Posttraumatic stress avoidance symptoms as mediators in the development of alcohol use disorders after exposure to childhood sexual abuse in a Swiss community sample

Mario Müller[1*], Caroline Vandeleur[2], Stephanie Rodgers[1], Wulf Rössler[1, 3, 4], Enrique Castelao[2], Martin Preisig[2], Vladeta Ajdacic-Gross[1]

[1]Department of Psychiatry, Psychotherapy and Psychosomatics, Zurich University Hospital of Psychiatry, Militärstrasse 8, 8021 Zurich, Switzerland

[2]Department of Psychiatry, CHUV, Site de Cery, 1008 Prilly, Lausanne, Switzerland

[3]Collegium Helveticum, University of Zurich and Swiss Federal Institute of Technology, Schmelzbergstrasse 25, 9 8092 Zurich, Switzerland

[4]Institute of Psychiatry, Laboratory of Neuroscience (LIM 27), University of Sao Paulo, Medical School, 05403-010, Sao Paulo, Brazil

The authors declare that there are no conflicts of interests.

Word count Abstract: 153

Word count text body (without Acknowledgements, References and Tables): 3'543

Number of Tables: 3

*Corresponding author:

Mario Müller, Ph.D., Zurich University Hospital of Psychiatry, Department of Psychiatry, Psychotherapy and Psychosomatics; PO Box 1930; CH-8021 Zurich; Switzerland; Tel: 0041-44-296 74 32; Fax: 0041-44-296 74 49, E-mail: mario.mueller@dgsp.uzh.ch

Email addresses of authors:

Mario Müller: mario.mueller@dgsp.uzh.ch

Caroline Vandeleur: caroline.vandeleur@chuv.ch

Stephanie Rodgers: stephanie.rodgers@dgsp.uzh.ch

Wulf Rössler: wulf.roessler@uzh.ch

Enrique Castelao: enrique.castelao@chuv.ch

Martin Preisig: martin.preisig@chuv.ch>

Vladeta Ajdacic-Gross: vajdacic@dgsp.uzh.ch

Abstract

This study examined the role of posttraumatic stress disorder (PTSD) symptoms of re-experience, avoidance, and hyperarousal in the relationship between different types of trauma and alcohol use disorders (AUD). We used data from 731 trauma-exposed individuals who participated in the first wave of the PsyCoLaus-study. Trauma characteristics were assessed relatively to the occurrence of lifetime PTSD symptoms and AUD. The results suggest that lifetime and childhood sexual abuse as well as overall childhood trauma were directly linked to AUD and PTSD symptoms, in particular to avoidance symptoms. From single symptom clusters PTSD avoidance was found to specifically mediate the trauma-AUD pathway. Both childhood and sexual trauma strongly contribute to the comorbidity of PTSD and AUD and avoidance-type symptoms appear to play a central role in maintaining this association. Hence, the alleviation of avoidance symptoms might be an important target for therapeutic intervention among victims of sexual abuse before specific addiction treatment is initiated.

Introduction

The experience of adverse or traumatic life events is associated with a number of negative consequences, such as posttraumatic stress disorder (PTSD), depression and suicide attempts (for an overview (McFarlane, 2004; Mulvihill, 2005). Other long-term consequences of trauma exposure include maladaptive behaviors such as excessive drinking, distorted eating as well as self-injurious behavior (Rorty & Yager, 1996).

The link between trauma exposure and alcohol use disorders (AUD) has been documented by numerous studies (Fetzner, McMillan, Sareen, & Asmundson, 2011; Walsh, et al., 2014). There is evidence from clinical studies that more than 80% of individuals who sought help for AUD have experienced at least one traumatic event during their lives (Dragan & Lis-Turlejska, 2007). The majority of them experienced their first traumatic event during childhood, mostly as sexual or physical abuse (Lown, Nayak, Korcha, & Greenfield, 2011; Zlotnick, et al., 2006). Adolescents with alcohol dependence were found to be up to 21 times more likely than controls to report a history of sexual abuse (Clark, Lesnick, & Hegedus, 1997). Similarly, associations between sexual abuse and adulthood alcohol use problems have been found in cross-sectional as well as in prospective community samples (for a review (Browne & Finkelhor, 1986; Molnar, Buka, & Kessler, 2001), albeit numbers were somewhat smaller than in help-seeking populations. However, the mechanisms and determinants underlying these associations remain unclear so far.

A conceptual model of long-term correlates of sexual abuse suggests that tension-reducing behaviors, such as the increased use of alcohol, may be seen as an attempt to cope with traumatic experiences (Polusny & Follette, 1995). Sexual abuse, especially at an early age, is often a persistent experience rather than restricted to a single event, such as an accident, and may therefore be more prone to severe psychopathological and developmental consequences in later adulthood, including high levels of anxiety and emotional distress (De Bellis, 2002;

Fergusson, Horwood, & Lynskey, 1996; Whiffen & Macintosh, 2005). This often includes the development of symptoms, such as autonomic hyperarousal, avoidant behaviors, and re-experiencing phenomena, which constitute the core diagnostic criteria for posttraumatic stress disorder (PTSD) according to the DSM-IV (APA, 1994). Therefore, it is not surprising that the comorbidity of AUD with PTSD (Leeies, Pagura, Sareen, & Bolton, 2010) is comparably higher for childhood or adult sexual trauma than for any other types of trauma (Blanco, et al., 2013; Najavits, Weiss, & Shaw, 1997).

It was observed that the development of PTSD often precedes the over- or misuse of alcohol and/or substances, i.e. consistent with the self-medication model (Khantzian, 1997; Ouimette, Read, Wade, & Tirone, 2010). If the self-medication hypothesis is true, alcohol will be used to reduce the symptoms of traumatic stress. Thus, higher stress will lead to more frequent PTSD symptoms, which, in turn, may mediate the development of alcohol use symptoms and consequently increase the risk for AUD (Epstein, Saunders, Kilpatrick, & Resnick, 1998). However, PTSD is known to be a heterogeneous disorder with its well-characterized symptom clusters, which could be differentially associated with alcohol use problems (for review (Jakupcak, et al., 2010). The extent to which specific PTSD symptoms contribute to the pathway between trauma and AUD remains unclear. This, however, will be the main focus of the current study.

Therefore, the purpose of the current study was to more closely examine the direct and indirect associations among trauma (type and timing), PTSD symptomatology (re-experience, avoidance, and hyperarousal symptom clusters), and AUD in a large, epidemiological sample of individuals with lifetime trauma. Our primary aim was to explore whether the three PTSD symptom clusters would mediate the well-known relationship of lifetime and childhood trauma, and of a history of sexual abuse in particular, with higher rates of AUD. Based on the

findings we hope to gain more insight into the underlying mechanisms of the comorbidity of PTSD and AUD.

Methods

Sample and procedure

All data were collected within the PsyCoLaus study, a substudy of the larger CoLaus randomly selected population-based cohort study of Lausanne, in the French-speaking part of Switzerland. From 2003 to 2006, a sample of N=6,734 subjects aged between 35 and 75 years (at the time of assessment) was recruited for the first wave of CoLaus, which was designed to assess the prevalence of cardiovascular risk factors and diseases. From a total of 5,535 individuals that finally participated, two thirds (N=3,720; 67.00%) agreed to take part in the additional psychiatric (PsyCoLaus) assessment. Since trauma exposure was conditional for the assessment of PTSD symptoms, only those subjects were included in the current study that reported any lifetime traumatic exposure (N=783; 21.20%). From those, another 52 (6.64%) subjects were excluded as they reported an onset of AUD prior to first trauma exposure, which lead to a final sample of N=731 subjects.

About 57% (57.32%) were females and the mean age was 49.44 years (SD=8.68; range: 35.03-65.87 years) (Table 1). More than a half of the study sample (52.79%) had basic education, 25.91% higher education and 21.31% had a university degree.

The study was approved by the Ethics Committee of the University of Lausanne. All participants provided written consent after being informed of the goal and funding of the study.

Measures

The data of the PsyCoLaus study were derived from the French version (Leboyer, et al., 1995) of the semi-structured Diagnostic Interview for Genetic Studies (DIGS) (Nurnberger, et al., 1994). In addition to demographic features, the French version of the DIGS comprises information on a broad spectrum of DSM-IV Axis I disorders as well as on some Axis II criteria and suicide behavior (Preisig, et al., 2009). According to the DIGS participants were coded as having an AUD if they met criteria for either alcohol abuse or dependence according to the DSM-IV at any point of their lives. The experience of PTSD symptoms was assessed using the relevant sections from the French version (Leboyer, et al., 1991) of the Schedule for Affective Disorders and Schizophrenia – Lifetime and Anxiety disorder version (Endicott & Spitzer, 1978).

Lifetime exposure to potentially traumatizing events was assessed asking the question "Have you ever been exposed to any of these events from the following categories?": 1.) accident, 2.) physical assault, 3.) combat and/or war, 4.) witness of murder, violence or death by an accident, and 5.) sexual abuse. Sexual abuse was defined as the experience of an event that a person judged as sexual and to which he/she did not consent, such as exhibitionism, being touched, threatened or raped. All trauma categories were binary coded as 1 "exposed" versus 0 "not exposed". Subsequently, the recalled age of first exposure was documented for any of the categories 1 through 4, and separately for sexual abuse (category 5). Exposure, below the age of 16 years, to events from categories 1 through 4 was coded as "childhood non-sexual trauma", from category 5 as "childhood sexual abuse, and as "childhood trauma" in general, respectively, when any event from categories 1 through 5 was experienced during this early life period.

Diagnosis of pretrauma depression was given when an individual met DSM-IV criteria for either major depression or dysthymia before the age of trauma exposure. Similarly, a

diagnosis of pretrauma anxiety disorder was given when an individual met DSM-IV criteria for at least one of the following disorders before the age of trauma exposure: agoraphobia, generalized anxiety disorder, overanxious disorder, panic disorder, separation anxiety disorder, simple phobia, and social phobia. Familial liability to depression and anxiety disorders were assessed by asking the participants whether they have any first degree family member that ever suffered from any of these disorders.

The French version of the DIGS revealed excellent inter-rater and fair to good test-retest reliability for AUD (kappa=0.72; Yule=0.73) (Berney, Preisig, Matthey, Ferrero, & Fenton, 2002). To test the reliability of the PTSD section of the French version of the SADS-LA a three-year follow-up study on 176 psychiatric patients was conducted, which revealed a test-retest reliability for the PTSD diagnosis of Yule=0.69. The three-year test-retest reliability in terms of Yule's Y coefficients for exposure to violent crime and sexual trauma in a sample of 176 adult psychiatric patients were as high as 0.84 and 0.57, respectively, although those for exposure to accidents and witnessing trauma to others were only 0.30 and 0.22, respectively (Perrin, et al., 2014). The test-retest reliability for exposure to war could not be tested in this sample given its rareness (Perrin, et al., 2014).

Statistical analysis

Descriptive sample statistics were derived for trauma types and potential predictors and mediators for the total study sample as well as for the subsample with AUD. Weighted proportions were given in percent (%) for categorical and means (M) and standard deviations (SD) for continuous variables. Differences between those with AUD versus those without were explored using paired t-tests for continuous variables and Chi-square statistics for

categorical variables. Bivariate relationships between PTSD symptom types and considered path model predictors were examined using Pearson correlation coefficients.

All these analyses were conducted using Stata/SE 12 (StataCorp, 2011).

Path modeling

For each AUD-related trauma type a separate path model was specified linking trauma to AUD through the three sets of PTSD symptom clusters, namely re-experience, avoidance and hyperarousal. Single clusters were excluded from the model if they were found to be unrelated to the main independent variable (trauma type) in the bivariate analyses. Covariates (gender, age, familial liability of mental illness and pre-trauma mental health condition) were added to the models if they were associated with AUD in the bivariate analyses. Modification indices were inspected for the purpose of model improvement with values of greater than 5.0 indicating that substantial changes were necessary for improving the model (Sorbom, 1989). For the analyses we used the INDIRECT command in MPlus to estimate indirect or mediated effects. Then, as recommended by MacKinnon and colleagues (Mackinnon, Lockwood, & Williams, 2004), all models were re-run with 1000 bootstrap samples to test for the significance of indirect effects. Bootstrap indirect path coefficients with 95% bias-corrected confidence intervals were calculated. Confidence intervals that did not include zero indicated significant indirect effects (Mackinnon, et al., 2004).

Furthermore, probabilities for direct and indirect effects were calculated by using the MODEL CONSTRAINT command in MPlus. Thus, the two parameter estimates from 1.) trauma type to the mediator and 2.) from the mediator to AUD were multiplied to obtain unstandardized effects that are the same as those from the INDIRECT procedure. Then, OR's (and 95%CI) of direct and indirect effects were calculated by exponentiating the unstandardized direct and indirect effect estimates from the MODEL CONSTRAINT

procedure. If a 95% CI did not contain the value 1.0 the effect was considered as significant at p<.05.

Path modeling was conducted using MPlus v7.11 (Muthen & Muthen, 1998-2012).

Results

Table 1 displays descriptive statistics on all initially considered study variables as well as their associations with AUD. From socio-demographic characteristics only male sex (61.25%) was significantly associated with AUD. The trauma most often reported was witnessing violence (48.43%), followed by the experience of an accident (26.54%), physical assault (crime; 19.56%), and finally sexual abuse (16.42%) and being involved in acts of combat and war (10.26%). Lifetime sexual abuse was about twice as likely in those with AUD compared to those without (27.50% vs. 15.05%; p=.005; OR=2.14; 95%CI:1.25-3.66). One third (34.34%) of the sample experienced their first trauma before the age of 16 from which one eighth (11.90%) had been sexually abused and one quarter (25.31%) had been exposed to other trauma during this early life period. Childhood trauma (55.00% vs. 31.80%; p<.001; OR=2.62; 95%CI:1.64-4.20) and childhood sexual abuse (25.00% vs. 10.29%; OR=2.91; 95%CI:1.65-5.12) were significantly more prevalent in the AUD group. Furthermore, pre-existing depression (14.36%) and anxiety disorders (29.27%) as well as familial liability to depression (24.97%) and anxiety disorder (10.15%) did not differ between those with and without AUD. From the three PTSD symptom clusters avoidance (mean difference=-.70; p=.003) and hyperarousal symptoms (mean difference=-.38; p=.038) were significantly higher among those with AUD than their counterparts.

-insert Table 1-

Table 2 presents bivariate correlations between those predictors found to be significant with AUD in the bivariate analyses and PTSD symptom clusters. Accordingly, female sex was associated with all three symptom clusters of PTSD. Lifetime and childhood sexual abuse were also linked to all three clusters while any childhood trauma was linked to PTSD avoidance only.

-insert Table 2-

Table 3 presents the results of the multiple mediation analyses for lifetime sexual abuse, any childhood trauma and childhood sexual abuse. Due to non-significant associations with the outcome, no other trauma types were used as covariates, but all models were adjusted for sex. Direct and indirect effects via the PTSD symptom clusters of re-experience, avoidance, and hyperarousal were tested in models with lifetime and childhood sexual abuse. In the model with any childhood trauma only avoidance symptoms served as a mediator since the other clusters were not associated with this trauma type. As recommended by Preacher and Hayes (2008) all regression coefficients are unstandardized and therefore represent a change by one unit in the dependent variable by change in the independent variable. In order to estimate the likelihood of AUD for a given condition OR's and 95%CI's were calculated additionally for all direct and indirect paths to AUD.

All three models were fully saturated (i.e. had zero degrees of freedom), and therefore fit statistics could not be used to determine how well the models fit. However, inspection of model indices indicated that no changes were required on any model. According to the results, all three models showed a significant total effect of trauma on AUD as well as an indirect

effect mediated through PTSD avoidance symptoms. Childhood sexual abuse revealed the highest total effects on AUD although both lifetime and childhood sexual abuse had identical indirect effects. Although any childhood trauma had the lowest indirect effect estimate its total effect on AUD was slightly higher than that of lifetime sexual abuse. The bias-corrected bootstrap procedure confirmed the significance of the indirect effects.

-insert Table 3-

Discussion

Notwithstanding the high rates of comorbidity between PTSD and AUD, little is known about the mechanisms that might be involved in the etiology of their co-occurrence. The current study was intended to fill this gap. Drawing from a dataset that specifically focused on a community-based sample of adults who experienced trauma during their life, this study is one of the first to examine the links among different types of trauma, PTSD symptomatology and subsequent AUD. This study might be relevant to mental health care providers given the large number of treatment-seeking individuals with AUD and a history of traumatic experiences and could serve as a basis for early identification and intervention for persons at risk.

Our study gives support to the self-medication hypothesis of PTSD, such that severe traumatic events might increase the risk for AUD, while this association was triggered by increased posttraumatic stress. As expected, our findings supported the well-established link between sexual trauma, in particular when experienced as a child, and AUD. This study found that this association was mediated by symptoms of posttraumatic stress and that in fact PTSD avoidance symptoms played an important role in this pathway. Consistent with the self-medication theory our findings suggest that individuals specifically exposed to severe events

such as sexual abuse experiences manifest more severe responses of posttraumatic distress, which in turn, make them more vulnerable to an increased use of alcohol as self-medication. Although our data suggest that sexually traumatized individuals seem to develop all three types of posttraumatic stress symptoms, it was only avoidance symptoms that subsequently contributed to the development of subsequent AUD. Previous studies have also described avoidance as an important construct to explain the link between sexual abuse and subsequent psychological distress (Polusny, Rosenthal, Aban, & Follette, 2004; Rosenthal, Rasmussen Hall, Palm, Batten, & Follette, 2005; Stovall-McClough & Cloitre, 2006). Avoidance symptoms promote a rather maladaptive pattern of emotion regulation that essentially contributes to the development and maintenance of psychological problems in sexual trauma survivors (Rosenthal, et al., 2005). Accordingly, dysfunctional behavioral strategies, such as consuming alcohol or illicit substances, are initiated to avoid unpleasant emotions or thoughts that are associated with the abuse experience (Polusny & Follette, 1995). Consequently, behaviors that were initially used to relieve distress can easily become excessive and cause serious psychopathology such as AUD (Polusny & Follette, 1995). It may indeed be difficult to regulate emotions that result as a consequence of the traumatic event since they might interfere with optimal cognitive processing. This, however, helps to explain why alcohol is used to deal with avoidance symptoms that are most enduring and therefore play a central role in the maintenance of PTSD (Morina, Stangier, & Risch, 2008).

In general, the associations that were found in this study were rather small in terms of effect size. However, since this study focused on individuals that were exposed to at least one trauma type during their lifes, specific effects of sexual abuse experiences on AUD might be underestimated and are probably higher in the full sample. Our sampling method allowed us to collect information on PTSD symptoms only if a person met criteria for a traumatic event, which, however, is the state of the art. Moreover, when confining the timing of sexual trauma to childhood we found almost identical estimates of its impact on AUD. Descriptive results

suggest that the majority or almost all sexually abused individuals experienced their first abuse below the age of 16 years.

This study entails some limitations that have to be acknowledged. First, the cross-sectional design of the study does not allow us to draw conclusions regarding causality. However, it is unlikely to assume that, at least for childhood trauma/sexual abuse, which was defined as having been experienced before the age of 16, a person met criteria of AUD at that time. Second, childhood traumatic experiences were assessed retrospectively and might therefore be subject to recall bias. A previous review, however, concluded that reports of childhood abuse and neglect in non-clinical populations slightly tend to underestimate its true incidences but, apart from that, are sufficiently valid to be usable (Hardt & Rutter, 2004). Third, we used a rather broad category of sexual abuse, which included both non-contact (e.g. exihibitionism) and contact forms (e.g. rape, unwanted touching) of sexual abuse. Some may argue that exihibitionism should not be conflated with other severe forms of sexual abuse experiences. However, to enable a more realistic estimate of the impact of the experience on the psychological state of the victim, we defined sexual abuse as an event that a person experienced as „sexual and not being consented to". Fourth, we excluded those that were diagnosed with AUD with an onset before the first trauma exposure in order to minimize bias. Additional research using prospective data is needed to draw more robust inferences on the meditational role of avoidance symptoms among victims of sexual abuse that develop AUD. Fifth, as trauma was reported retrospectively, the report of past adverse experiences may have been influenced by current affective states or other unknown factors that were not assessed in this study. Thus, it is possible that the recollection of traumatic exposure, rather than the actual exposure itself, was associated with higher consumption patterns and appropriate caution should be exercised in interpreting these findings. Sixth and finally, in addition to avoidance symptoms, there may be other factors that act as mediators in

the pathway between trauma and AUD. Indeed, it is possible that other types of psychological distress contribute to the development of trauma-related alcohol misuse. Likewise, unhealthy or maladaptive coping strategies in general might be triggered by other problems, such as parental substance misuse, family dysfunction or personality factors, such as neuroticism and low self-esteem, which could indirectly contribute to the development of AUD (Haugland, Holmen, Ravndal, & Bratberg, 2013; Hwang, et al., 2014; Tomaka, Morales-Monks, & Shamaley, 2013). Future studies should further address these aspects, which extend beyond the scope of the present research.

Taken together, the research summarized in this article provides strong support for the self-medication hypothesis of PTSD. Our results suggest that posttraumatic stress symptoms predict the emergence of AUD following sexual trauma, in particular if experienced during childhood. Beyond that, our study shows new findings in that it is specifically avoidance symptoms that play a prominent role in this pathway. Therefore, our findings have important implications for clinical practice. First, it suggests the need to examine both trauma type and PTSD symptom clusters in more detail as they may be differentially linked to AUD. Second, as sexual trauma victims are particularly prone to respond with avoidance symptoms (Murphy, et al., 2014), it further suggests that interventions should more specifically address the treatment of avoidance symptoms in order to minimize the risk of self-medication among individuals with sexual traumatization. Similarly, those individuals utilizing mental health services presenting with already comorbid PTSD/AUD and a history of sexual abuse would benefit from a two-step intervention. Thus, integrated treatments should target first on the alleviation of PTSD (avoidance) symptoms, which will help to improve the problematic use of alcohol and/or substances even prior to specific addiction treatment rather than vice versa (Back, Brady, Sonne, & Verduin, 2006). This, however, is still somewhat problematic since patients are mostly required to be abstinent before dealing with their traumatic experiences (Back, et al., 2006).

References

APA, A. P. A.-. (1994). *Diagnostic and Statistical Manual of Mental Disorders, 4th edition*. Washington, DC: American Psychiatric Press.

Back, S. E., Brady, K. T., Sonne, S. C., & Verduin, M. L. (2006). Symptom improvement in co-occurring PTSD and alcohol dependence. *Journal of Nervous and Mental Disease, 194*(9), 690-696.

Berney, A., Preisig, M., Matthey, M. L., Ferrero, F., & Fenton, B. T. (2002). Diagnostic interview for genetic studies (DIGS): inter-rater and test-retest reliability of alcohol and drug diagnoses. *Drug Alcohol Depend, 65*(2), 149-158.

Blanco, C., Xu, Y., Brady, K., Perez-Fuentes, G., Okuda, M., & Wang, S. (2013). Comorbidity of posttraumatic stress disorder with alcohol dependence among US adults: results from National Epidemiological Survey on Alcohol and Related Conditions. *Drug Alcohol Depend, 132*(3), 630-638.

Browne, A., & Finkelhor, D. (1986). Impact of child sexual abuse: a review of the research. *Psychol Bull, 99*(1), 66-77.

Clark, D. B., Lesnick, L., & Hegedus, A. M. (1997). Traumas and other adverse life events in adolescents with alcohol abuse and dependence. *J Am Acad Child Adolesc Psychiatry, 36*(12), 1744-1751.

De Bellis, M. D. (2002). Developmental traumatology: a contributory mechanism for alcohol and substance use disorders. *Psychoneuroendocrinology, 27*(1-2), 155-170.

Dragan, M., & Lis-Turlejska, M. (2007). Lifetime exposure to potentially traumatic events in a sample of alcohol-dependent patients in Poland. *J Trauma Stress, 20*(6), 1041-1051.

Endicott, J., & Spitzer, R. L. (1978). A diagnostic interview: the schedule for affective disorders and schizophrenia. *Arch Gen Psychiatry, 35*(7), 837-844.

Epstein, J. N., Saunders, B. E., Kilpatrick, D. G., & Resnick, H. S. (1998). PTSD as a mediator between childhood rape and alcohol use in adult women. *Child Abuse & Neglect, 22*(3), 223-234.

Fergusson, D. M., Horwood, L. J., & Lynskey, M. T. (1996). Childhood sexual abuse and psychiatric disorder in young adulthood: II. Psychiatric outcomes of childhood sexual abuse. *J Am Acad Child Adolesc Psychiatry, 35*(10), 1365-1374.

Fetzner, M. G., McMillan, K. A., Sareen, J., & Asmundson, G. J. (2011). What is the association between traumatic life events and alcohol abuse/dependence in people with and without PTSD? Findings from a nationally representative sample. *Depress Anxiety, 28*(8), 632-638.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *J Child Psychol Psychiatry, 45*(2), 260-273.

Haugland, S. H., Holmen, T. L., Ravndal, E., & Bratberg, G. H. (2013). Parental alcohol misuse and hazardous drinking among offspring in a general teenage population: gender-specific findings from the Young-HUNT 3 study. *BMC Public Health, 13*, 1140.

Hwang, J. Y., Choi, J. S., Gwak, A. R., Jung, D., Choi, S. W., Lee, J., et al. (2014). Shared psychological characteristics that are linked to aggression between patients with Internet addiction and those with alcohol dependence. *Ann Gen Psychiatry, 13*(1), 6.

Jakupcak, M., Tull, M. T., McDermott, M. J., Kaysen, D., Hunt, S., & Simpson, T. (2010). PTSD symptom clusters in relationship to alcohol misuse among Iraq and

Afghanistan war veterans seeking post-deployment VA health care. *Addict Behav, 35*(9), 840-843.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4*(5), 231-244.

Leboyer, M., Barbe, T., Gorwood, P., Teherani, M., Allilaire, J. F., Preisig, M., et al. (1995). *Interview diagnostique pour les études génétiques.*Unpublished manuscript, Paris.

Leboyer, M., Maier, W., Teherani, M., Lichtermann, D., D'Amato, T., Franke, P., et al. (1991). The reliability of the SADS-LA in a family study setting. *Eur Arch Psychiatry Clin Neurosci, 241*(3), 165-169.

Leeies, M., Pagura, J., Sareen, J., & Bolton, J. M. (2010). The Use of Alcohol and Drugs to Self-Medicate Symptoms of Posttraumatic Stress Disorder. *Depression and Anxiety, 27*(8), 731-736.

Lown, E. A., Nayak, M. B., Korcha, R. A., & Greenfield, T. K. (2011). Child physical and sexual abuse: a comprehensive look at alcohol consumption patterns, consequences, and dependence from the National Alcohol Survey. *Alcohol Clin Exp Res, 35*(2), 317-325.

Mackinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence Limits for the Indirect Effect: Distribution of the Product and Resampling Methods. *Multivariate Behav Res, 39*(1), 99.

McFarlane, A. (2004). The contribution of epidemiology to the study of traumatic stress. *Soc Psychiatry Psychiatr Epidemiol, 39*(11), 874-882.

Molnar, B. E., Buka, S. L., & Kessler, R. C. (2001). Child sexual abuse and subsequent psychopathology: results from the National Comorbidity Survey. *Am J Public Health, 91*(5), 753-760.

Morina, N., Stangier, U., & Risch, A. K. (2008). Experiential avoidance in civilian war survivors with current versus recovered posttraurnatic stress disorder: A pilot study. *Behaviour Change, 25*(1), 15-22.

Mulvihill, D. (2005). The health impact of childhood trauma: an interdisciplinary review, 1997-2003. *Issues Compr Pediatr Nurs, 28*(2), 115-136.

Murphy, R. A., Sink, H. E., Ake, G. S., 3rd, Carmody, K. A., Amaya-Jackson, L. M., & Briggs, E. C. (2014). Predictors of treatment completion in a sample of youth who have experienced physical or sexual trauma. *J Interpers Violence, 29*(1), 3-19.

Muthen, L. K., & Muthen, B. O. (1998-2012). *Mplus User's Guide. Seventh Edition*. Los Angeles, CA: Muthén & Muthén.

Najavits, L. M., Weiss, R. D., & Shaw, S. R. (1997). The link between substance abuse and posttraumatic stress disorder in women. A research review. *Am J Addict, 6*(4), 273-283.

Nurnberger, J. I., Jr., Blehar, M. C., Kaufmann, C. A., York-Cooler, C., Simpson, S. G., Harkavy-Friedman, J., et al. (1994). Diagnostic interview for genetic studies. Rationale, unique features, and training. NIMH Genetics Initiative. *Arch Gen Psychiatry, 51*(11), 849-859; discussion 863-844.

Ouimette, P., Read, J. P., Wade, M., & Tirone, V. (2010). Modeling associations between posttraumatic stress symptoms and substance use. *Addict Behav, 35*(1), 64-67.

Perrin, M., Vandeleur, C. L., Castelao, E., Rothen, S., Glaus, J., Vollenweider, P., et al. (2014). Determinants of the development of post-traumatic stress disorder, in the general population. *Soc Psychiatry Psychiatr Epidemiol*.

Polusny, M. A., & Follette, V. M. (1995). Long-Term Correlates of Child Sexual Abuse - Theory and Review of the Empirical Literature. *Applied & Preventive Psychology, 4*(3), 143-166.

Polusny, M. A., Rosenthal, M. Z., Aban, I., & Follette, V. M. (2004). Experimental avoidance as a mediator of the effects of adolescent sexual victimization on negative adult outcomes. *Violence Vict, 19*(1), 109-120.

Preisig, M., Waeber, G., Vollenweider, P., Bovet, P., Rothen, S., Vandeleur, C., et al. (2009). The PsyCoLaus study: methodology and characteristics of the sample of a population-based survey on psychiatric disorders and their association with genetic and cardiovascular risk factors. *BMC Psychiatry, 9*, 9.

Rorty, M., & Yager, J. (1996). Histories of childhood trauma and complex post-traumatic sequelae in women with eating disorders. *Psychiatr Clin North Am, 19*(4), 773-791.

Rosenthal, M. Z., Rasmussen Hall, M. L., Palm, K. M., Batten, S. V., & Follette, V. (2005). Chronic avoidance helps explain the relationship between severity of childhood sexual abuse and psychological distress in adulthood. *J Child Sex Abus, 14*(4), 25-41.

Sorbom, D. (1989). Model modification. *Psychometrika, 54*, 371-384.

StataCorp (2011). Stata Statistical Software (Version Release 12). College Station, TX: StataCorp.

Stovall-McClough, K. C., & Cloitre, M. (2006). Unresolved attachment, PTSD, and dissociation in women with childhood abuse histories. *J Consult Clin Psychol, 74*(2), 219-228.

Tomaka, J., Morales-Monks, S., & Shamaley, A. G. (2013). Stress and coping mediate relationships between contingent and global self-esteem and alcohol-related problems among college drinkers. *Stress Health, 29*(3), 205-213.

Walsh, K., Elliott, J. C., Shmulewitz, D., Aharonovich, E., Strous, R., Frisch, A., et al. (2014). Trauma exposure, posttraumatic stress disorder and risk for alcohol, nicotine, and marijuana dependence in Israel. *Compr Psychiatry, 55*(3), 621-630.

Whiffen, V. E., & Macintosh, H. B. (2005). Mediators of the link between childhood sexual abuse and emotional distress: a critical review. *Trauma Violence Abuse, 6*(1), 24-39.

Zlotnick, C., Johnson, D. M., Stout, R. L., Zywiak, W. H., Johnson, J. E., & Schneider, R. J. (2006). Childhood abuse and intake severity in alcohol disorder patients. *J Trauma Stress, 19*(6), 949-959.

Table 1. Socio-demographic, trauma-related and mental health characteristics for the total sample and for subjects with AUD (versus those without AUD)

	Total sample (N=731)	No AUD (N=651; 89.06%)	AUD (N=80; 10.94%)	p-value	OR (95%CI)
Sex, female %	57.32	59.60	38.75	**<.001**	**.43 (.27-.69)**
Age M±SD	49.44±8.68	49.44±8.60	49.41±9.36	.971	1.00 (.79-1.26)
Education					
Basic %	52.79	51.64	62.03	.215	Ref
Higher %	25.91	26.45	21.52		.68 (.38-1.21)
University degree %	21.31	21.91	16.46		.63 (.33-1.19)
Lifetime trauma					
Accident %	26.54	26.57	26.25	.951	.98 (.58-1.67)
Physical assault %	19.56	19.66	18.75	.846	.94 (.52-1.71)
War/combat %	10.26	10.29	10.00	.935	.97 (.45-2.10)
Witness %	48.43	49.00	43.75	.375	.81 (.51-1.29)
Sexual abuse %	16.42	15.05	27.50	**.005**	**2.14 (1.25-3.66)**
Childhood trauma					
Any trauma %	34.34	31.80	55.00	**<.001**	**2.62 (1.64-4.20)**
Sexual abuse %	11.90	10.29	25.00	**<.001**	**2.91 (1.65-5.12)**
Non-sexual trauma %	25.31	24.27	33.75	.066	1.59 (.97-2.61)
Pretrauma mental health condition					
Depression %	14.36	15.21	7.50	.064	.45 (.19-1.07)
Anxiety disorder %	29.27	28.26	37.50	.087	1.52 (.94-2.47)
Familial liability					
Depression %	24.97	24.49	28.75	.407	1.24 (.74-2.09)
Anxiety disorder %	10.15	10.17	10.00	.962	.98 (.45-2.13)

PTSD avoidance and AUD

PTSD symptoms					
Re-experience M±SD	1.82±1.70	1.79±1.69	2.04±1.80	.216	1.15 (.92-1.45)
Avoidance M±SD	1.70±1.99	1.63±1.93	2.33±2.30	**.003**	**1.37 (1.11-1.69)**
Hyperarousal M±SD	1.28±1.53	1.24±1.49	1.61±1.76	**.038**	**1.25 (1.01-1.55)**

Lifetime trauma categories are not mutually exclusive
AUD = alcohol use disorder
PTSD = posttraumatic stress disorder
Percentages are column %
OR (95%CI) = odds ratio (95% confidence intervals)
M±SD = mean±standard deviation

Table 2. Bi-variate associations between predictor and mediator variables

	PTSD re-experience	PTSD avoidance	PTSD hyperarousal
Sex, female	.19***	.22***	.19***
Lifetime sexual abuse	.14***	.29***	.22***
Any childhood trauma	.06	.11**	.06
Childhood sexual abuse	.13***	.26***	.19***

Reported estimates are based on Pearson correlation coefficients
***p<.001
** p<.01
PTSD = posttraumatic stress disorder

Table 3. Results of mediation analyses for childhood trauma and/or sexual abuse on AUD via PTSD symptoms

Independent variable (IV)	Mediator	Effect of IV on mediator	Effect of mediator on AUD		Indirect effect estimates[2]		Total effect of IV on AUD		Direct effect of IV on AUD	
		Estimate[1]	Estimate[1]	OR (95%CI)	Estimate[1]	OR (95%CI)	Estimate[1]	OR (95%CI)	Estimate[1]	OR (95%CI)
Lifetime sexual abuse	Re-experience	**.272***	-.055	.95 (.79-1.13)	-.015	.99 (.90-1.03)	**.679***	**1.97 (1.44-2.84)**	**.538***	**1.71 (1.23-2.45)**
	Avoidance	**.676***	**.205***	**1.23 (1.07-1.46)**	**.139***	**1.15 (1.05-1.34)**				
	Hyperarousal	**.506***	.034	1.04 (.88-1.22)	.017	1.02 (.94-1.11)				
Any childhood trauma	Re-experience	-	-	-	-	-	**.722***	**2.06 (1.60-2.64)**	**.679***	**1.97 (1.50-2.53)**
	Avoidance	**.205***	**.208***	**1.23 (1.09-1.39)**	**.043***	**1.04 (1.01-1.10)**				
	Hyperarousal	-	-	-	-	-				
Childhood sexual abuse	Re-experience	**.298***	-.055	.95 (.80-1.14)	-.016	.98 (.90-1.03)	**.832***	**2.30 (1.62-3.33)**	**.693***	**2.00 (1.40-2.89)**
	Avoidance	**.696***	**.199***	**1.22 (1.06-1.44)**	**.139***	**1.15 (1.05-1.36)**				
	Hyperarousal	**.495***	.035	1.04 (.88-1.22)	.017	1.02 (.95-1.12)				

[1]Effect estimates are unstandardized regression coefficients
[2]Based on 1000 bootstrapped samples
AUD = alcohol use disorder
PTSD = posttraumatic stress disorder
OR (95%CI) = odds ratio (95% confidence intervals)
All models were adjusted for sex

PTSD avoidance and AUD

*p<.05
**p<.01
***p<.001