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Early alcohol use and psychopathological symptoms in university students

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Abstract

Background: Adolescent brain may be particularly vulnerable to alcohol. Plus, psychopathological disorders tend to emerge in this period. Consequently, early alcohol use may increase the risk of psychopathological disorders, with time and sex-dependent effects. However, few studies have analyzed the relationship between alcohol consumption and adolescent psychopathology in the general population. The objective was to determine the association between age of onset of alcohol use and psychopathological symptoms in university students, separately for both sexes. **Method:** A cross-sectional study involving first-year university students (n = 3,696) was conducted. Symptoms were measured by the Symptom Checklist-R (SCL-90-R). The independent variable was age of first alcohol use. Dependent variables were the SCL-90-R dimensions, dichotomized. Alcohol consumption was considered a mediator variable. Data were analyzed separately for males and females. **Results:** The findings showed that a younger age of onset is a risk factor for the following global indexes: Global Severity Index, Positive Symptom Total for females, and Positive Symptom Distress Index, for males. Alcohol consumption showed a higher mediator effect for females than for males. **Conclusion**: Early age of alcohol use is associated with increased psychopathological symptomatology in both sexes during the college freshman year. The pattern of symptomatology is different in each sex.

Keywords: Age of onset, alcohol, youths, psychopathology.

Resumen

Consumo temprano de alcohol y síntomas psicopatológicos en estudiantes universitarios. **Antecedentes**: durante la adolescencia el cerebro es especialmente vulnerable a los efectos del alcohol. El consumo temprano de alcohol puede aumentar el riesgo de sintomatología psicopatológica. Pocos estudios han analizado la relación entre consumo de alcohol y sintomatología psicopatológica en adolescentes en la población general. El objetivo de este estudio es determinar la asociación entre edad de inicio del consumo de alcohol y síntomas psicopatológicos en estudiantes universitarios, separadamente para ambos sexos. **Método:** estudio transversal en estudiantes universitarios (n = 3.696). Los síntomas se midieron con el SCL-90-R. La variable independiente fue la edad de inicio del consumo de alcohol. Las variables dependientes fueron las dimensiones del SCL-90-R dicotomizadas. El consumo de alcohol fue una variable mediadora. **Resultados:** una temprana edad de inicio es un factor de riesgo para los siguientes índices globales: Índice de Severidad Global, Total de Síntomas Positivos, solo en mujeres, e Índice de Malestar, solo para hombres. El consumo de alcohol muestra un mayor efecto mediador en las mujeres. **Conclusión:** una temprana edad de inicio en el consumo de alcohol se asocia con un aumento de sintomatología psicopatológica en ambos sexos durante el primer año de Universidad. El patrón de sintomatología difiere en hombres y mujeres.

Palabras clave: edad de inicio, alcohol, jóvenes, psicopatología.

Alcohol consumption has become increasingly common among European adolescents, especially among college students (Wicki, Kuntsche, & Gmel, 2010). Consumption has been linked to an array of negative consequences including poor academic performance, use of other drugs, risky sexual behavior and neurocognitive deficits (Jacobus & Tapert, 2013; White & Hingson, 2014). Alcohol consumption is also frequently comorbid with internalizing and externalizing disorders (Armstrong & Costello, 2002).

Another concern is the growing tendency for young people to start drinking alcohol at an early age (Marshall, 2014). In a survey involving European countries, it was estimated that 60% of adolescents have consumed at least one glass of alcohol at age 13 years or earlier, and 12% of these had been drunk at that age (Hibell et al., 2012). Early age of first drinking has been associated with risk of developing an alcohol use disorder (AUD) (Dawson, Goldstein, Chou, Ruan, & Grant, 2008; DeWit, Adlaf, Offord, & Ogborne, 2000; Hingson, Heeren, & Winter, 2006).

Adolescence is a crucial stage that involves numerous psychobiological and social changes (Casey, Jones, & Hare, 2008; Smith, Chein, & Steinberg, 2013). The processes underlying affective behavior undergo major developmental changes during the first stage of adolescence (Smith et al., 2013; Yurgelun-Todd, 2007). These maturational transformations are hormonally-driven and have different sex-dependent trajectories (Giedd et al., 2006; Lenroot & Giedd, 2010).

Psychopathology often emerges during adolescence (Costello, Copeland, & Angold, 2011; Giedd, Keshavan, & Paus, 2008). Some of the common disorders that start in this period (e.g., depression and anxiety) have been related to hormonal changes and to activity of still maturing areas, such as the amygdala and hippocampus (Lenroot & Giedd, 2010). The rates of prevalence

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of these disorders also differ between males and females during adolescence (Zahn-Waxler, Shirtcliff, & Marceau, 2008). In particular, studies carried out to date suggest that externalizing disorders are more associated with males (Couwenbergh et al., 2006) while internalized disorders are specially linked to females (Clark & Bukstein, 1998; O'Neil, Conner, & Kendall, 2011).

Altogether, the above considerations may indicate some vulnerabilities inherent to this important period of transition (Spear, 2015), which may contribute both to psychopathological disorders and enhanced sensitivity to the negative effects of early onset of alcohol use (Bava & Tapert, 2010; Geier, 2013). Consequently, early initiation of alcohol use might increase the risk of occurrence of psychopathological disorders (other than AUD) in late adolescence. Also, it is highly likely to have distinct outcomes in males than females due to sex-related differences in neuromaturation (Lenroot & Giedd, 2010), alcohol neurotoxicity (Sharrett-Field, Butler, Reynolds, Berry, & Prendergast, 2013) and psychopathology (Zahn-Waxler et al., 2008).

As alcohol use and psychopathology often interact with each other worsening the prognosis and exacerbating concurrent problems, a broad understanding of this issue would help in the design of interventions better adapted to the comorbidity problem in boys and girls.

However, few studies have focused specifically on analyzing the relationship between alcohol consumption and adolescent psychopathology in the general population (Storr, Pacek, & Martins, 2012). Most such studies have involved adolescents already diagnosed with alcohol use disorders (Blumenthal, Leen-Feldner, Badour, & Babson, 2011; Chassin, Sher, Hussong, & Curran, 2013; Falk, Yi, & Hilton, 2008; Kushner, Abrams, & Borchardt, 2000).

The goal of this study was to determine if the early age of onset of alcohol use is a risk factor for distress symptoms among university students, separately in each sex. In this model, current alcohol intake was considered an intermediate variable in the causative chain.

Method

Participants

A cross-sectional study was carried out among first-year students attending the Universidad Complutense de Madrid (Spain). A random sample of classrooms was selected, and all students present in class were recruited for the study (*N*= 4,464). After excluding students older than 18 years old and teetotalers, the sample was finally composed of 3,696 participants. One hundred and sixteen students did not provide information about sex, hence their data were not considered for the statistical analysis. Tables 1 and 2 show the characteristics of the sample for each sex. The Universidad Complutense de Madrid is a public university in Madrid (Spain). Students attending the university come from all over the region (6,448,270 inhabitants) and from representative socioeconomic and sociocultural strata. After appropriate corrections, the analytical results can also be extrapolated to all adolescents with similar academic formation.

Instruments

Psychopathological symptoms were measured using the validated Spanish version of the Symptom Check List-Revised (SCL-90-R; Derogatis, 1983) by González de Rivera (2002). This questionnaire asked for psychopathological symptoms over the past week. It consists of nine dimensions of psychopathological symptoms: somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. The intensity of the suffering in each symptom is graded in a Likert scale from 0 (no discomfort) to 4 (maximum discomfort). It also offers three global indexes: the Global Severity Index (GSI), which reflects the overall severity of the symptoms and is the best indicator of distress; the Index of Positive symptom Distress (PSDI), indicating the intensity of the symptoms; and Positive symptoms Total (PST), which includes the number of symptoms experienced by the subject. The Spanish version include a new index which is called Additional scale which is composed by a wide variety of distress symptoms: poor appetite or binge eating, sleeping problems, thoughts about death or dying, and feelings of guilt. Reliability values found in the Spanish sample are similar to those described by Derogatis (1983) in the original version, with values between 0.81 and 0.90. Participants responded to an additional questionnaire about the amount/frequency of alcohol consumption and other drug use. In this questionnaire subjects were asked about their current consumption ("Currently, do you consume alcohol?"/ "Yes, I have consumed in the last 6 months"/" Yes, I have consumed alcohol more than 6 months ago") and then further details (e.g. frequency, quantity and speed of consumption in a typical week of consumption). It allowed us to record relevant aspects such us the number of standard drink units consumed a week. Age of onset of alcohol consumption and sociodemographic variables such as sex, were also ascertained via the questionnaire.

Procedure

Data collection was carried out in the university classrooms during the first semester in an anonymous way. Students older than 18 years and teetotalers were excluded.

Dependent variables. SCL-90-R dimensions and global indexes were used as continuum variables for linear regression and dichotomized for logistic regression. For this categorization the 90th percentile was used as a cut-off for the transformation to yield a dysfunction criterion at a preclinical level.

Independent variables. Age of onset of alcohol use. The question asked was "At what age did you start voluntarily drinking alcohol for the first time?" This variable was categorized in three categories: 16 years and older, between 14 and 15 years old, and between 11 and 13 years old. This categorization was made to easily interpret the clinical results and according to the frequency distribution in our sample.

Mediator variable. Alcohol consumption. This variable was measured as the number of standard drink units (10 g of pure alcohol in Spain) consumed per week. This measure of current consumption was subdivided into four categories: 0.4-6g, >6- 12g, >12-24g, and >24g for further description of the sample.

Data analysis

Sobel's test was used to assess the mediation by alcohol consumption on relationship between age of onset of alcohol consumption and SCL-90-R dimensions/global indexes. When the Sobel test was significant, the proportion of effect mediated by alcohol consumption was calculated using the formula prosed by Szklo (Szklo & Nieto, 2013). It considers the change in the linear

regression coefficient for the main independent variable when the model is adjusted by the mediator variable.

Logistic regression was used to estimate the Odds Ratios (*OR*) for different SCL-90-R dimensions/global indexes. The models were adjusted by alcohol consumption using the criteria of alcohol consumption p-value ≤ .20, only when alcohol consumption did not show any significant mediator effect.

Results

The questionnaire response rate was 99%. The main characteristics of the sample are shown in Table 1 for females and in Table 2 for males. The characteristics of participants are also depicted according to the age of onset of alcohol use.

Sobel's test for mediation by alcohol consumption in the relationship between age of onset of alcohol use and SCL-90-R

Table 1
Main characteristics of the sample for females (percentages, means and 95% confident intervals)

	Females			
	Age of onset of alcohol use			
	Total (n = 2,102)	**11 - 13 years old (n = 226; 10.8%)**	**14 - 15 years old (n =1,077; 51.2%)**	**16 years and older (n = 733; 34.9%)**
Standard drink units per week (%)				
0.4 - 6	31.7	15.5	20.0	39.3
>6 - 12	29.3	19.5	30.9	30.0
>12 - 24	28.2	35.0	33.3	19.6
>24	10.8	27.0	11.0	5.6
Global Severity Index [a]	0.57 [0.65, 0.59]	0.68 [0.61, 0.75]	0.57 [0.54, 0.60]	0.53 [0.50, 0.56]
Positive Symptoms Total [a]	33.6 [32.8, 34.4]	40.0 [34.6, 39.4]	33.5 [32.4, 34.6]	32.7 [31.4, 34.0]
Positive Symptom Distress [a]	1.48 [1.47, 1.50]	1.60 [1.53, 1.66]	1.50 [1.47, 1.52]	1.44 [1.41, 1.46]
Global Severity Index [b]	9.7	15.9	9.3	8.5
Positive Symptoms Total [b]	11.2	16.4	10.6	10.5
Positive Symptom Distress [b]	8.3	9.7	8.7	7.4

Note: [a]Mean. [b]Percentage above 90th percentile

Table 2
Main characteristics of the sample for males (percentages, means and 95% confident intervals)

	Males			
	Age of onset of alcohol use			
	Total (n = 1,478)	**11 - 13 years old (n =183; 12.4%)**	**14 - 15 years old (n = 599; 40.5%)**	**16 years and older (n = 636; 43.2%)**
Standard drink units per week (%)				
0.4 - 6	21.2	6.6	11.2	25.9
> 6 - 12	24.9	14.8	22.2	30.7
> 12 - 24	29.6	27.9	34.1	25.2
> 24	24.2	49.7	28.5	13.0
Global Severity Index[a]	0.47 [0.44, 0.49]	0.51 [0.45, 0.58]	0.46 [0.43, 0.49]	0.45 [0.42, 0.49]
Positive Symptoms Total[a]	29.0 [28.1, 29.9]	30.3 [27.7, 32.9]	29.4 [27.9, 30.8]	28.3 [27.0, 29.6]
Positive Symptom Distress[a]	1.44 [1.42, 1.47]	1.54 [1.47, 1.61]	1.44 [1.41, 1.47]	1.41 [1.38, 1.44]
Global Severity Index[b]	5.8	6.0	5.2.	6.1
Positive Symptoms Total[b]	7.3	8.7	8.5	5.5
Positive Symptom Distress[b]	6.0	9.3	5.3	4.7

Note: [a]Mean. [b]Percentage above 90th percentile

dimensions/global indexes are shown in Table 3. This table also provides the proportions of effect mediated by alcohol consumption. In females alcohol consumption shows a mediator effect for all dimensions and indexes, except for Interpersonal Sensitivity, Phobic Anxiety, Additional scale, and Positive Symptoms Total. The effect mediated by alcohol consumption ranged between 14% for Anxiety to 73% for Psychoticism. On the contrary, among males alcohol consumption did not show a mediator effect for the majority of the variables, except for Somatization, Hostility, Additional scale and Positive Symptom Distress. In this case, there was a lower variability in the effect mediated by alcohol consumption, ranging from 31% for Somatization to 40% for Positive Symptom Distress.

Early age of onset (11-13 years old *vs*. 16 years and older) of alcohol use was associated with increased odds of being in the top deciles (> 90th percentiles) for the following global indexes: Global Severity Index and Positive Symptom Total, for females (*OR* = 2.26, 95% CI [1.46, 3.75] and *OR* = 1.77 [1.09, 2.55]); and Positive Symptom Distress Index, for males (*OR* = 1.37 [1.26, 2.44]) (Table 3). Finally, the relationship between the age of onset of alcohol use and different SCL-90-R dimensions is also included in Table 4.

Discussion

The results of the study show that an early age of drinking onset is associated with increased psychopathology during

Table 3
Sobel test for mediation by alcohol consumption in the relationship between age of onset of alcohol use and SCL-90-R dimensions/global indexes

	Females		Males	
	Sobel test p-value	**% of the effect mediated by alcohol consumption**	**Sobel test p-value**	**% of the effect mediated by alcohol consumption**
Somatization	.001	43%	.048	31%
Obsessive-compulsive	.001	40%	.319	
Interpersonal Sensitivity	.319		.319	
Depression	.048	26%	.319	
Anxiety	.048	14%	.319	
Hostility	.001	29%	.003	32%
Phobic Anxiety	.319		.319	
Paranoid Ideation	.003	64%	.726	
Psychoticism	.003	73%	.319	
Additional scale	.689		.003	34%
Global Severity Index	.003	25%	.319	
Positive Symptoms Total	.098		.997	
Positive Symptom Distress	.001	29%	.003	40%

Table 4
Relationships between age of onset of alcohol use and SCL-90-R dimensions/global indexes. Logistic regression models

	Females Odds ratio (95%CI)		**Males Odds ratio (95%CI)**	
	Age of onset of alcohol use		**Age of onset of alcohol use**	
	14-15 years old*	**11-13 years old***	**14-15 years old***	**11-13 years old***
Somatization	1.40 [1.03, 1.91]	2.05 [1.33, 3.16]	2.00 [1.17, 3.41]	2.60 [1.31, 3.11]
Obsessive-compulsive [b]	0.94 [0.69, 1.29]	1.37 [0.87, 2.16]	0.89 [0.57, 1.37]	1.54 [0.89, 2.68]
Interpersonal Sensitivity [a, b]	1.32 [0.98, 1.79]	1.30 [0.80, 2.11]	1.12 [0.68, 1.83]	1.18 [0.55, 2.51]
Depression [b]	1.00 [0.74, 1.37]	1.77 [1.16, 2.71]	1.10 [0.68, 1.78]	1.59 [0.85, 2.98]
Anxiety [b]	1.12 [0.82, 1.54]	2.48 [1.75, 3.74]	0.92 [0.58, 1.44]	1.20 [0.65, 2.20]
Hostility	1.21 [0.89, 1.65]	2.17 [1.43, 3.30]	1.43 [0.97, 2.11]	1.94 [1.17, 3.23]
Phobic Anxiety [a, b]	0.92 [0.69, 1.23]	1.08[0.70, 1.69]	1.01 [0.66, 1.56]	0.91 [0.47, 1.77]
Paranoid Ideation [b]	0.89 [0.64, 1.23]	1.39 [0.88, 2.21]	1.01 [0.70, 1.47]	0.93 [0.52, 1.73]
Psychoticism [b]	0.92 [0.65, 1.30]	1.09 [0.64, 1.86]	1.05 [0.72, 1.55]	1.65 [1.00, 2.74]
Additional scale [a]	1.41 [0.99, 2.02]	1.99 [1.22, 3.26]	1.01 [0.63, 1.64]	2.14 [1.22, 3.76]
Global Severity Index [b]	1.10 [0.79, 1.54]	2.26 [1.46, 3.75]	0.90 [0.55, 1.47]	1.11 [0.55, 2.23]
Positive Symptoms Total [a,b]	1.01 [0.74, 1.37]	1.77 [1.09, 2.55]	1.60 [1.03, 2.50]	1.65 [0.90, 3.03]
Positive Symptom Distress	1.20 [0.84, 1.70]	1.46 [0.86, 2.47]	1.22 [0.73, 2.04]	1.37 [1.26, 2.44]

Note: * Reference category: 16 years and older
[a]Adjusted by alcohol consumption for females when alcohol consumption p-value ≤ .20
[b]Adjusted by alcohol consumption for males when alcohol consumption p-value ≤ .20

college freshman year. Thus, to start drinking at 11-13 years old in comparison with a later onset (16 years and older) increased the risk of distress symptoms. An early onset of alcohol (between 11 and 13 years) is a risk factor for the following symptomatic dimensions of the SCL-90-R: somatization, depression, anxiety, hostility and additional scale in females; and somatization, hostility, psychoticism and additional scale in males. In addition, this early age of onset of drinking was also a risk factor for the following general indexes: Positive Symptom Total and Global Severity Index, for females; and Positive Symptom Distress Index, for males. Also, the relationship between the age of onset and psychopathological symptoms is partially mediated by current alcohol consumption, particularly in females.

As expected, results showed that a different pattern of distress symptoms was shown by each sex. The highest association for females is regarding the anxiety whereas for males is regarding somatization. The biggest difference rely on the fact that GSI index, which is the best indicator of distress, is significant in females whereas in males is not. It may indicate a window of vulnerability in early adolescence, especially in females. Although the SCL-90-R is a screening test, the results are of considerable importance as a preclinical 90th percentile cut-off was used for all indexes in an attempt to identify those individuals who require special attention.

Considering that maturational changes during early adolescence are regionally-, age-, and sex-dependent (Spear, 2013), alcohol misuse may have sex-specific and time-dependent effects (Spear, 2015). The processes underlying affective response suffer major maturational changes during early adolescence (Smith et al., 2013). In addition, developing corticolimbic systems including the amygdala and hippocampus exhibit enhanced vulnerability to alcohol induced damage (Jacobus & Tapert, 2013). Alterations in these areas have also been associated with several psychopathological disorders such as anxiety and depression (Lenroot & Giedd, 2010). Exposure to alcohol later on in adolescence may be more likely to impact prefrontal cortex systems still developing at that time (see Spear 2015 for discussion and references), resulting in different alterations. But we can only speculate about this framework.

Studies carried out to date suggest that young adults with AUD are more likely to have associated psychopathology, most commonly externalizing disorders in boys (Couwenbergh et al., 2006) and internalized disorder in girls (Clark & Bukstein, 1998; O'Neil et al., 2011), although the nature of this comorbidity is still not clear (Kushner et al., 2000). This fact seems to be partially consistent with our findings. For example, depression and anxiety (internalized) showed significant associations in females but not in males, whereas hostility (externalized) was significant for both sexes.

In sum, we analyzed the relationship between age of onset of alcohol consumption and psychopathological symptoms in female and male university students not suffering from alcohol use disorder. Although the findings reported here are strengthened by the large epidemiological sample, the study is not without its limitations. Given that the study is based on cross-sectional data, we cannot rule out the possibility that the psychopathological symptoms preceded alcohol use. However, the SCL-90-R questionnaire only asked about frequency of symptoms in recent weeks (not in the past); furthermore, the main independent variable introduces a longitudinal element in the design and thus ensures the criterion of temporality (the effect must occur after the cause). Another limitation is that the variable age of onset is based on retrospective self-report, which may introduce some bias, the so-called "telescoping effect" (Janssen, Chessa, & Murre, 2006). Finally, the SCL-90-R questionnaire may underestimate the presence of externalizing psychopathology, as "hostility" is the only dimension representing this factor; and the internalizing factor may be over-represented (four of the aspects are clearly internalizing: anxiety, depression, somatization and ADI). Future studies should assess symptoms by using a more varied range of tests to enable identification of the manifestation of possible different symptoms (internalized or externalized) in relation to sex. Given the limitations in the existing literature, several recommendations can be made for future studies.

First, longitudinal prospective designs are required in order to determine the temporal order of comorbid disorders. Temporality should be considered along with designs that explicitly disentangle affects associated with puberty and age (e.g. samples equal in chronological age but at different levels of pubertal maturation) (Blakemore, Burnett, & Dahl, 2010; Graber, 2013). Second, alcohol consumption in adolescence is a major concern in the field of public health and there is therefore a need for studies that focus on those adolescents not diagnosed with alcohol use disorder. This group of adolescents is more representative at a general population level. Spear (2015) identified the timing of specific effects of adolescent ethanol exposure in relation to sex as a gap in the current literature. More efforts should be made to determine the role of earlier age of first drinking in the still maturing brain, by exploring the consequences for emotional or affective behavior as well as at the neurocognitive level. Here, we reported marked differences in those students who had their first drink at 11-13 years in comparison with those who had their first drink at 16 years, but these increased odds have not been found in those who start drinking at 14-15 years of age. This may suggest a specific period of vulnerability which deserves to be carefully explored in future prospective studies.

In this respect, the question as to whether earlier age of first drinking is a better predictor of psychopathology than the age of first being drunk or the onset of binge drinking pattern remains unanswered. This variable would be an interesting target not only in the study of comorbidity but also in the broad field of neurocognitive consequences of heavy alcohol consumption in young people, in which mood disorders are typically a common exclusion criterion, leaving this subset of youths excluded from their peers. Focusing on this under-addressed topic may provide critical answers for intervention and prevention programs.

In conclusion, the present study represents an advance towards a better understanding of the relationship between the early age at first drink and psychopathology symptoms in university students in a general representative sample analyzed by sex. The novelty of this study is the analysis of a variable that has classically been associated with future negative consequences (alcohol dependence, injuries, etc) and exploration of the role of this variable as a risk factor for psychopathology in a sample of adolescents, taking into account the explanatory weight of alcohol as an intermediate variable and analyzing the results for each sex separately. The major finding of this study is that young people who start drinking at an early age display an increased risk of having psychopathological symptoms during young adulthood,

with females showing more vulnerability. Delaying the age of first alcohol use should be a major goal in preventive strategies. This work is a claim for a better understanding of the neurobiological changes that occur during adolescence, their possible relationship with the emergence of psychopathology and the long-term consequences of an early age of alcohol consumption.

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References

Armstrong, T. D., & Costello, E. J. (2002). Community studies on adolescent substance use, abuse, or dependence and psychiatric comorbidity. *Journal of Consulting and Clinical Psychology*, *70*(6), 1224-1239.

Bava, S., & Tapert, S. F. (2010). Adolescent brain development and the risk for alcohol and other drug problems. *Neuropsychology Review*, *20*(4), 398-413.

Blakemore, S. J., Burnett, S., & Dahl, R. E. (2010). The role of puberty in the developing adolescent brain. *Human Brain Mapping*, *31*(6), 926-933.

Blumenthal, H., Leen-Feldner, E. W., Badour, C. L., & Babson, K. A. (2011). Anxiety psychopathology and alcohol use among adolescents: A critical review of the empirical literature and recommendations for future research. *Journal of Experimental Psychopathology*, *2*(3), 318-353.

Casey, B. J., Jones, R. M., & Hare, T. a. (2008). The adolescent brain. *Annals of the New York Academy of Sciences*, *1124*, 111-126.

Chassin, L., Sher, K. J., Hussong, A., & Curran, P. (2013). The developmental psychopathology of alcohol use and alcohol disorders: Research achievements and future directions. *Development and Psychopathology*, *25*, 1567-1584.

Clark, D. B., & Bukstein, O. G. (1998). Psychopathology in adolescent alcohol abuse and dependence. *Alcohol Health and Research World*, *22*(2), 117-121.

Costello, E. J., Copeland, W., & Angold, A. (2011). Trends in psychopathology across the adolescent years: What changes when children become adolescents, and when adolescents become adults? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *52*(10), 1015-1025.

Couwenbergh, C., Van Den Brink, W., Zwart, K., Vreugdenhil, C., Van Wijngaarden-Cremers, P., & Van Der Gaag, R. J. (2006). Comorbid psychopathology in adolescents and young adults treated for substance use disorders: A review. *European Child and Adolescent Psychiatry*, *15*(6), 319-328.

Dawson, D. A., Goldstein, R. B., Chou, S. P., Ruan, W. J., & Grant, B. F. (2008). Age at first drink and the first incidence of adult-onset DSM-IV alcohol use disorders. *Alcoholism, Clinical and Experimental Research*, *32*(12), 2149-2160.

Derogatis, L. R. (1983). *SCL-90-R. Administration, scoring and procedures manual II for the revised version of the SCL-90-R*. Baltimore: John Hopkins University Press.

DeWit, D. J., Adlaf, E. M., Offord, D. R., & Ogborne, a C. (2000). Age at first alcohol use: A risk factor for the development of alcohol disorders. *The American Journal of Psychiatry*, *157*(5), 745-750.

Falk, D. E., Yi, H. Y., & Hilton, M. E. (2008). Age of onset and temporal sequencing of lifetime DSM-IV alcohol use disorders relative to comorbid mood and anxiety disorders. *Drug and Alcohol Dependence*, *94*(1), 234-245.

Geier, C. F. (2013). Adolescent cognitive control and reward processing: Implications for risk taking and substance use. *Hormones and Behavior*, *64*(2), 333-342.

Giedd, J. N., Clasen, L. S., Lenroot, R., Greenstein, D., Wallace, G. L., Ordaz, S., …, Chrousos, G. P. (2006). Puberty-related influences on brain development. *Molecular and Cellular Endocrinology*, *254-255*, 154-162.

Giedd, J. N., Keshavan, M., & Paus, T. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews. Neuroscience*, *9*(12), 947-957.

Graber, J. A. (2013). Pubertal timing and the development of psychopathology in adolescence and beyond. *Hormones and Behavior*, *64*(2), 262-269.

González de Rivera, J. L. (2002). *SCL-90-R. Cuestionario de 90 síntomas* [Symptom Checklist 90]. Madrid: TEA.

Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A., & Kraus, L. (2012). The 2011 ESPAD Report. *Substance Use Among Students in*, *36*, 123-134.

Hingson, R. W., Heeren, T., & Winter, M. R. (2006). Age at drinking onset and alcohol dependence: Age at onset, duration, and severity. *Archives of Pediatrics & Adolescent Medicine*, *160*(7), 739-746.

Jacobus, J., & Tapert, S. F. (2013). Neurotoxic effects of alcohol in adolescence. *Annual Review of Clinical Psychology*, *9*, 703-721.

Janssen, S. M., Chessa, A. G., & Murre, J. M. (2006). Memory for time: How people date events. *Memory & Cognition*, *34*(1), 138-147.

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review*, *20*(2), 149-171.

Lenroot, R. K., & Giedd, J. N. (2010). Sex differences in the adolescent brain.*Brain and Cognition*, *72*(1), 46-55.

Marshall, E. J. (2014). Adolescent alcohol use: Risks and consequences. *Alcohol and Alcoholism*, *49*(2), 160-164.

O'Neil, K. A., Conner, B. T., & Kendall, P. C. (2011). Internalizing disorders and substance use disorders in youth: Comorbidity, risk, temporal order, and implications for intervention. *Clinical Psychology Review*, *31*(1), 104-112.

Sharrett-Field, L., Butler, T. R., Reynolds, A. R., Berry, J. N., & Prendergast, M. A. (2013). Sex differences in neuroadaptation to alcohol and withdrawal neurotoxicity. *Pflugers Archiv European Journal of Physiology*, *465*(5), 643-654.

Szklo, M., & Nieto, J. (2013). *Epidemiology: Beyond the Basics* (3th ed.). Boston, MA: Jones & Bartlett Publishers.

Smith, A. R., Chein, J., & Steinberg, L. (2013). Impact of socio-emotional context, brain development, and pubertal maturation on adolescent risk-taking. *Hormones and Behavior*, *64*(2), 323-332.

Spear, L. P. (2013). Adolescent neurodevelopment. *Journal of Adolescent Health*, *52*(2), S7-S13.

Spear, L. P. (2015). Adolescent alcohol exposure: Are there separable vulnerable periods within adolescence? *Physiology & Behavior*, *148*, 122-130.

Storr, C. L., Pacek, L. R., & Martins, S. S. (2012). Substance use disorders and adolescent psychopathology. *Public Health Reviews*, *34*(2), 442-484

White, A., & Hingson, R. (2014). The burden of alcohol use: Excessive alcohol consumption and related consequences among college students.*Alcohol Research : Current Reviews*, *35*(2), 201-218.

Wicki, M., Kuntsche, E., & Gmel, G. (2010). Drinking at European universities? A review of students' alcohol use. *Addictive Behaviors*, *35*(11), 913-924.

Yurgelun-Todd, D. (2007). Emotional and cognitive changes during adolescence. *Current Opinion in Neurobiology*, *17*(2), 251-257.

Zahn-Waxler, C., Shirtcliff, E. A., & Marceau, K. (2008). Disorders of childhood and adolescence: Gender and psychopathology. *Annual Review of Clinical Psychology*, *4*, 275-303.