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ORIGINAL ARTICLE

Early substance use initiation and suicide ideation and attempts among students in France and the United States

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Abstract
Objective In response to recent research documenting a link between early substance use and suicidal behaviors among youth, the current study sought to examine the associations between ages of substance use initiation and suicidal behavior among students in France and the USA.
Methods Cross-sectional logistic regression analyses based on the 2003 European School Survey Project on Alcohol and Other Drugs (ESPAD) survey (France; $n = 13{,}187$) and the 2003 Youth Risk Behavior Survey (YRBS) (United States; $n = 15{,}136$) assessed associations between early substance use initiation (i.e., alcohol, cigarette and cannabis/marijuana) and suicide ideation and attempts while controlling for potential confounders.
Results Early alcohol use initiation ($OR_{adj} = 1.52$; 95% CI 1.17–1.97) and early cannabis/marijuana use initiation ($OR_{adj} = 2.90$; 95% CI 2.20–3.83) were associated with suicide attempt in France. Early smoking was associated with suicide attempt in both France ($OR_{adj} = 1.92$; 95% CI 1.55–2.37) and the USA ($OR_{adj} = 1.53$; 95% CI 1.02–2.28). Sex differences were also noted.
Conclusions The associations between substance use initiation and suicidal behaviors differed in the United States and France. These findings, placed into context, can assist the development and implementation of prevention strategies that seek to reduce the harmful consequences of early substance use among youth.

Keywords Alcohol use initiation · Cigarette initiation · Cannabis initiation · Marijuana initiation · Suicide attempts · Suicide ideation · France · USA · Students

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Introduction

Alcohol and other drug use are serious risk factors for chronic diseases, injuries and other adverse health outcomes worldwide (Benegal et al. 2007; Rehm et al. 2009; World Health Organization [WHO] 2007, 2008, 2009). The widespread uses of tobacco products, alcohol, and other substances have been well documented as have the many harmful consequences of their use. It is estimated that globally, alcohol causes 1.8 million or 3.2% of all deaths and accounts for 4.0% of disease burden (Benegal et al. 2007). Similarly, tobacco use is estimated to kill more than 5 million people worldwide each year (WHO 2009). To emphasize the problem of tobacco use, the World Health Organization (2008) published a report on the Global

Tobacco Epidemic , which outlined tobacco as the "global agent of death." The global burden of disease from alcohol and tobacco use and exposure are of tremendous scope and represents a priority for prevention worldwide.

While substance abuse and misuse are of major concern across populations and age groups, substance use by youth is particularly troubling. Youth appear very vulnerable to adverse health outcomes of early substance use, including both acute and long-term consequences resulting in injuries, violence, substance dependence, and other chronic diseases and conditions. With respect to alcohol, there is increasing empirical support that early alcohol use initiation specifically contributes to long lasting health problems over the life course. More specifically, research shows that early alcohol use is associated with higher likelihood of alcohol dependence (Hingson et al. 2006), other substance use and criminal activity (Ellickson et al. 2003), unintentional injuries (Hingson et al. 2000, 2003a) unplanned and unprotected sex (Hingson et al. 2003b), involvement in physical fights (Hingson et al. 2001), and suicidal ideation and attempts (Bossarte and Swahn 2011; Cho et al. 2007; Swahn and Bossarte 2007; Swahn et al. 2008, 2010).

While early alcohol use has been documented to be an important risk factor for adverse health outcomes, there are relatively few reports on early initiation of alcohol use and risk for suicidal ideation and attempts specifically (Bossarte and Swahn 2011; Cho et al. 2007; Swahn and Bossarte 2007; Swahn et al. 2008, 2010). These studies are in contrast with previous research on alcohol use, e.g., moderate to heavy alcohol consumption, for which there are abundant data showing an association with suicide and suicidal behaviors (Borowsky et al. 2001; Brady 2006; Bridge et al. 2006; Department of Health and Human Services 1999; Flisher et al. 2000; Moscicki 2001; Wu et al. 2004). However, recent research linking early alcohol and substance use initiation to suicide ideation and attempts is particularly intriguing. One study of youth in a disadvantaged, urban community in the United States (USA) found that youth who reported pre-teen (<13 years of age) alcohol use initiation were significantly more likely than non-drinkers to also report suicide ideation and suicide attempts (Swahn et al. 2008). Similar findings have been reported in other students representing different populations (Bossarte and Swahn 2011; Swahn and Bossarte 2007; Swahn et al. 2010).

Another study of urban youth in the USA examined the role of early substance use initiation and suicidal behaviors among high school students (Cho et al. 2007). The study by Cho and colleagues (2007) also examined the role of initiation of other substances including cigarette smoking and hard drugs on suicidal behaviors, and found that among girls, early initiation of cigarette smoking, getting drunk, and hard drug use was also associated with depressive symptoms and suicidal behaviors, while among boys, earlier onset of cigarette smoking and hard drug use was associated with suicidal behaviors. There is a an increasing number of studies that show smoking as a significant factor associated with suicidal behaviors and suicide mortality among youth and adults in the USA (Hockenberry et al. 2010), in Germany (Schneider et al. 2010), in Greece (Kokkevi et al. 2010), in Hungary (Döme et al. 2011) and in New Zealand (Boden et al. 2008; McGee et al. 2005). However, important findings have been noted with respect to sex differences between boys and girls. Findings from the USA, also indicate that smoking may be a stronger factor for planning a suicide attempt and also for making a suicide attempt among girls than boys (Epstein and Spirito 2010).

Fewer studies have examined the role of cannabis use in suicidal behaviors but also show an important association between cannabis use and completed suicides among Swedish men in the military (Price et al. 2009) and between cannabis use and deliberate self-harm among adolescents in England and Norway (Rossow et al. 2009). These important findings suggest that substance use among youth is strongly associated with different measures of suicidal behaviors and also completed suicides. However, the extent to which early initiation of these substances, in particular cannabis, may also increase the risk for involvement in suicidal behaviors in nationally representative samples of youth in the USA and France is not well known.

In France, the cultural context for alcohol and other drug use as well as the prevalence and scope of use differ markedly from the USA. However, few studies have sought to specifically compare data between the USA and France to better disentangle the potential social and cultural similarities and differences that may contribute to patterns and consequences of drug use. Research shows that in France the relationship between substance use and suicide attempts is also striking (Pages et al. 2004), suggesting that the link may not be culture and context specific.

Although the specific mechanism is unclear, findings from previous research suggest that early initiation of any substance use may increase the likelihood of suicidal behaviors and that these findings may be applicable across cultures. It appears that alcohol use contributes to suicidal behaviors both directly and indirectly. More specifically, early and acute alcohol use or intoxication may serve as a facilitator of suicide attempts (Bridge et al. 2006), and may also predispose suicidal behavior through its depressogenic affect and promotion of adverse life events (Brady 2006). However, with respect to other substances such as tobacco and marijuana/cannabis, the pathways to suicide and suicidal behavior are likely very different from those identified for alcohol use. It is also likely that early alcohol

use or use of other substances early in life may be markers for the complex interactions between sociocultural, developmental, psychiatric, psychological, and family-environmental factors that can all contribute to suicidal behaviors among youth (Bridge et al. 2006).

To replicate and extend findings from previous research, the current study will examine the associations between pre-teen smoking initiation, pre-teen alcohol use initiation, pre-teen cannabis/marijuana initiation and suicidal ideation and attempt among two nationally representative samples of students in the USA and in France. These comparisons will determine if the associations between early substance use initiation and suicidal behaviors are unique to youth in the USA or extend to youth in different cultural contexts and also if they vary for boys and girls. This is important since previous research indicates different patterns by sex (Cho et al. 2007; Epstein and Spirito 2010; Swahn et al. 2010). Moreover, comparisons across countries may help elucidate, at least indirectly, the extent to which policies, legal restrictions or social norms may play a role in the potential associations between early substance use initiation and suicidal behaviors.

Alcohol remains the most commonly used drug among both boys and girls in high school across the USA and France. Use of both tobacco products and other substances are also relatively common among youth in the USA and France [Centers for Disease Control and Prevention (CDC) (2008; Choquet et al. 2008). Policies with respect to access and use of substances are clearly different across countries. Therefore, determining the extent to which early substance use initiation is linked to suicidal behaviors among youth in cross-cultural settings is critically important and can provide useful information for the selection of appropriate prevention strategies as well as clinical interventions.

Methods

Data used for the analyses were collected as part of the 2003 National Youth Risk Behavior Surveillance System (YRBSS) conducted by the CDC. Details regarding the survey methodology are described elsewhere (CDC 2004). In brief, this survey used a three-stage cluster sample design to produce a nationally representative sample of high school students in grades 9 through 12. The first stage sampling frame contained primary sampling units (PSUs), consisting of large counties or groups of smaller, adjacent counties. From the 1,256 PSUs, 57 were selected from 16 strata formed on the basis of the degree of urbanization and the relative percentage of Black or African American, non-Hispanic Students and Hispanic (Hispanic or Latino student of any race) in the PSU. The PSUs were selected with probability proportional to total school enrollment. At the second sampling stage, 195 schools were selected with probability also proportional to individual school enrollment. The third stage of sampling consisted of randomly selecting one or two intact classes of a required subject (e.g., English or social studies) from grades 9–12 at each chosen school. All students in the selected classes were eligible to participate. Participation in the survey was voluntary and anonymous following parental permission. Student completed the self-administered questionnaire consisting of 95 items and recorded responses directly on a computer-scannable answer sheet. In 2003, 153 of the 195 sampled schools participated in the survey. There were 15,214 usable questionnaires received from the 15,240 completed questionnaires. The school response rate was 81%, and the student response rate was 83%, resulting in an overall response rate of 67%. A weighting factor was applied to each student record to adjust for non-response and for the varying probabilities of selection. The data in the final analytic file are representative of students in grades 9–12 attending public and private schools in the USA.

The European School Survey Project on Alcohol and Other Drugs (ESPAD) dataset (France) was coordinated by Marie Choquet at Institut National de la Santé et de la Recherche Médicale (INSERM) and François Beck at Observatoire Français des Drogues et des Toxicomanies (OFDT). The French study covered all grades from 6 to 12. The Ministry of Education conducts a population census of the population of pupils each year in September. The sample of 450 schools was drawn from a computerized list of schools, which was updated at the end of November 2002, as a stratified random sample of schools proportionate to school size. The strata represented type of school, type of area (urban/rural) and educational characteristics (priority zone or not). From each selected school, two grades were selected by identifying (by headmaster) two classes with a teacher's name closest to L in the alphabet resulting in a sample of 900 classes. The gender distribution in the different types of schools was 50% girls in public and 48% in private junior high schools, and 55% in both types of senior high schools. The sample, which covers *all* age groups from 11 to 19, was considered to be self-weighted. Participation in the ESPAD survey was voluntary and anonymous following passive parental consent (parental permission was refused by only 1.2%). Student completed the self-administered questionnaire in about 45 min. One hundred fifty-eight of the 195 sampled schools participated in the survey. The student response rate was 91.0%.

Measures

Most questions were worded similarly across the ESPAD and YRBS. The description and wording of the measures used in the analyses are presented in Table 1. Both of the outcome variables, suicide ideation and attempts, as well as the measures of current or lifetime substance use and potential confounders were dichotomized. Each measure of

Table 1 Wording and coding of questions used in analyses of the European School Survey Project on Alcohol and Other Drugs (ESPAD) and the Youth Risk Behavior Survey (YRBS)

Variables	European School Survey Project on Alcohol and Other Drugs (France) Wording of the 2003 survey Response options/variable coding	Youth Risk Behavior Survey (USA) Wording of the 2003 survey questions Response options/variable coding
Suicide ideation	During the last 12 months, did you ever think about suicide? Coded: Often enough or very often, versus everyone else	During the past 12 months, did you ever seriously consider attempting suicide? Coded: Any versus none
Suicide attempt	During the life course, how many times did you actually attempt suicide? Coded: Once or more often, versus everyone else	During the past 12 months, how many times did you actually attempt suicide? Coded: Any versus none
Alcohol initiation	When (if ever) did you first drink? (a) beer, (b) wine (at least one glass), (c) cider, (d) champagne (at least one glass), (e) spirits (at least one glass). Coded for year of initiation and then dichotomized <13 versus ≥13)	How old were you when you had your first drink of alcohol other than a few sips? Coded <13 versus ≥13
Smoking initiation	When (if ever) did you first smoke your first cigarette? Coded for year of initiation and then dichotomized <13 versus ≥13)	How old were you when you smoked a whole cigarette for the first time? Coded <13 versus ≥13
Marijuana initiation	When (if ever) did you first try marijuana, hashish? Coded for year of initiation and then dichotomized <13 versus ≥13)	How old were you when you tried marijuana for the first time? Coded <13 versus ≥13
Tobacco use	During the last 30 days, did you smoke cigarettes? Coded: any smoking versus none	During the past 30 days, on how many days did you smoke cigarettes? Coded: Any versus none
Heavy alcohol use	During the last 30 days, how many times (if any) have you had 5 or more drinks of alcohol in a row? Coded any heavy alcohol use versus none	During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours? Coded: Any versus none
Cannabis/ marijuana use	During the last 30 days, how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil)? Coded: Any use versus none	During the past 30 days, how many times did you use marijuana? Coded: Any versus none
Cocaine use	During your life course, how many occasions (if any) have you used? (a) crack, (b) cocaine. Coded: Any use of either crack or cocaine versus none	During the past 30 days, how many times did you use any form of cocaine, including powder, crack, or freebase? Coded: Any versus none
Sadness/ depressive mood	During the last 12 months, how often have you? (a) felt too tired to do things, (b) having trouble going to sleep or staying asleep, (c) felt unhappy, sad or depressed, (d) felt hopeless about the future, (e) felt nervous or tense, and (f) worrying too much about things. Responses ranged from never (1), rarely (2), often enough/very often (3). Depressive mood was defined as the sum of the items (range 6-18) equal or higher than 17[a]	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing your usual activities? Coded: Any versus none
Violence victimization	During the last 12 months, have you been victim of …?: knocks, stealing, racket, racial actions, verbal violence. (Coded: Yes for at least one item reflecting any victimization	During the past 12 months, did your boyfriend or girlfriend ever hit, slap, or physically hurt you on purpose? Coded: Any versus none
Sexual assault	In the course of your life, have you been victim of a sexual aggression? Coded: Any versus none	Have you ever been physically forced to have sexual intercourse when you did not want to? Coded: Any versus none
Involvement in fight	During the last 12 months, how often have you? Hit one of your teachers/Gotten mixed into a fight in school or at work/Taken part in a fight where a group of your friends were against another group. Coded: 1 or more time versus none for any of the items	During the past 12 months, how many times were you in a physical fight? Coded: Any versus none.

[a] Depressive mood was measured by the French version of a self-reported scale for adolescents [Kandel DB, Davies M. Epidemiology of depressive mood in adolescents an empirical study. Arch Gen Psychiatry 1982; 39: 1205-1212]. The European School Survey Project on Alcohol and Other Drugs (ESPAD) was conducted in France in 2003 and the Youth Risk Behavior Survey (YRBS) was conducted in the USA in 2003

substance use initiation was trichotomized to indicate never use, substance use initiation prior to age 13, or substance use initiation after age 13. Moreover, a range of potential confounders were included in the analyses to assess current substance use levels (i.e., any smoking, heavy drinking, any cannabis use, and any cocaine use), sadness/depressive mood, sexual assault victimization, other violent victimization, involvement in physical fights.

Analysis

Cross-sectional logistic regression analyses were conducted of each dataset to determine the associations between pre-teen substance use initiation and suicide ideation and attempts. Analyses were stratified by sex and limited to students 13 years of age and older. YRBS data were analyzed using SAS and SUDAAN statistical software and ESPAD data were analyzed using STATA software.

Results

In the USA, 16.8% and 7.6% of students reported suicide ideation and attempts, respectively, whereas in France, 9.6% and 8.9% of students reported suicide ideation and attempts, respectively (Table 2). The prevalence of substance use initiation, current and lifetime substance use and other measures is presented in Table 2. In the USA, the prevalence of initiating pre-teen alcohol use, smoking and marijuana was 27.7%, 18.1%, and 9.7%, respectively. In France, the prevalence of initiating pre-teen alcohol use, smoking and marijuana was 65.1%, 24.1%, and 3.9%, respectively.

Table 2 Prevalence of suicidal ideation and attempts, age of substance use initiation, substance use, sadness, sexual assault and dating violence victimization, and involvement in fights

	2003 European School Survey Project on Alcohol and Other Drugs			2003 Youth Risk Behavior Survey		
	France			United States		
	Full sample (n = 13,187) %	Boys (n = 6,319) %	Girls (n = 6,868) %	Full sample (n = 15,136) %	Boys (n = 7,576) %	Girls (n = 7,530) %
Suicide ideation	9.59	6.84	12.11	16.81	12.63	21.23
Suicide attempt	8.88	5.38	12.10	7.58	4.73	10.57
Age of alcohol use initiation						
Never	31.06	30.67	31.42	24.55	25.75	23.36
<13 years	65.14	65.63	64.69	27.67	31.88	23.24
≥13 years	3.80	3.70	3.89	47.77	42.37	43.39
Age of cigarette smoking initiation						
Never	49.73	51.92	47.71	55.97	55.19	61.75
<13 years	24.13	24.62	23.68	18.14	19.85	16.33
≥13 years	26.14	23.45	28.61	25.89	24.96	26.80
Age of cannabis/marijuana use initiation						
Never	68.28	65.06	71.24	59.04	56.55	61.75
<13 years	3.88	5.44	2.45	9.74	12.48	6.86
≥13 years	27.84	29.50	26.31	31.22	30.97	31.39
Any smoking	30.04	28.61	31.35	21.78	21.69	21.85
Any heavy drinking	22.21	28.42	16.50	28.18	28.79	27.47
Any cannabis use	18.15	22.66	14.01	22.19	24.97	19.23
Any cocaine use	3.03	3.61	2.49	3.97	4.40	3.49
Sadness/depressive mood	16.99	9.40	23.98	28.47	21.78	35.43
Sexual assault victimization	4.62	1.36	7.62	8.82	5.91	11.82
Violence victimization	31.45	34.28	28.84	8.73	8.67	8.75
Any involvement in fights	38.68	50.89	27.45	32.90	40.46	24.97

Table 3 Bivariate associations between age of substance use initiation, other risk factors and suicide ideation

	2003 European School Survey Project on Alcohol and Other Drugs			2003 Youth Risk Behavior Survey		
	France			United States		
	Full sample (n = 13,187) OR (95% CI)	Boys (n = 6,319) OR (95% CI)	Girls (n = 6,86 8) OR (95% CI)	Full sample (n = 15,136) OR (95%CI)	Boys (n = 7,576) OR (95% CI)	Girls (n = 7,530) OR (95% CI)
Age of alcohol use initiation						
<13 years	**1.32 (1.15–1.50)**	1.11 (0.89–1.38)	**1.47 (1.24–1.74)**	**2.95 (2.43–3.59)**	**2.56 (1.97–3.32)**	**3.72 (2.85–4.84)**
≥13 years	1.13 (0.81–1.56)	0.78 (0.43–1.44)	1.34 (0.91–1.99)	**1.85 (1.52–2.26)**	**1.48 (1.07–2.04)**	**2.00 (1.54–2.60)**
Age of cigarette smoking initiation						
<13 years	**2.23 (1.94–2.55)**	**1.64 (1.31–2.04)**	**2.70 (2.26–3.21)**	**2.62 (2.17–3.16)**	**2.51 (1.92–3.28)**	**3.00 (2.49–3.61)**
≥13 years	**1.37 (1.18–1.59)**	0.93 (0.72–1.21)	**1.59 (1.32–1.90)**	**1.91 (1.67–2.19)**	**1.71 (1.31–2.22)**	**2.06 (1.81–2.34)**
Age of cannabis/marijuana use initiation						
<13 years	**2.57 (2.03–3.25)**	**2.73 (1.97–3.79)**	**3.27 (2.29–4.65)**	**3.43 (2.73–4.30)**	**3.99 (2.92–5.45)**	**3.99 (2.92–5.44)**
≥13 years	**1.51 (1.34–1.72)**	**1.31 (1.06–1.63)**	**1.73 (1.48–2.03)**	**1.94 (1.71–2.21)**	**1.80 (1.44–2.27)**	**2.13 (1.87–2.42)**
Any smoking	**2.32 (2.06–2.61)**	**1.97 (1.61–2.40)**	**2.49 (2.15–2.88)**	**2.43 (1.96–3.01)**	**2.19 (1.63–2.96)**	**2.66 (2.15–3.30)**
Any heavy drinking	**1.53 (1.34–1.74)**	**1.42 (1.15–1.74)**	**2.00 (1.69–2.37)**	**1.96 (1.63–2.35)**	**1.72 (1.26–2.36)**	**2.23 (1.90–2.62)**
Any cannabis use	**1.89 (1.66–2.16)**	**1.57 (1.27–1.94)**	**2.60 (2.19–3.09)**	**2.45 (2.16–2.78)**	**2.81 (2.27–3.49)**	**2.56 (2.22–2.95)**
Any cocaine use	**3.25 (2.56–4.11)**	**3.74 (2.66–5.25)**	**3.31 (2.37–4.63)**	**4.91 (3.20–7.52)**	**4.85 (3.02–7.80)**	**5.82 (3.45–9.81)**
Sadness/depressive mood	**7.37 (6.52–8.34)**	**8.67 (6.98–10.77)**	**6.23 (5.35–7.25)**	**10.35 (9.19–11.66)**	**10.67 (8.32–13.68)**	**9.32 (7.71–11.28)**
Sexual assault victimization	**5.29 (4.42–6.34)**	**5.53 (3.41–8.95)**	**4.40 (3.61–5.36)**	**4.72 (3.94–5.65)**	**4.95 (3.61–6.77)**	**4.13 (3.30–5.16)**
Violence victimization	**2.42 (2.15–2.72)**	**2.06 (1.69–2.51)**	**2.87 (2.48–3.33)**	**3.14 (2.62–3.77)**	**3.34 (2.72–4.10)**	**3.09 (2.44–3.92)**
Any involvement in fights	**1.61 (1.43–1.81)**	**1.89 (1.54–2.32)**	**2.01 (1.73–2.33)**	**1.96 (1.71–2.24)**	**1.87 (1.50–2.33)**	**2.69 (2.22–3.28)**

Reference categories for each logistic regression model were never initiated alcohol use, never initiated cigarette smoking, never initiated cannabis/marijuana use, no current smoking, no heavy drinking, no cocaine use, no sadness, no sexual assault victimization, no dating violence victimization and no involvement in fights. The European School Survey Project on Alcohol and Other Drugs (ESPAD) was conducted in France in 2003 and the Youth Risk Behavior Survey (YRBS) was conducted in the USA in 2003

Significant associations are boldfaced

OR odds ratio, *95% CI* 95 percent confidence interval

Bivariate logistic regression analyses examining the associations between substance use initiation and suicide ideation are presented in Table 3. Relative to those who had not initiated substance use, pre-teen initiation of alcohol use was associated with suicide ideation among girls in France, and among both boys and girls in the USA. Pre-teen initiation of smoking and cannabis/marijuana was associated with suicide ideation among boys and girls in France and also among boys and girls in the USA. Bivariate associations between substance use initiation and suicide attempts are presented in Table 4.

Logistic regression analyses of the associations between substance use initiation and suicide ideation and attempts, adjusted for demographic characteristics and potential confounders, are presented in Table 5. Pre-teen alcohol use initiation was associated with suicide ideation among boys and girls in the USA and with suicide attempts among girls in France. Pre-teen smoking initiation was associated with suicide ideation and attempts among girls in France and in the USA. Pre-teen cannabis/marijuana initiation was associated with suicide ideation and attempts among boys and girls in France and among girls in the USA. Associations were also observed between teen substance use initiation and suicide ideation and attempts in both France and the USA.

Discussion

The current study examined the associations between early substance use initiation, defined as first use prior to age 13 years, and suicide ideation and attempts in two large, nationally representative samples of students in France and the USA. Our findings show that after controlling for confounders, early alcohol use initiation was associated with suicide ideation and attempts among girls in France and with suicide ideation among girls in the USA.

These findings confirm earlier studies conducted in the USA and also clearly indicate that early alcohol use

Table 4 Bivariate associations between age of substance use initiation, other risk factors and suicide attempt

	2003 European School Survey Project on Alcohol and Other Drugs			2003 Youth Risk Behavior Survey		
	France			United States		
	Full sample (n = 13,187) OR (95% CI)	Boys (n = 6,319) OR (95% CI)	Girls (n = 6,868) OR (95% CI)	Full sample (n = 15,136) OR (95% CI)	Boys (n = 7,576) OR (95% CI)	Girls (n = 7,530) OR (95% CI)
Age of alcohol use initiation						
<13 years	**1.60 (1.39–1.85)**	1.07 (0.84–1.37)	**1.98 (1.66–2.38)**	**4.54 (2.99–6.89)**	**4.39 (2.60–7.40)**	**5.38 (3.28–8.81)**
≥13 years	**1.60 (1.17–2.20)**	0.91 (0.48–1.72)	**2.07 (1.42–3.01)**	**2.08 (1.41–3.07)**	1.60 (0.96–3.65)	**2.13 (1.33–3.41)**
Age of cigarette smoking initiation						
<13 years	**2.99 (2.58–3.46)**	**1.89 (1.48–2.43)**	**3.84 (3.09–4.62)**	**4.31 (3.14–5.92)**	**5.14 (2.90–9.12)**	**4.49 (3.49–5.79)**
≥13 years	**2.08 (1.79–2.43)**	1.22 (0.92–1.62)	**2.49 (2.06–3.01)**	**2.60 (2.06–3.29)**	**2.77 (1.62–4.74)**	**2.57 (2.10–3.14)**
Age of cannabis/marijuana use initiation						
<13 years	**4.02 (3.19–5.05)**	**4.23 (3.03–5.91)**	**5.68 (4.05–7.95)**	**5.57 (3.96–7.83)**	**7.46 (4.41–12.62)**	**6.54 (4.45–9.60)**
≥13 years	**2.37 (2.09–2.70)**	**1.66 (1.31–2.12)**	**3.01 (2.59–3.51)**	**2.50 (1.98–3.16)**	**2.15 (1.32–3.51)**	**2.80 (2.22–3.54)**
Any smoking	**3.59 (3.17–4.06)**	**2.86 (2.29–3.56)**	**3.94 (3.39–4.57)**	**3.44 (2.60–4.55)**	**3.86 (2.48–6.02)**	**3.35 (2.60–4.32)**
Any heavy drinking	**2.23 (1.96–2.53)**	**1.97 (1.58–2.47)**	**3.22 (2.74–3.78)**	**2.66 (2.26–3.12)**	**2.49 (1.65–3.76)**	**2.89-2.44–3.42)**
Any cannabis use	**2.65 (2.33–3.02)**	**2.41 (1.92–3.02)**	**3.66 (3.11–4.32)**	**3.17 (2.63–3.83)**	**3.95 (2.71–5.75)**	**3.41 (2.86–4.08)**
Any cocaine use	**4.80 (3.84–6.00)**	**5.30 (3.77–7.43)**	**5.69 (4.16–7.78)**	**9.11 (5.96–13.90)**	**11.93 (6.45–22.06)**	**8.98 (6.31–12.78)**
Sadness/depressive mood	**4.68 (4.13–5.31)**	**4.40 (3.42–5.67)**	**3.96 (3.41–4.60)**	**11.58 (8.92–15.04)**	**8.99 (6.17–13.09)**	**11.95 (8.71–16.41)**
Sexual assault victimization	**7.15 (5.98–8.53)**	**10.81 (6.86–17.03)**	**5.23 (4.30–6.36)**	**6.68 (4.98–8.96)**	**8.70 (5.37–14.08)**	**5.05 (3.82–6.68)**
Violence victimization	**2.81 (2.49–3.18)**	**2.53 (2.03–3.16)**	**3.30 (2.85–3.83)**	**4.84 (3.65–6.42)**	**6.76 (4.45–10.26)**	**4.13 (3.02–5.63)**
Any involvement in fights	**2.04 (1.81–2.30)**	**2.65 (2.08–3.38)**	**2.75 (2.37–3.19)**	**2.81 (2.19–3.62)**	**2.83 (1.93–4.15)**	**3.91 (2.97–5.16)**

Reference categories for each logistic regression model were never initiated alcohol use, never initiated cigarette smoking, never initiated cannabis/marijuana use, no current smoking, no heavy drinking, no cocaine use, no sadness, no sexual assault victimization, no violence victimization and no involvement in fights. The European School Survey Project on Alcohol and Other Drugs (ESPAD) was conducted in France in 2003 and the Youth Risk Behavior Survey (YRBS) was conducted in the USA in 2003

Significant associations are boldfaced

OR odds ratio, *95% CI* 95 percent confidence interval

initiation is an important issue across cultural contexts, especially for girls (Cho et al. 2007; Swahn and Bossarte 2007; Swahn et al. 2008; Swahn et al. 2010). However, in contrast to previous studies in the USA, in the current analyses early alcohol use initiation was not associated with suicide attempts in multivariate analyses.

The study also found that early smoking initiation was associated with suicide ideation and attempts in both France and the USA. These findings also confirm previous studies indicating that smoking is an important correlate of suicidal behaviors among youth in other countries (Boden et al. 2008; Epstein and Spirito 2010; Cho et al. 2007; Kokkevi et al. 2010; Hockenberry et al. 2010; McGee et al. 2005). Moreover, similar to previous findings in the USA that indicate that smoking is an important factor in suicide attempt for girls (Epstein and Spirito 2010), the current measure of the age of smoking initiation was an important correlate of suicide attempts for girls, but not for boys, in stratified analyses of students in France and the USA.

The analyses of early cannabis/marijuana use initiation and the associations with suicidal ideation and attempt also confirmed previous research documenting a relationship between cannabis use and deliberate self-harm among adolescents in England and Norway (Rossow et al. 2009). Early cannabis/marijuana initiation was associated with suicide ideation and suicide attempts for both boys and girls in France and for girls only in the USA. Documenting again that the link between substance use initiation and suicidal behaviors vary for boys and girls. Future research should explore in more detail, preferably in longitudinal cohorts, the underlying factors associated with the sex differences observed in these studies with respect to initiation of substance use and its association with suicidal behaviors.

Table 5 Multivariate associations between pre-teen substance use initiation and suicide ideation and attempts in France and the United States

	2003 European School Survey Project on Alcohol and Other Drugs		2003 Youth Risk Behavior Survey	
	France		United States	
	Ideation (past 12 months) OR_{adj} (95% CI)	Attempts (lifetime) OR_{adj} (95% CI)	Ideation (past 12 months) OR_{adj} (95% CI)	Attempts (past 12 months) OR_{adj} (95% CI)
Alcohol initiation <13 years*	**1.41 (1.10–1.80)**	**1.52 (1.17–1.97)**	**1.50 (1.17–1.92)**	1.55 (0.93–2.59)
Alcohol initiation ≥13 years*	1.26 (0.83–1.89)	1.37 (0.91–2.05)	**1.44 (1.13–1.83)**	1.66 (0.99–2.77)
Smoking initiation <13 years±	**1.54 (1.27–1.87)**	**1.92 (1.55–2.37)**	**1.31 (1.04–1.65)**	**1.53 (1.02–2.28)**
Smoking initiation ≥13 years±	1.01 (0.82–1.25)	**1.41 (1.13–1.77)**	**1.45 (1.18–1.78)**	**2.18 (1.69–2.82)**
Cannabis/marijuana initiation <13 years↓	**1.80 (1.34–2.42)**	**2.90 (2.20–3.83)**	1.28 (0.90–1.82)	1.56 (0.88–2.76)
Cannabis/marijuana initiation ≥13 years↓	**1.20 (1.00–1.45)**	**1.93 (1.61–2.31)**	**1.40 (1.17–1.68)**	**1.95 (1.41–2.71)**
Boys (n = 6,319)			Boys (n = 7,576)	
Alcohol initiation <13 years*	1.48 (0.93–2.34)	1.41 (0.83–2.43)	**1.51 (1.01–2.27)**	1.57 (0.84–2.91)
Alcohol initiation ≥13 years*	0.94 (0.44–2.03)	1.05 (0.46–2.39)	1.32 (0.91–1.91)	1.52 (0.85–2.71)
Smoking initiation <13 years±	1.17 (0.86–1.61)	1.42 (0.98–2.05)	1.14 (0.72–1.81)	1.42 (0.69–2.92)
Smoking initiation ≥13 years±	0.70 (0.49–1.00)	0.96 (0.64–1.44)	1.46 (0.99–2.15)	**2.47 (1.19–5.11)**
Cannabis/marijuana initiation <13 years↓	**2.37 (1.55–3.62)**	**3.46 (2.22–5.38)**	1.18 (0.65–2.12)	1.41 (0.49–4.09)
Cannabis/marijuana initiation ≥13 years↓	1.29 (0.94–1.77)	**1.61 (1.11–2.31)**	1.13 (0.81–1.59)	1.46 (0.81–2.64)
Girls (n = 6,868)			Girls (n = 7,530)	
Alcohol initiation <13 years*	**1.40 (1.05–1.87)**	**1.59 (1.18–2.15)**	**1.56 (1.20–2.04)**	1.64 (0.87–3.08)
Alcohol initiation ≥13 years*	1.45 (0.89–2.37)	1.45 (0.91–2.32)	**1.45 (1.02–2.07)**	1.59 (0.86–2.96)
Smoking initiation <13 years±	**1.85 (1.43–2.38)**	**2.28 (1.75–2.98)**	**1.59 (1.15–2.20)**	**1.83 (1.16–2.86)**
Smoking initiation ≥13 years±	1.24 (0.95–1.61)	**1.61 (1.23–2.11)**	**1.46 (1.15–1.86)**	**2.09 (1.46–2.97)**
Cannabis/marijuana initiation <13 years↓	**1.67 (1.09–2.55)**	**3.37 (2.29–4.96)**	**1.58 (1.02–2.46)**	**2.01 (1.15–3.51)**
Cannabis/marijuana initiation ≥13 years↓	1.15 (0.91–1.45)	**2.12 (1.71–2.63)**	**1.60 (1.26–2.04)**	**2.19 (1.51–3.20)**

In analyses of the European School Survey Project on Alcohol and Other Drugs-France: *Controlling for heavy drinking, age, grade, and depressive mood; ±Controlling for current smoking, age, grade, and depressive mood; ↓Controlling for current cannabis use, grade, and depressive mood

In analyses of the Youth Risk Behavior Survey-USA: *Controlling for heavy drinking, grade, and sadness; ±Controlling for current smoking, grade, and sadness; ↓ Controlling for current marijuana use, grade, and sadness. Significant associations are boldfaced. The European School Survey Project on Alcohol and Other Drugs (ESPAD) was conducted in France in 2003 and the Youth Risk Behavior Survey (YRBS) was conducted in the USA in 2003

OR_{adj} Adjusted odds ratio, *95% CI* 95 percent confidence interval

Comparisons across nations highlight the importance of understanding the need for, and use of, alcohol and other drug use by youth and how the context and setting of alcohol use, cultural norms and practices and policies impact early alcohol and drug use and their adverse health outcomes such as suicidal behaviors. In particular, the

findings in this study highlight that early substance use is associated with suicidal behaviors regardless of the larger context of substance use within each country. In France, the legal age for purchasing beer and wine at the time of the survey 16 (18 for spirits) was much lower than in the USA where it is 21 years of age. As expected, the prevalence of alcohol use and early alcohol use initiation among youth would be much higher in France than the USA. Accordingly, our findings show that in France the prevalence of reporting alcohol use prior to age 13 was much higher (65%) than in the USA (28%). However, regardless of these different cultural contexts and policies, early alcohol use initiation was associated with suicidal ideation among youth in both countries and the strength of the observed associations was remarkably similar.

These findings, particularly of early alcohol use, that are also relevant across countries, suggest that the associations between substance use initiation and suicidal behaviors may be driven at least in part by the pharmacological effect of the alcohol as well as the impact of use on adolescent development rather than just the social context of use. This is an important area for future cross-national research to consider and explore since the current study cannot assess any of these factors specifically. Moreover, recent research highlights that early alcohol use as well as the use of other substances can greatly impact brain response patterns and functioning among adolescents (Schweinsburg et al. 2008; Schweinsburg et al. 2010; Squeglia et al. 2009a, b) which in turn may influence risk for suicidal behaviors. However, the impact of substance use on brain development and subsequent suicidal behaviors is an emerging area of research that remains to be studied in greater detail.

Previous studies have documented a link between tobacco and cannabis use on suicidal behaviors but suggest that most likely these associations are noted because of shared factors rather than a direct relationship (Boden et al. 2008; McGee et al. 2005; Hockenberry et al. 2010; Rossow et al. 2009). These conclusions are supported by research that show that the association between cannabis and suicide can be explained when other psychological or behavior problems or life circumstances are taken into consideration (Boden et al. 2008; Price et al. 2009). One intriguing study found that the increased risk of suicidal ideation among smokers was only important if they did not have parents who smoked (Hockenberry et al. 2010). Similarly, another study found that the association between early tobacco smoking and suicidal ideation was no longer important when the analyses considered the impact of stress, depression and low family attachment (McGee et al. 2005). These findings underscore the importance of understanding the psychosocial and family context of early substance use and its associated risk with suicidal behaviors. Future longitudinal cohorts are best suited to address and answer these questions and would ideally include a range of measures about multiple substances, the ages of initiation for each substance and levels of use to better understand these complex relationships with suicidal behaviors among youth.

There are several limitations that should be considered when interpreting the findings of this study. First, the study is based on self-reported data of students in the USA and France and results may not generalize to other populations or to youth who are no longer in school. Second, while the findings show statistically significant association between early substance use initiation, prior to age 13, and suicide ideation and attempts in the past year, more specific temporal ordering cannot be determined, nor can causality be inferred. Third, the survey methodologies, the specific ages, as well as the measures vary somewhat across studies which may also have impacted the findings. Fourth, the overall response rates were relatively low which may also impact the findings from each study as well as in the comparisons across the two studies. Finally, there may be other potential confounders, mediators or moderators, driving the associations between early substance use and suicidal ideation and attempt that were not assessed in these studies.

In conclusion, relatively few investigations have examined the impact of early substance use initiation and its influence on suicidal behaviors among youth. The cross-sectional studies that have been conducted so far in the USA have demonstrated strong associations particularly between pre-teen alcohol use initiation, smoking, and hard drugs and suicidal behaviors among youth in the USA (Bossarte & Swahn, 2011; Cho et al. 2007; Hingson et al. 2001; Swahn and Bossarte 2007; Swahn et al. 2010). While associations identified using data in the USA provide important information about the relationship between early substance use initiation and suicidal behaviors, analyses conducted in different countries and settings are needed to provide additional perspectives and context to potential cultural and regional differences that impact early substance use and its consequences. In this study, comparisons of nationally representative samples of youth across France and the USA highlight similarities and differences in the associations between early alcohol use, early smoking, and early cannabis/marijuana use and suicidal ideation and attempts. In particular, intriguing differences were observed for boys and girls. These findings, placed into context, can assist the development and implementation of prevention and intervention strategies that seek to reduce the harmful consequences of early substance use among youth. Meanwhile, our findings support increased efforts to develop and implement evidence-based interventions within the clinical, school, family, community, and policy

settings that are designed to delay and reduce early substance use initiation and the many adverse outcomes associated with its use.

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