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Risk factors for females being under the influence of alcohol compared to other illicit substances at the time of committing violent crimes

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Abstract

Purpose—We investigated women under the influence of alcohol compared to other illicit substances at the time of committing a crime, to identify predictors of being under the influence of alcohol and female enacted crime.

Methods—Analyses of data, obtained from private interviews and examinations of female prison inmates, included regression analyses exploring predictors of being under the influence of alcohol at the time of the crime and predictors of violent crime. Additionally, a reanalysis of a previously reported model, predicting conviction of a violent crime, was conducted including a new variable, being under the influence of alcohol at the time of the crime.

Results—Those under the influence of alcohol at the time of their crime had experienced greater non-family childhood sexual abuse (CSA) and traumatic brain injuries (TBI) with loss of consciousness predating their crime. They were more likely to have committed a violent, rather than non-violent crime compared to those under the influence of other substances, the latter being not significantly different for those not under the influence of any substance. Being under the influence of alcohol increased the risk of committing a violent crime adjusting for other predictors of female violence.

Conclusion—Women under the influence of alcohol are at greater risk for committing violent crimes than those on other substances. Female non-family CSA and TBI victims were at higher risk for being under the influence of alcohol, in comparison to other substances, at the time of committing a violent crime.

Introduction

According to 2012 *National Survey on Drug Use and Health* approximately 17 million adults in the United States aged 18 and older had an alcohol use disorder, including 5.7

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Conflicts of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

million women (Substance Abuse and Mental Health Services Administration [SAMHSA], 2012). Among women of childbearing age, 18–44 years, the percentage drinking alcohol was 51.5% for non-pregnant women and 7.6% for pregnant women (Centers for Disease Control and Prevention [CDC], 2012). Alcohol is problematic when drinking harms the drinker and/or places others, such as crime victims at risk.

It is not clear why female alcohol use prevalence is increasingly converging with men's (Bratberg et al., 2016; Keyes, Grant, & Hasin, 2008; Keyes, Li, & Hasin, 2011; Keyes, Martins, Blanco, & Hasin, 2010; SAMHSA, 2014; White et al., 2015; White House Council on Women and Girls [WCWG], 2011). It is critical to determine if alcohol increases risk for violence perpetrated by women, and in order to inform preventive intervention development, identify risk factors for alcohol-related female violence. Women are more likely to commit violent crimes now than in the past. During recent decades, imprisonment rates have risen exponentially for women in the United States (Court Services and Offender Supervision Agency [COSA], 2016) who represented 18% of all arrestees for violent felony offenses in 2008, up from 11% in 1990 (WCWG, 2011). Most studies of violence while the perpetrator was under the influence of substances do not separate alcohol's effects from that of other illicit substances. There may be a perception that legal substances such as alcohol are safer than illegal substances.

Theoretical Framework

This study builds on life course theory (Giele & Elder, 1998), developmental traumatology theory (De Bellis, 2001), and cue salience models (Pernanen, 1976; Steele & Josephs, 1990; Taylor & Leonard, 1983). Life course framework posits that early life influences and events, such as adverse childhood experiences (ACEs), including abuse and traumatic brain injuries (TBIs) with loss of consciousness, impact lifespan developmental outcomes later in life, such as violence while under the influence of alcohol in adulthood (Alwin, 2012). Life course events such as childhood abuse could impact the hypothalamic-pituitary-adrenal (HPA) axis regulation of cortisol that is related to adult female violence (Brewer-Smyth & Burgess, 2008; Brewer-Smyth, Burgess, & Shults, 2004). Developmental traumatology theory explains effects of ACE such as dysregulated biological stress systems (cortisol) leading to alcohol misuse (De Bellis, 2002) and violence (De Bellis, 2001; De Bellis & Zisk, 2014). Cue salience suggests that alcohol intoxication restricts cognitive attention to subtle, mitigating cues such as those predicting consequences, allowing for impulsivity that may result in alcohol-related violence. This may be more pronounced in victims of TBI. Therefore, we evaluated early life events (ACEs and TBIs) for their relationship to adult female violent criminal behavior while under the influence of alcohol.

Adverse Childhood Experiences (ACEs), Alcohol, and Violence

The association between alcohol use and violence has been well established. However, because alcohol use co-occurs with other risk factors for violence, the causal link between alcohol use and violence in relation to other risk factors is not well defined for women. ACEs such as childhood physical abuse (CPA), childhood emotional abuse (CEA), and childhood sexual abuse (CSA) are directly related to the risk for violent behaviors against others including violence perpetrated by females (Brewer-Smyth & Burgess, 2008; Brewer-

Smyth et al., 2004; Brewer-Smyth, Cornelius, & Pickelsimer, 2015; Harford, Yi, & Grant, 2014; Mair, Cunradi, & Todd, 2012). Childhood maltreatment (Fenton et al., 2013) and lifetime victimization (Nayak, Lown, Bond, & Greenfield, 2012) are both associated with increased risk for diverse alcohol use problems for both men and women. Childhood maltreatment may increase vulnerability to the effects of subsequent stressors contributing to problematic alcohol use (Keyes et al., 2012). Though CSA is linked to problematic alcohol use later in life (Shin, Edwards, & Heeren, 2009), the impact of family versus non-family perpetrators has not been reported.

Alcohol use is reported to be temporally associated with physical violence perpetrated by females (Stuart et al., 2013). Alcohol has been shown to be associated with intimate partner perpetration and victimization in both genders (Lee, Stefani, & Park, 2014). However, studies of associations between alcohol and violence rarely adjust for other predictors of violence that are prevalent challenges in female prison populations. These may include physical and sexual abuse, TBI, and salivary cortisol (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004; Ferguson, Pickelsimer, Corrigan, Bogner, & Wald, 2012; Shiroma, Ferguson, & Pickelsimer, 2012; Wolff & Shi, 2012).

Trauma, such as childhood abuse, precipitates long-lasting psychobiological effects including the hypothalamic-pituitary-adrenal (HPA) axis dysfunction of the neuroendocrine stress system evidenced by abnormal cortisol levels (Danese & McEwen, 2012; De Bellis, Spratt, & Hooper, 2011). Women who experienced greater victimization exhibited flatter patterns of diurnal cortisol characterized by both higher midday levels and more attenuated decreases in cortisol levels across the day, when compared to women with less victimization (Kim et al., 2015). Decreased diurnal salivary cortisol variation with low morning (AM) and high evening (PM) levels are prevalent in adult female victims of childhood abuse and adult female perpetrators of violent crimes (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004).

Alcohol, Traumatic Brain Injury (TBI) and Crime

Bidirectional relationships between TBI and problematic alcohol use have been described and both are related to criminal behavior. A high incidence of heavy drinking was reported both before and after TBI among patients with a history of arrest (Kreutzer, Marwitz, & Witol, 1995). TBI is associated with increased criminal behavior, and early substance use was a mediating factor for those injured early in life (McKinlay, Corrigan, Horwood, & Fergusson, 2014). History of problematic alcohol use is common with TBI and it is a risk factor for behavioral problems resulting in incarceration (Castaño-Monsalve, Bernabeu-Guitart, López, Bulbena-Vilarrasa, & Quemada, 2013; Moore, Indig, & Haysom, 2014). The relationship between TBI and alcohol use during the commission of violent crimes enacted by women is not well understood.

Even though 80% of female inmates were under the influence of alcohol and/or illicit substances at the time of their crime, specific types of substance use were not evaluated as correlates of violent crime (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004). The purpose of this study was to investigate relationships between being under the influence of alcohol, versus being under the influence of other substances, while committing a violent,

versus nonviolent crime, and furthermore, to define risk factors for being under the influence of alcohol.

Methods

Design

A modified case-control design was used to compare female prison inmates who were under the influence of alcohol to those under the influence of an illicit substance at the time of their crime. Additionally, we compared these two groups to those who were not under the influence of illicit substance at the time of the crime. We also reevaluated predictors of committing a violent crime by including an additional variable, being under the influence of alcohol, to adjust for known predictors of female violence. This study used a secondary analysis of data from previous studies (Brewer-Smyth, 2014; Brewer-Smyth et al., 2007; Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004). Previously, these data reports indicated that 80% of perpetrators were under the influence of alcohol and/or street drugs at the time of their crime. No further information was given about alcohol or illicit substances.

Data collection methods were reported previously in those articles. Briefly, data were collected by the first author during individual private interviews and examinations of female prison inmates who were recruited from minimum and maximum-security sections of a women's prison in the Mid-Atlantic region of the United States. All federal regulations related to research with prisoners were adhered to (Brewer-Smyth, 2008). All inmates signed informed consent forms approved by the University of Pennsylvania or University of Delaware Institutional Review Boards. Consent forms and instruments were read to each inmate during private face-to-face interviews to assure ethical study participation and data integrity.

Eighty-one percent of eligible inmates volunteered to be in this study. Distributions of demographic variables of participants including race, age, and types of crimes committed by the participants were consistent with the general prison population.

Measurements

Alcohol—Participants were asked if they were under the influence of alcohol and/ or street drugs at the time of their crime. Records were evaluated for all participants and corroborated with self-report. Research interview questionnaires are believed to be better sources of data than records for behavioral conditions of prison inmates because conditions, such as substance use, were reported more frequently in interview questionnaires than records (Bai et al., 2014). Inmates were less likely to report, at the time of the crime, substance use to law enforcement or correctional authorities in fear of apprehension, especially if the offender was not apprehended until hours or days after testing could detect substance use. The informed consent forms signed by participants, as required by federal mandates (Brewer-Smyth, 2008), explained that participation in this research would have no influence on their sentence, time served, probation, parole or treatment by prison staff; and to discourage inmates from providing false information, they were informed that no one would have access to their individual responses. Additionally, self-reports of alcohol use have been shown to be

reliable (Sobell & Sobell, 1988) and are used in most studies (Robinson, Sobell, Sobell, Arcidiacono, & Tzall, 2014).

Violence—Crimes were obtained from criminal records and dichotomized as violent (1) or nonviolent (0) similar to previous investigators (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004; Cook, Ludwig, & Braga, 2005; Federal Bureau of Investigation [FBI], 2015). Violent crimes are crimes against people including murder, non-negligent manslaughter, robbery, assault, sexual assault, and kidnapping. Nonviolent crimes include theft, burglary, forgery, conspiracy, drug-related crimes, driving-related crimes, or nonviolent probation violations. Violent crimes, where there was no violent intent, such as negligence, including reckless endangerment while under the influence, or those charges as accomplices who did not participate in the crime, were categorized as nonviolent.

Physical and Sexual Abuse—Muenzenmaier's scale (Meyer, Muenzenmaier, Cancienne, & Struening, 1996; Muenzenmaier, Meyer, Struening, & Ferber, 1993) was slightly revised to assess frequency and severity of CSA and CPA before age 18. It has reported validity and reliability with women of similar age, ethnic background, and education, including women with mental illness (Meyer et al., 1996; Muenzenmaier et al., 1993). Other data included items on the abuse scale that occurred after age 18, when it occurred last, and abuse that resulted in health care access. Self-reports are frequently used by others (Gould et al., 2012) and were verified by evidence of injury and records when available.

Neurological/Neuropsychiatric History and Physical Examination—General health, specifically neurological histories and physical examinations were assessed by a certified neuro-rehabilitation clinical nurse specialist, in accordance with standards that were validated by two neurologists and a neuropsychologist (Brewer-Smyth et al., 2007). Other examination evidence was investigated to corroborate histories provided by each inmate, such as neurological deficits, cranial-facial scars and palpable skull damage consistent with TBI self-reports. Medical records were examined to verify reports. Data were stratified by specific histories and examination findings, such as TBIs. Data collection occurred prior to the development of validated TBI measurements (Bogner & Corrigan, 2009). Inmates were also asked if they had attempted suicide and how many times.

Cortisol—Salivary measurements of the stress hormone cortisol were evaluated because of its relationship to violent crime (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004). To evaluate resting basal morning peak (AM) and afternoon (PM) levels of the cortisol diurnal rhythm, saliva samples were taken upon awakening between 4:45 AM and 6:00 AM before eating, drinking, or smoking, and again between 3:00 PM and 5:00 PM before the evening meal. Morning saliva samples were collected within the first 30 minutes after awakening. Participants were asked not to smoke on the testing day or to eat or drink anything other than water between the noon meal and the afternoon sample. Participants were asked to chew on the cotton swab of a salivette (Sarstedt AG & Co., Numbrecht, Germany) for 60 seconds according to supplier guidelines for saliva sample collection.

Samples were transported on ice to freezer storage. All samples were analyzed at the same time under the same conditions, as previously described (Brewer-Smyth et al., 2004).

Statistical Analyses

Compared to the total sample reported in previous literature, the initial analyses were made up of only inmates who were under the influence of any substance at the time the crime was committed. For this subset of inmates, we compared being under influence of alcohol with being under the influence of other illicit substances. Being under the influence of alcohol was defined as being under the influence of any alcohol, either by itself or in conjunction with another illicit substance. Our outcome variable, alcohol, compared those under the influence of alcohol to those under the influence of another substance. Bivariate relationships with alcohol were assessed using chi-square tests for categorical data, and point-biserial correlations for continuous measures. Logistic regression models were built using significant predictors from bivariate tests.

Additionally, we also compared those who were not under the influence of any substance to those under the influence of alcohol only, alcohol and other substance, those under the influence of substances other than alcohol, and noncriminal comparison females.

Furthermore, we reanalyzed previously reported logistic regression models, predicting conviction of a violent crime but now including the variable, being under the influence of alcohol. It was important to know if the relationship between being under the influence of alcohol would remain significantly related to being convicted of a violent crime adjusting for variables previously reported to predict female violence: TBI, AM cortisol, suicide attempts, and number of years since last victimized by physical or sexual abuse (Brewer-Smyth et al., 2004).

Results

The sample for the initial analyses included 113 inmates (82%) of 138 who were under the influence of any substance at the time their crime was committed. Of those 113 inmates, 60 (53%) were under the influence of alcohol. Twenty were under the influence of alcohol alone and 40 were under the influence of alcohol in combination with another substance. The remaining 53 were only under the influence other substances, i.e. crack cocaine, heroin, marijuana, etc. In the sample there were 23 (20%) inmates incarcerated for violent crimes and 90 for non-violent crimes.

Bivariate analysis showed that, total CSA, CSA by non-family member, number of TBIs, and committing a violent crime were significantly related to being under the influence of alcohol versus other substances at the time of the crime (Table I). While total CSA was significant, since it is the sum of familial and non-familial abuse, it is likely this was caused by the fact that non-familial abuse was significant, but to be conservative both CSA types were placed into the logistic regression model. Though non-family CSA and the number of TBIs were higher in alcohol groups (alcohol only, alcohol and other substance), non-family CSA and TBIs were not significant when divided into five groups including those not under any influence and non-criminals (Table II). Those under the influence of other substances

with and without alcohol and those not under the influence of any substance, were significantly younger than those under the influence of alcohol only.

The logistic regression model comparing having been under the influence of alcohol to those under the influence of other substances (Table III) includes variables with significant bivariate relationships (Table I). Women committing a violent crime were five times more likely to be under influence of alcohol compared to other substances adjusting for number of TBIs, familial CSA, and non-familial CSA. For each increase in non-family CSA scale score, the likelihood of being under the influence of alcohol compared to other substance while committing a crime increased adjusting for number of TBIs, familial CSA, and if the crime was violent. Lastly, the number of TBIs per person predating the crime was positively and significantly related to being under the influence of alcohol compared to other substances adjusting for familial CSA, non-familial CSA, and if the crime was violent.

Given these new findings, we reanalyzed previously reported logistic regression models predicting conviction of a violent versus nonviolent crime to determine if being under the influence of alcohol significantly predicts violent crime adjusting for TBI, AM cortisol, suicide attempts, and number of years since last victimized by abuse. When having been under the influence of alcohol versus other substances was included in the logistic regression model, this was not significantly related to violent crime.

Furthermore, in the same model as Table III, rather than individuals simultaneously under the influence of alcohol and other illicit substances, we evaluated being under the influence of only alcohol and no other substance at the time of the crime, $n=20$, compared to the rest of the original sample, $n=118$, who were a) not under the influence of any substances, b) under the influence of illicit substances but not alcohol, and c) under the influence of a combination of alcohol and/ or other drugs. Having been under the influence of only alcohol at the time of the crime was significantly related to committing a violent versus non-violent crime ($OR = 5.974$; $95\%CI=2.027-17.611$) while neither type of CSA or TBI was significant in this model.

Under the influence of only alcohol at the time of the crime remained significantly related to committing a violent versus non-violent crime ($OR=8.764$; $95\%CI:1.532-50.138$) adjusting for TBI ($OR=1.497$; $95\%CI:1.086-2.063$), suicide attempts ($OR=1.230$; $95\%CI: 1.034-1.463$), number of years since last abuse ($OR=.863$; $95\%CI:.759-.982$), and AM cortisol ($OR=.024$; $95\%CI:.001-.422$).

We further evaluated those who were not under the influence of any substance at the time of the crime. Table IV displays a nominal regression comparing those who were under the influence of any amount of alcohol with or without other substance at the time of the crime to those who were not under the influence of any substance and those under the influence of other illicit substance(s) including crack cocaine, heroin, or marijuana at the time of their crime. None of the variables were significantly related to having not been under the influence of any substances at the time of the crime.

Discussion

This study demonstrates that non-family CSA and TBI are risk factors for being under the influence of alcohol compared to other substances that can result in violent crime perpetration by adult female victims. Though causation cannot be determined with this design, and though most victims of CSA and TBI do not commit alcohol-related violence, women under the influence of any amount of alcohol at the time of their crime were more likely victims of more frequent and severe non-family CSA, more TBIs predating their crime, and to be convicted of a violent versus nonviolent crime compared to those under the influence of other substances at the time of the crime. Being under the influence of alcohol only, compared to a combination of alcohol and/ or other substance, or not under any influence, placed one at 8.76 times greater risk of committing a violent versus non-violent crime adjusting for related variables. Interestingly, those who reported that they were not under the influence of any substance did not have less TBI or less non-family CSA as expected. This could be due to inmates being fearful that, even though, being under the influence of alcohol had not been detected when they were arrested and they had not been charged with such, they could still face negative consequences if they revealed that they were under the influence.

Effects of CSA, including dysregulated biological stress systems can lead to alcohol misuse (De Bellis, 2002) and violence (De Bellis, 2001; De Bellis & Zisk, 2014). Hyper arousal of the stress system evidenced by cortisol abnormalities may contribute to over reacting to situations, which may lead to violent behavior. This may be more pronounced in women who have also sustained TBIs that could have resulted in damage to brain regions responsible for emotional regulation and decision-making.

Our findings are consistent with others who reported no relationship between being under the influence of legal or illegal drugs and violent crime, possibly because of sedation that can occur following the consumption of various drugs (Kirschbaum & Grigoleit). Those under the influence of substances other than alcohol were often arrested for being in possession of the illegal substance rather than for a violent crime. Those under the influence of other substances often committed instrumental crimes such as theft, shoplifting or prostitution to support their drug habit.

These results are consistent with a report that CSA by a non-caregiver was associated with higher posttraumatic stress, and internalizing and externalizing behavior problems compared to youth victimized by a caregiver (Kiser et al., 2014). Though CSA was linked to problematic alcohol use later in life (Shin et al., 2009), categories of perpetrators, such as non-family members, have not been previously reported. However, though it is not related to alcohol use, CSA by a family member was related to women later committing a violent crime including homicide (Brewer-Smyth & Burgess, 2008). Importantly, all forms of CSA could have serious implications with neurodevelopmental, psychobiological, and behavioral consequences (De Bellis, 2012; De Bellis et al., 2011). Further work is needed in CSA prevention and treatment.

Strengths and Limitations

The results related to those under the influence of alcohol only, must be viewed with caution due to the small number (n=20) under the influence of alcohol only. Though causation cannot be determined by this study design, CSA and TBI histories occurred in the correct temporal sequence, predating perpetration of the crime for which the women were currently incarcerated, and that occurred while under the influence of alcohol.

Prospective studies are preferred, yet CSA self-reports have been stable over time in longitudinal studies (Pereira da Silva & da Costa Maia, 2013). Though self-reporting may not be as accurate as actual records, previous studies indicated congruence between prisoners' self-reports and records (Schofield, Butler, Hollis, & D'Este, 2011). Records were examined for everyone in this sample. Though records were not contradictory to self-reports, more information was obtained from private interviews and physical examinations than records, consistent with reports of others (Bai et al., 2014). Those who reported that they were not under the influence of any substances could not have their response validated if they were apprehended long enough after the crime when this could not be confirmed by laboratory tests.

It was not possible to accurately measure the exact amount of alcohol intake immediately prior to the crime, which may vary between inmates. Individual inmates were apprehended and levels tested within different time frames after the crime, making it difficult to determine consistent blood alcohol levels at the time the crime actually occurred between inmates. Variables were dichotomized (yes/ no) to mitigate dose response of the amount of alcohol intake. Federal regulations governing ethical conduct of research with prisoners, limits secondary gain or fear of providing accurate information. All participants were required to sign an informed consent form indicating that any information they provided would not influence their sentence, time served, probation, parole, or treatment by correctional officials since the researcher is independent of the prison and not permitted to disclose individual information.

It is suspected that self-reported CPA and CSA scores could be a slight underestimate of the severity of this problem because some participants became emotional and refused to continue completing the questionnaire. They did however; provide enough information to indicate that they had been victims, though the exact severity or frequency of the abuse may be a slight underestimate for those participants.

Our finding of high rates of TBI in prison is consistent with others (CDC, 2015; Ferguson et al., 2012; Shiroma et al., 2012). While it is established that alcohol intoxication increases probability of suffering a TBI in accidents or acts of violence (Bjork & Grant, 2009), little is known about whether the brain insult itself increases the likelihood that a previously non-substance-abusing individual would develop substance abuse disorder. Further prospective studies are needed to evaluate the direction of the relationship between TBI and alcohol abuse.

Implications for Clinical Forensic Nursing Practice

These findings demonstrate the critical need for health care providers to encourage limiting alcohol use especially by female CSA and TBI victims in order to prevent violent perpetration by female victims. Female CSA victims may self-medicate with alcohol for potentially related mood disorders (Crum et al., 2013). Intoxicated women who have been victimized by violence may be more likely to perpetrate violence themselves.

As women often receive short sentences even for violent crimes, and are frequently released and re-incarcerated, it is even more critical for prison correctional systems to help female inmates limit alcohol use and thereby, reduce the risk of recidivism. (Brewer-Smyth et al., 2004). Correctional health care providers and counselors have a public-health opportunity to prevent further violence precipitated by alcohol use. Though it is critical for corrections officials to address illegal use of all substances, these findings suggest that consuming alcohol is more problematic than other substances in commission of a violent crime by women who cycle in and out of prison and are known to have a high prevalence of both TBI and CSA.

Conclusion

All types of substance use resulted in criminal convictions. However, these findings suggest that any amount of alcohol use, compared to the use of other illicit substances, is a risk factor for women committing a violent versus nonviolent crime. CSA is a serious problem that can influence neurodevelopment and biological stress systems (De Bellis et al., 2011) that could result in alcohol use that could increase the likelihood of violent criminal behavior in adulthood. This may be particularly problematic for those who have also sustained a TBI.

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References

- Alwin DF. 2012; Integrating varieties of life course concepts. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*. 67B(2):206–220. DOI: 10.1093/geronb/gbr146
- Bai JR, Mukherjee DV, Befus M, Apa Z, Lowy FD, Larson EL. 2014; Concordance between medical records and interview data in correctional facilities. *BMC Medical Research Methodology*. 14:50.doi: 10.1186/1471-2288-14-50 [PubMed: 24716525]
- Bjork JM, Grant SJ. 2009; Does traumatic brain injury increase risk for substance abuse? *Journal of Neurotrauma*. 26(7):1077–1082. DOI: 10.1089/neu.2008-0849 [PubMed: 19203230]
- Bogner J, Corrigan JD. 2009; Reliability and predictive validity of the Ohio State University TBI identification method with prisoners. *Journal of Head Trauma Rehabilitation*. 24(4):279–291. DOI: 10.1097/HTR.0b013e3181a66356 [PubMed: 19625867]

- Bratberg GH, Wilsnack CS, Wilsnack R, Håvås Haugland S, Krokstad S, Sund ER, Bjørngaard JH. 2016; Gender differences and gender convergence in alcohol use over the past three decades (1984–2008), The HUNT Study, Norway. *BMC Public Health*. 16:723.doi: 10.1186/s12889-016-3384-3 [PubMed: 27492155]
- Brewer-Smyth K. 2008; Ethical, regulatory, and investigator considerations in prison research. *ANS: Advances in Nursing Science*. 31(2):119–127. DOI: 10.1097/01.ANS.0000319562.84007.22 [PubMed: 18497588]
- Brewer-Smyth K. 2014; Obesity, traumatic brain injury, childhood abuse, and suicide attempts in females at risk. *Rehabilitation Nursing*. 39(4):183–191. DOI: 10.1002/rnj.150 [PubMed: 24668743]
- Brewer-Smyth K, Bucurescu G, Shults J, Metzger D, Sacktor N, van Gorp W, Kolson D. 2007; Neurological function and HIV risk behaviors of female prison inmates. *The Journal of neuroscience nursing : journal of the American Association of Neuroscience Nurses*. 39(6):361–372. [PubMed: 18186421]
- Brewer-Smyth K, Burgess AW. 2008; Childhood sexual abuse by a family member, salivary cortisol, and homicidal behavior of female prison inmates. *Nursing Research*. 57(3):166–174. [PubMed: 18496102]
- Brewer-Smyth K, Burgess AW, Shults J. 2004; Physical and sexual abuse, salivary cortisol, and neurologic correlates of violent criminal behavior in female prison inmates. *Biological Psychiatry*. 55(1):21–31. [PubMed: 14706421]
- Brewer-Smyth K, Cornelius ME, Pickelsimer EE. 2015; Childhood adversity, mental health, and violent crime. *Journal of Forensic Nursing*. 11(1):4–14. DOI: 10.1097/JFN.0000000000000062 [PubMed: 25695207]
- Castaño-Monsalve B, Bernabeu-Guitart M, López R, Bulbena-Vilarrasa A, Quemada JI. 2013; Alcohol and drug use disorders in patients with traumatic brain injury: neurobehavioral consequences and caregiver burden. *Revista de Neurología*. 56(7):363–369. [PubMed: 23520005]
- Centers for Disease Control and Prevention. Traumatic Brain Injury in Prisons and Jails: An Unrecognized Problem. 2015. Retrieved from http://www.cdc.gov/traumaticbraininjury/pdf/Prisoner_TBI_Prof-a.pdf
- Centers for Disease Control and Prevention. 2012; Alcohol Use and Binge Drinking Among Women of Childbearing Age — United States, 2006–2010. *Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report Surveillance Summaries*. 61(28):534–538.
- Cook PJ, Ludwig J, Braga AA. 2005; Criminal records of homicide offenders. *JAMA*. 294(5):598–601. [PubMed: 16077054]
- Crum RM, Mojtabai R, Lazareck S, Bolton JM, Robinson J, Sareen J, ... Storr CL. 2013; A prospective assessment of reports of drinking to self-medicate mood symptoms with the incidence and persistence of alcohol dependence. *JAMA psychiatry*. 70(7):718–726. DOI: 10.1001/jamapsychiatry.2013.1098 [PubMed: 23636710]
- Court Services and Offender Supervision Agency. Statistics on Women Offenders-2016. Court Services and Offender Supervision Agency for the District of Columbia (CSOSA); 2016. Retrieved from <http://www.csosa.gov/newsmedia/factsheets/statistics-on-women-offenders-2016.pdf>
- Danese A, McEwen BS. 2012; Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiology and Behavior*. 106(1):29–39. DOI: 10.1016/j.physbeh.2011.08.019 [PubMed: 21888923]
- De Bellis MD. 2001; Developmental traumatology: the psychobiological development of maltreated children and its implications for research, treatment, and policy. *Development and Psychopathology*. 13(3):539–564. [PubMed: 11523847]
- De Bellis MD. 2002; Developmental traumatology: a contributory mechanism for alcohol and substance use disorders. *Psychoneuroendocrinology*. 27(1):155–170. DOI: 10.1016/S0306-4530(01)00042-7 [PubMed: 11750776]
- De Bellis, MD. The intergenerational transmission of family violence: The neurobiology of the relationships among child victimization, parental mental health, and addiction. New York, NY, US: Oxford University Press; 2012.

- De Bellis MD, Spratt EG, Hooper SR. 2011; Neurodevelopmental biology associated with childhood sexual abuse. *J Child Sex Abus.* 20(5):548–587. DOI: 10.1080/10538712.2011.607753 [PubMed: 21970646]
- De Bellis MD, Zisk A. 2014; The biological effects of childhood trauma. *Child and Adolescent Psychiatric Clinics of North America.* 23(2):185–222. vii. DOI: 10.1016/j.chc.2014.01.002 [PubMed: 24656576]
- Federal Bureau of Investigation. Violent Crime. Crime in the United States. 2015. Retrieved from <https://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/violent-crime>
- Fenton MC, Geier T, Keyes K, Skodol AE, Grant BF, Hasin DS. 2013; Combined role of childhood maltreatment, family history, and gender in the risk for alcohol dependence. *Psychological Medicine.* 43(5):1045–1057. DOI: 10.1017/S0033291712001729 [PubMed: 22883538]
- Ferguson PL, Pickelsimer EE, Corrigan JD, Bogner JA, Wald M. 2012; Prevalence of traumatic brain injury among prisoners in South Carolina. *Journal of Head Trauma Rehabilitation.* 27(3):E11–20. DOI: 10.1097/HTR.0b013e31824e5f47 [PubMed: 22573044]
- Giele, JZ, Elder, GH. *Methods of life course research : qualitative and quantitative approaches.* Thousand Oaks, Calif: Sage Publications; 1998.
- Gould F, Clarke J, Heim C, Harvey PD, Majer M, Nemeroff CB. 2012; The effects of child abuse and neglect on cognitive functioning in adulthood. *Journal of Psychiatric Research.* 46(4):500–506. DOI: 10.1016/j.jpsychires.2012.01.005 [PubMed: 22336639]
- Harford TC, Yi H-y, Grant BF. 2014; Associations between childhood abuse and interpersonal aggression and suicide attempt among U.S. adults in a national study. *Child Abuse and Neglect.* 38(8):1389–1398. DOI: 10.1016/j.chiabu.2014.02.011 [PubMed: 24656711]
- Keyes KM, Grant BF, Hasin DS. 2008; Evidence for a closing gender gap in alcohol use, abuse, and dependence in the United States population. *Drug and Alcohol Dependence.* 93(1–2):21–29. DOI: 10.1016/j.drugalcdep.2007.08.017 [PubMed: 17980512]
- Keyes KM, Li G, Hasin DS. 2011; Birth cohort effects and gender differences in alcohol epidemiology: a review and synthesis. *Alcoholism, Clinical and Experimental Research.* 35(12): 2101–2112. DOI: 10.1111/j.1530-0277.2011.01562.x
- Keyes KM, Martins SS, Blanco C, Hasin DS. 2010; Telescoping and gender differences in alcohol dependence: new evidence from two national surveys. *American Journal of Psychiatry.* 167(8): 969–976. DOI: 10.1176/appi.ajp.2009.09081161 [PubMed: 20439391]
- Keyes KM, McLaughlin KA, Koenen KC, Goldmann E, Uddin M, Galea S. 2012; Child maltreatment increases sensitivity to adverse social contexts: neighborhood physical disorder and incident binge drinking in Detroit. *Drug and Alcohol Dependence.* 122(1–2):77–85. DOI: 10.1016/j.drugalcdep.2011.09.013 [PubMed: 21981990]
- Kim HK, Tiberio SS, Capaldi DM, Shortt JW, Squires EC, Snodgrass JJ. 2015; Intimate partner violence and diurnal cortisol patterns in couples. *Psychoneuroendocrinology.* 51:35–46. DOI: 10.1016/j.psyneuen.2014.09.013 [PubMed: 25286224]
- Kirschbaum KM, Grigoleit. *Illegal drugs and delinquency.* *Forensic Science International.* 226(1–3): 230.
- Kiser LJ, Stover CS, Navalta CP, Dorado J, Vogel JM, Abdul-Adil JK, ... Briggs EC. 2014; Effects of the child–perpetrator relationship on mental health outcomes of child abuse: It’s (not) all relative. *Child Abuse and Neglect.* 38(6):1083–1093. DOI: 10.1016/j.chiabu.2014.02.017 [PubMed: 24661693]
- Kreutzer JS, Marwitz JH, Witold AD. 1995; Interrelationships between crime, substance abuse, and aggressive behaviours among persons with traumatic brain injury. *Brain Injury.* 9(8):757–768. [PubMed: 8605509]
- Lee M, Stefani KM, Park EC. 2014; Gender-specific differences in risk for intimate partner violence in South Korea. *BMC Public Health.* 14:415.doi: 10.1186/1471-2458-14-415 [PubMed: 24885985]
- Mair C, Cunradi CB, Todd M. 2012; Adverse childhood experiences and intimate partner violence: testing psychosocial mediational pathways among couples. *Annals of Epidemiology.* 22(12):832–839. DOI: 10.1016/j.annepidem.2012.09.008 [PubMed: 23084843]
- McKinlay A, Corrigan J, Horwood LJ, Fergusson DM. 2014; Substance abuse and criminal activities following traumatic brain injury in childhood, adolescence, and early adulthood. *The Journal of*

head trauma rehabilitation. 29(6):498–506. DOI: 10.1097/HTR.000000000000001 [PubMed: 24263173]

Meyer IH, Muenzenmaier K, Cancienne J, Struening E. 1996; Reliability and validity of a measure of sexual and physical abuse histories among women with serious mental illness. *Child Abuse and Neglect*. 20(3):213–219. [PubMed: 8734551]

Moore E, Indig D, Haysom L. 2014; Traumatic brain injury, mental health, substance use, and offending among incarcerated young people. *The Journal of head trauma rehabilitation*. 29(3):239–247. DOI: 10.1097/HTR.0b013e31828f9876 [PubMed: 23656964]

Muenzenmaier K, Meyer I, Struening E, Ferber J. 1993; Childhood abuse and neglect among women outpatients with chronic mental illness. *Hospital and Community Psychiatry*. 44(7):666–670. [PubMed: 8192738]

Nayak MB, Lown EA, Bond JC, Greenfield TK. 2012; Lifetime victimization and past year alcohol use in a U.S. population sample of men and women drinkers. *Drug and Alcohol Dependence*. 123(1–3):213–219. DOI: 10.1016/j.drugalcdep.2011.11.016 [PubMed: 22177898]

Pereira da Silva SS, da Costa Maia A. 2013; The stability of self-reported adverse experiences in childhood: a longitudinal study on obesity. *Journal of Interpersonal Violence*. 28(10):1989–2004. DOI: 10.1177/0886260512471077 [PubMed: 23360751]

Pernanen, K. Alcohol and crimes of violence. In: Kissin, B, Begleiter, H, editors. *The biology of alcoholism*. New York: Plenum Press; 1976. 351–444. Vol. 4. Social aspects of alcoholism

Robinson SM, Sobell LC, Sobell MB, Arcidiacono S, Tzall D. 2014; Alcohol and drug treatment outcome studies: new methodological review (2005–2010) and comparison with past reviews. *Addictive Behaviors*. 39(1):39–47. DOI: 10.1016/j.addbeh.2013.09.029 [PubMed: 24140306]

Substance Abuse and Mental Health Services Administration. Substance Abuse and Mental Health Services Administration (SAMHSA) Results from the 2013 National Survey on Drug Use and Health: National Findings. NSDUH Series H-48. 2014. Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.pdf>

Substance Abuse and Mental Health Services Administration. National Survey on Drug Use and Health (NSDUH). 2012. Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUHresults2012/NSDUHresults2012.pdf>

Schofield P, Butler T, Hollis S, D'Este C. 2011; Are prisoners reliable survey respondents? A validation of self-reported traumatic brain injury (TBI) against hospital medical records. *Brain Injury*. 25(1):74–82. DOI: 10.3109/02699052.2010.531690 [PubMed: 21117913]

Shin SH, Edwards EM, Heeren T. 2009; Child abuse and neglect: Relations to adolescent binge drinking in the national longitudinal study of Adolescent Health (AddHealth) Study. *Addictive Behaviors*. 34(3):277–280. DOI: 10.1016/j.addbeh.2008.10.023 [PubMed: 19028418]

Shiroma EJ, Ferguson PL, Pickelsimer EE. 2012; Prevalence of traumatic brain injury in an offender population: a meta-analysis. *Journal of Head Trauma Rehabilitation*. 27(3):E1–10. DOI: 10.1097/HTR.0b013e3182571c14

Sobell LC, Sobell. 1988; Reliability of a timeline method: assessing normal drinkers' reports of recent drinking and a comparative evaluation across several populations. *British Journal of Addiction*. 83(4):393. [PubMed: 3395719]

Steele CM, Josephs RA. 1990; Alcohol myopia: Its prized and dangerous effects. *American Psychologist*. 45(8):921–933. DOI: 10.1037/0003-066X.45.8.921 [PubMed: 2221564]

Stuart GL, Moore TM, Elkins SR, O'Farrell TJ, Temple JR, Ramsey SE, Shorey RC. 2013; The temporal association between substance use and intimate partner violence among women arrested for domestic violence. *Journal of Consulting and Clinical Psychology*. 81(4):681–690. DOI: 10.1037/a0032876 [PubMed: 23647284]

Taylor, SP, Leonard, KE. Alcohol and human physical aggression. In: Geen, RG, Donnerstein, EI, editors. *Aggression: Theoretical and empirical reviews*. Vol. 2. New York: Academic Press; 1983. 77–102.

White A, Castle IJ, Chen CM, Shirley M, Roach D, Hingson R. 2015; Converging Patterns of Alcohol Use and Related Outcomes Among Females and Males in the United States, 2002 to 2012. *Alcoholism, Clinical and Experimental Research*. 39(9):1712–1726. DOI: 10.1111/acer.12815

- White House Council on Women and Girls. 2011. Retrieved from https://www.whitehouse.gov/sites/default/files/rss_viewer/Women_in_America.pdf
- Wolff N, Shi J. 2012; Childhood and adult trauma experiences of incarcerated persons and their relationship to adult behavioral health problems and treatment. International journal of environmental research and public health. 9(5):1908–1926. DOI: 10.3390/ijerph9051908 [PubMed: 22754481]

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Table 1

Demographics

Measure	Under Influence of Other Substance(s) at Time of Crime (N = 53)	Under Influence of Alcohol at Time of Crime [†] (N = 60)	p-value
	Mean ± SD or n (%)	Mean ± SD or n (%)	
Age at Time of Interview	33.09 ±8.11	35.78 ±8.54	.090
Violent Current Crime			
Non-Violent	48 (91%)	42 (70%)	
Violent	5 (9%)	18 (30%)	.007*
Race/Ethnic			
Black	19 (36%)	27 (46%)	
Caucasian	28 (53%)	28 (48%)	
Hispanic	2 (4%)	2 (3%)	
Other	4 (8%)	2 (3%)	.628
Number of Brain Injuries with loss of Consciousness	0.49±1.05	1.39±1.90	.003*
Frequency and Severity of Childhood Abuse before age 18 Total Score			
Physical Abuse	5.00 ±4.75	5.92 ±4.93	.324
Sexual Abuse by Family Member	1.83 ±2.56	1.49 ±2.74	.505
Sexual Abuse by Non-Family	.37 ±.92	1.29 ±2.21	.005*
Sexual Abuse Total	1.86 ±2.99	3.12 ±3.37	.043*
Physical and Sexual Abuse Total	6.41 ±7.09	8.47 ±6.85	.124

*
p < .05[†] includes those under influence of alcohol and other illicit substance

Table 2

Demographics

Measure	Non-Criminal (N=14)		Not Under Influence (N=26)		Under Influence of Only Other Substance(s) at Time of Crime (N = 53)		Under Influence of Alcohol and Other Substance at Time of Crime (N =40)		Under Influence of Only Alcohol at Time of Crime (N =20)		p-value
	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	
Age at Time of Interview	39.38±5.55		33.15±7.55		32.96 ±8.31		34.13 ±7.64		39.10 ±9.45		.002 *
Violent Current Crime											
Non-Violent	-		19 (73%)		46 (87%)		32 (80%)		10 (50%)		
Violent	-		7 (27%)		7 (13%)		8 (20%)		10 (50%)		.063
Race/Ethnic											
Black	6 (42.6%)		15 (57.7%)		19 (35%)		19 (48%)		8 (42%)		
Caucasian	6 (42.6%)		10 (38.5%)		28 (53%)		18 (45%)		10 (53%)		
Hispanic	1 (7.7%)		1 (3.8%)		2 (4%)		2 (5%)		0 (0%)		
Other	0 (0.0%)		0 (0%)		4 (8%)		1 (2%)		1 (5%)		.896
Number of Brain Injuries with loss of Consciousness	0.08 ±0.28		0.96± 2.20		0.94±3.53		1.38±2.02		1.40±1.70		.564
Frequency and Severity of Childhood Abuse before 18 Total Score											
Physical Abuse	5.46±5.81		5.00 ±4.83		5.22 ±5.29		6.54 ±5.03		5.46 ±4.81		.587
Sexual Abuse by Family Member	0.62±1.45		2.50 ±3.06		1.63 ±2.77		1.95 ±2.79		1.6 ±2.70		.342
Sexual Abuse by Non-Family	0.31±.63		1.12 ±2.54		0.57 ±1.53		1.56 ±2.46		1.55 ±0.93		.119
Sexual Abuse Total	0.92±1.94		3.62 ±4.70		2.20 ±3.73		3.51 ±3.61		2.35 ±2.80		.108
Abuse Total	6.15±4.43		8.08 ±7.66		7.02 ±8.20		9.36 ±7.54		6.75 ±4.98		.490

*
p < .05

Logistic regression comparing those who were under the influence of any amount of alcohol at the time of the crime to those who were under the influence of other illicit substance(s) including crack cocaine, heroin, or marijuana at the time of their crime

Table 3

	B	S.E.	Wald	df	Sig.	Odds Ratio	95% C.I.	
							Lower	Upper
Number of TBIs per Person	.453	.186	5.930	1	.015 *	1.572	1.092	2.263
Violent Compared to Nonviolent Current Crime	1.652	.647	6.513	1	.011 *	5.219	1.467	18.565
Frequency and Severity of CSA by Family Member	-.051	.086	.347	1	.556	.950	.802	1.126
Frequency and Severity of CSA by Non-Family	.366	.164	5.015	1	.025 *	1.442	1.047	1.988
Constant	-.721	.296	5.909	1	.015 *	.486		

The reference category is: Those Under the Influence of Other Illicit Substance (Not Alcohol) at the Time of the Crime.

TBI=Traumatic Brain Injury with Loss of Consciousness; CSA=Childhood Sexual Abuse.

*
p < .05

Table 4

Nominal regression comparing those who were under the influence of any amount of alcohol with or without other substance at the time of the crime to those who were not under the influence of any substance and those under the influence of other illicit substance(s) including crack cocaine, heroin, or marijuana but no alcohol at the time of their crime

	B	S. E.	Wald	df	Sig.	Odds Ratio	95% C. I.	
							Lower	Upper
No Substance at Time of Crime								
Intercept	-.662	.370	3.206	1	.073			
Number of TBIs per Person	-.162	.156	1.086	1	.297	.850	.627	1.154
Violent Compared to Nonviolent Current Crime	-.269	.543	.246	1	.620	.764	.263	2.216
Frequency and Severity of CSA by Family Member	.144	.090	2.581	1	.108	1.155	.969	1.378
Frequency and Severity of CSA by Non-Family	-.041	.116	.122	1	.727	.960	.765	1.206
Other Substance No Alcohol at Time of Crime								
Intercept	.534	.309	2.989	1	.084			
Number of TBIs per Person	-.480	.214	5.021	1	.025 *	.619	.407	.942
Violent Compared to Nonviolent Current Crime	-1.074	.546	3.862	1	.049 *	.342	.117	.997
Frequency and Severity of CSA by Family Member	.110	.090	1.501	1	.221	1.117	.936	1.333
Frequency and Severity of CSA by Non-Family	-.300	.159	3.575	1	.059 *	.741	.543	1.011

The reference category is: Those Under the Influence of Any Alcohol With and Without Other Substance at the Time of the Crime.

TBI=Traumatic Brain Injury with Loss of Consciousness; CSA=Childhood Sexual Abuse.

* p < .059