	Crude PR (95%CI)	Adjusted PR * (95%CI)
Males						
0	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
1	2.3 (1.5, 3.7)	2.3 (1.4, 3.8)	1.6 (1.3, 2.0)	1.5 (1.2, 1.9)	2.5 (1.1, 5.4)	3.0 (1.2, 7.4)
2	1.6 (0.7, 3.8)	0.9 (0.3, 2.7)	1.8 (1.4, 2.4)	1.8 (1.3, 2.5)	4.0 (1.5, 10.4)	4.0 (1.4, 11.7)
3 or more	2.1 (0.7, 6.4)	2.0 (0.5, 8.3)	1.9 (1.2, 2.8)	2.0 (1.3, 3.1)	4.0 (1.0, 16.8)	5.3 (1.5, 19.4)
Females						
0	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
1	3.4 (2.3, 5.0)	3.1 (2.0, 4.8)	1.7 (1.4, 2.0)	1.7 (1.4, 2.0)	4.7 (2.0, 11.3)	3.3 (1.2, 9.2)
2	5.5 (3.5, 8.5)	4.5 (2.7, 7.3)	1.8 (1.4, 2.2)	1.8 (1.4, 2.3)	6.5 (2.3, 18.5)	3.7 (1.0, 13.0)
3 or more	6.9 (4.3, 11.0)	5.2 (2.9, 9.3)	2.4 (1.9, 2.9)	2.4 (1.8, 3.1)	26.1 (11.4, 59.6)	25.5 (10.5, 61.8)

95%CI: 95% confidence interval; PR: prevalence ratio.

\* Adjusted for property index, skin color, mother's schooling, mother smoking, mother's alcohol use, adolescent's use of alcohol, use of tobacco, and drug experimentation at age 11, mother's mental health, and adolescent's mental health.

to gender. Females who had three or more ACEs had a prevalence of illicit drugs experimentation almost 5 times higher than males.

## Discussion

The results of this study show a positive association between multiple ACEs and alcohol, tobacco, and illicit drugs use among 15-year-old adolescents. They also show that emotional neglect, domestic violence and physical abuse were the most frequently reported ACEs, whilst alcohol and tobacco were the most consumed substances.

The prevalence of alcohol and tobacco use found in this study was similar to other broader scope Brazilian studies such as PeNSE<sup>3</sup>. The widespread use of alcohol and tobacco may be justified since it is a socially accepted drug seen as pleasurable throughout the world, besides the constant exposition to the publicity of alcoholic drinks in Brazil<sup>28</sup> and the great availability and easy access to them<sup>29</sup>. Regarding illicit drugs experimentation, a prevalence below the one observed in PeNSE<sup>3</sup> was seen, even though similar drugs were investigated in both studies. It is worth pointing out that in the nationwide survey, despite the fact that most students were between 13 and 15 years old, older adolescents were also interviewed, which may account for the higher prevalence of drug use compared to the

present study, since drug use tends to increase with age<sup>1,30,31</sup>.

As shown in other studies, these substances are more widely consumed by males<sup>1,32,33</sup>. However, researchers who assess alcohol use, taking gender differences into account, have revealed that the social pressures are related to the increase of alcohol consumption among women as a way of relieving stress or for them to match the behaviors accepted for males, particularly among those with more schooling<sup>34</sup>. Similar patterns can happen with tobacco use<sup>35</sup>. Although these behaviors have been found in adults<sup>34</sup>, they could start during adolescence, explaining the higher prevalence of alcohol and tobacco use among females. As well as alcohol and tobacco, illicit drugs also play a role in facing adversities, and its consumption has increased in recent years among Brazilian adolescents<sup>3</sup>. A differential relief assigned to illicit drugs can have great influence in its consumption<sup>17</sup>.

Compared to those who reported no ACEs, the adolescents who experienced more adverse experiences had higher prevalence for substance use. Other studies have also shown that being exposed to several adversities during childhood, particularly different types of violence, abuse and conflict with the parents, increases the risk of substance use in adolescence and/or adulthood<sup>11,12,14,17,18</sup>. The dose-response effect found in this and other studies can be linked to a number of factors that may explain the substance use.

The occurrence of ACEs can contribute to the adoption of behavioral and psychological coping mechanisms, which can leverage the adoption of negative health behaviors, such as alcohol, tobacco and illicit drugs consumption<sup>17</sup>. Being exposed to one or more ACEs may disclose to the adolescents the feeling of being poorly protected, and therefore of having a faulty family and social support<sup>17,36</sup>. Coupled with this, is the idea and the perceived (and biologically explained) fact that substance use causes emotional relief and pleasure, even if temporary<sup>2</sup>. Furthermore, substance use among those who experienced ACEs may be mediated by psychiatric disorders, such as post-traumatic stress and depression<sup>37</sup>.

Few studies have assessed gender-specific associations between ACEs and substance use<sup>13,22</sup>, and our findings suggest a higher prevalence for tobacco use and illicit drug experimentation among females who had a higher number of ACEs. Considering the idea of scarce sources of social and family support for those who were more victimized and the higher risk for illicit drugs and tobacco use, it is believed that girls can be more easily persuaded to use illicit drugs and tobacco, and also to believe that this behavior is “appropriate” and not harmful in short- and long-term<sup>22</sup>. However, more studies assessing the interactions between multiple ACEs and gender in the association with substance use should be encouraged.

Some limitations in this study must be highlighted. First, the possibility of information bias regarding the questionnaire used for data collection cannot be rejected. In the substance use report, particularly of illicit drugs, even the guaranteed anonymity might not have kept some adolescents from revealing use, whether due to self-censorship, memory failure, guilt, or for being linked to the study, whose regular follow-ups might allow them to be identified. In this context, drugs use prevalence may be interpreted as minimum estimates of the actual values, which might be higher than those found. Nevertheless, the use of a self-applied confidential questionnaire guarantees anonymity and is one of the procedures to obtain information on this type

of behavior<sup>38</sup>. Secondly, in spite of knowing that the importance attributed to each adversity can interfere on how the event is perceived, as well as its reactions, the way in which the ACE affected the adolescent could not be ascertained. Moreover, despite being a cohort study, both exposures and outcomes were investigated at the same time, and the timing of the ACE occurrence was not assessed; this could lead to reverse causality. However, studies suggest that adverse experiences are more likely to happen in young infancy or soon after the onset of puberty<sup>39</sup>. Although it was not possible to determine the temporal relationship of the association between ACEs and substance use in this study, it does not mean the results have no relevance, since both ACEs and use of substance in adolescence can be harmful to health in later life, and interrupting this chain could be beneficial to the individual's health over time. The lack of information on other possible confounding factors (e.g. parent-child relationship, problems at school, and other family environment characteristics) is also a limitation. However, it was possible to adjust for several confounders usually assessed in the literature and collected prospectively.

It is also pointed out that this study was carried out on a representative sample of the adolescents born in the city of Pelotas, with a high follow-up rate of over 85%<sup>25</sup>, which made it possible to assess the association between the occurrence of multiple ACEs and substance use with adjustment for important potential confounding factors such as socioeconomic characteristics, and the mental health of the adolescents and their mothers.

In conclusion, the results showed that a higher number of ACEs are related to alcohol, tobacco and illicit drug use during adolescence, and this relation can differ according to gender for some substances. These findings indicate that the strategies for preventing substance use must feature interventions both among adolescents and within the family environment. Adverse childhood experiences should be investigated, tracked and seen as a not just a familiar or individual problem, but also of social interest.



## Contributors

H. Gonçalves designed the study and reviewed the final version of the manuscript. A. L. G. Soares conducted the statistical analyses, wrote the first draft of the manuscript, and reviewed the final version of the manuscript. A. P. G. Santos and C. G. Ribeiro conducted literature searches and provided summaries of previous research studies about the theme, conducted the statistical analyses and wrote the first draft of the manuscript. I. O. Bihals, L. S. Vieira and N. L. Hellwig conducted literature searches and provided summaries of previous research studies about the theme, also wrote the first draft of the manuscript. F. C. Wehrmeister and A. M. B. Menezes designed the study and reviewed the final version of the manuscript. All authors contributed to and have approved the final manuscript.

## Acknowledgments

This article is based on data from the *Pelotas Birth Cohort, 1993*, conducted by the Postgraduate Program in Epidemiology at the Federal University of Pelotas with the collaboration of the Brazilian Public Health Association (ABRASCO). From 2004, the Wellcome Trust supported the 1993 birth cohort study. The European Union, National Support Program for Centers of Excellence (PRONEX), the Brazilian National Research Council (CNPq), and the Brazilian Ministry of Health supported previous phases of the study.

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## Resumo

O objetivo deste estudo foi investigar a associação entre experiências adversas na infância (ACEs) e uso de álcool, fumo e drogas ilícitas em adolescentes de uma coorte brasileira. A ocorrência de cinco ACEs, o uso de álcool e fumo e a experimentação de drogas ilícitas foram investigados na Coorte de Nascimentos de 1993 de Pelotas, aos 15 anos ( $n = 4.230$ ). Um escore de ACEs foi criado e sua associação com o uso de substâncias foi avaliada. Cerca de 25% dos adolescentes consumiram álcool, 6% fumaram e 2,1% relataram ter usado drogas pelo menos uma vez na vida. Os ACEs estiveram associados com o uso de álcool, fumo e drogas ilícitas. Uma relação dose-resposta entre o número de ACEs e o consumo de substâncias foi evidenciada, especialmente para drogas ilícitas. A ocorrência de ACEs esteve positivamente associada com o uso de álcool, tabaco e drogas ilícitas em adolescentes, e o risco pode diferir conforme o sexo. Esses resultados salientam que as estratégias para a prevenção do uso de substâncias devem conter intervenções para adolescentes, bem como no ambiente familiar.

*Transtornos Relacionados ao Uso de Substâncias; Hábito de Fumar; Consumo de Bebidas Alcoólicas; Drogas Ilícitas; Adolescente*

## Resumen

El objetivo fue investigar la asociación entre experiencias adversas en la infancia (ACEs) y consumo de alcohol, tabaco y drogas ilícitas en adolescentes de una cohorte brasileña. La ocurrencia de cinco ACEs, el consumo de alcohol y tabaco y el primer consumo de drogas ilícitas se investigaron en la Cohorte de Nacimientos de 1993 de Pelotas, a los 15 años ( $n = 4.230$ ). Se creó un marcador de ACEs y se evaluó su asociación con el uso de estas sustancias. Cerca de un 25% de los adolescentes consumieron alcohol, un 6% fumaron y un 2,1% informaron haber consumido drogas por lo menos una vez en la vida. Los ACEs estuvieron asociados con el consumo de alcohol, tabaco y drogas ilícitas. Se evidenció una relación dosis-respuesta entre el número de ACEs y el consumo de sustancias, especialmente, en el caso de drogas ilícitas. La ocurrencia de ACEs estuvo positivamente asociada con el uso de alcohol, tabaco y drogas ilícitas en adolescentes y el riesgo puede diferir según sexo. Esos resultados resaltan que las estrategias para la prevención del consumo de estas sustancias deben contar con intervenciones para adolescentes, así como en su ambiente familiar.

*Trastornos Relacionados con Sustancias; Hábito de Fumar; Consumo de Bebidas Alcohólicas; Drogas Ilícitas; Adolescente*

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Submitted on 01/Jun/2015

Final version resubmitted on 08/Oct/2015

Approved on 06/Nov/2015