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Posttraumatic Stress Disorder and Co-Occurring Substance Use Disorders: Advances in Assessment and Treatment

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Abstract

Posttraumatic stress disorder (PTSD) and substance use disorders (SUDs) are prevalent and frequently co-occur. Comorbid PTSD/SUD is associated with a more complex and costly clinical course when compared with either disorder alone, including increased chronic physical health problems, poorer social functioning, higher rates of suicide attempts, more legal problems, increased risk of violence, worse treatment adherence, and less improvement during treatment. In response, psychosocial treatment options have increased substantially over the past decade and integrated approaches – treatments that address symptoms of both PTSD and SUD concurrently – are fast becoming the preferred model for treatment. This paper reviews the prevalence, etiology and assessment practices as well as advances in the behavioral and pharmacologic treatment of comorbid PTSD and SUDs.

Keywords

PTSD; posttraumatic stress disorder; trauma; substance use disorders; addiction; integrated treatment

Overview of PTSD and Substance Use Disorders

Posttraumatic stress disorder (PTSD) is an anxiety disorder that may develop subsequent to exposure to a traumatic event (experienced or witnessed). Traumatic events are defined as events that involve actual or threatened death, serious injury, or threat to the physical integrity of oneself or others, and are responded to with intense fear, helplessness or horror (American Psychiatric Association, 2000). Diagnosis of PTSD requires that the traumatic event (Criterion A) is followed by at least one month of the following three distinct symptom clusters; intrusive recollection or reexperiencing (Criterion B), avoidance or emotional numbing (Criterion C), and hyperarousal (Criterion D). With respect to substance use disorders (SUDs), the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV) provides diagnostic criteria for two forms of SUDs – substance abuse and substance dependence. Substance abuse is characterized by a maladaptive pattern of use leading to clinically significant impairment or distress. Maladaptive use is described as the recurrence of at least one of the following: use in physically hazardous situations, substance-related legal problems, failure to fulfill major role obligations, or social/interpersonal problems related to use. Substance dependence is also a maladaptive pattern of use that is characterized by three or more of the following: (1) tolerance of the substance; (2)

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withdrawal symptoms when the substance is reduced or ceased; (3) using more than was planned or for a longer period than was planned; (4) unsuccessful efforts to reduce or control use; (5) significant time spent obtaining, using, or recovering from use; (6) interference with important social, occupational, or recreational activities; and (7) continued use despite knowledge of its cause or exacerbation of a physical or psychological problem(s).

Comorbidity of PTSD and SUDs is prevalent across a diverse range of populations and settings. In addition, comorbid PTSD/SUD is associated with a more complex and costly clinical course when compared with either disorder alone, including increased chronic physical health problems, poorer social functioning, higher rates of suicide attempts, more legal problems, increased risk of violence, worse treatment adherence, and less improvement during treatment (Back et al., 2000; Driessen et al., 2008; Norman, Tate, Anderson, & Brown, 2007; Ouimette, Brown, & Najavits, 1998; Ouimette, Goodwin, & Brown, 2006; Tarrier, 2004; Tate, Norman, McQuiad, & Brown, 2007; Young, Rosen, & Finney, 2005). The current paper (1) reviews the epidemiology and etiology of comorbid PTSD/SUD; (2) highlights commonly used self-report, clinician-administered, and biological assessments for PTSD and SUDs; and (3) discusses advances in evidence-based psychotherapeutic and pharmacologic treatment options for patients presenting with comorbid PTSD/SUD.

Epidemiology and Etiology of PTSD and SUDs

Several large-scale epidemiological surveys conducted among the general population over the past two decades have demonstrated the high co-occurrence of PTSD and SUDs. The National Comorbidity Survey (NCS; $N = 5,877$), which assessed the prevalence and co-occurrence of a range of psychiatric disorders using the Diagnostic and Statistical Manual, Third Edition-Revised (DSM-III-R) revised diagnostic criteria, provided one of the earliest national estimates of the scope of the problem among the general U.S. population (Kessler, Sonega, Bromet, Hughes, & Neslon, 1995). NCS data indicated a 7.8% lifetime prevalence of PTSD and a 26.6% lifetime prevalence of SUDs; individuals with PTSD were 2 to 4 times more likely than individuals without PTSD to meet criteria for an SUD. The National Comorbidity Survey – Replication ($N = 9,282$; Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005) conducted approximately ten years later using DSM-IV diagnostic criteria (American Psychiatric Association, 2000), documented similar estimates of lifetime PTSD (6.4%) and lifetime SUDs (35.3%). More recently, data from the 2010 National Epidemiologic Survey on Alcohol and Related Conditions ($N = 34,653$) estimated a lifetime PTSD prevalence of 6.4% (Pietrzak, Goldstein, Southwick, & Grant, 2011). Among individuals with PTSD, nearly half (46.4%) also met criteria for an SUD and more than one-in-five (22.3%) met criteria for substance dependence. Similarly, international data from the Australian National Survey of Mental Health and Well-Being ($N = 10,641$) found that over one-third (34.4%) of individuals meeting criteria for PTSD also met criteria for at least one SUD, most commonly alcohol use disorders (Mills, Teeson, Ross, Peters, 2006).

Among treatment-seeking populations, high rates of comorbid PTSD and SUDs also have been consistently observed. Patients with PTSD have been shown to be up to 14 times more likely than patients without PTSD to have an SUD (Chilcoat & Menard, 2003; Ford, Russo, & Mallon, 2007). Conversely, among patients seeking treatment for SUDs, lifetime PTSD rates range between 30% and over 60% (Back et al., 2000; Brady, Back, & Coffey, 2004; Dansky, Brady, & Roberts, 1994; Jacobsen, Southwick, & Kosten, 2001; Stewart, Conrod, Samoluk, Pihl, Dongier, 2000; Triffleman, Marmar, Delucchi, & Ronfeldt, 1995). The variation in estimates observed across the aforementioned studies is likely attributable to differences in the types of clinics sampled, variant patient populations and measurement techniques employed.

Finally, research on Veteran populations demonstrates that, in comparison to the general population, Veterans are at increased risk for developing both PTSD and SUDs, and that severity of combat exposure is directly linked to risk for development and chronicity of PTSD symptoms (Hoge et al., 2004; Kang, Natelson, Mahan, Lee, & Murphy, 2003). A recent study assessed army Veterans three to four months post-deployment from Iraq and found a 27% prevalence rate for alcohol misuse, as well as a significant association between severity of combat exposure and alcohol misuse, such that those with higher severity of combat exposure had a 93% higher odds of screening positive for alcohol misuse (Santiago et al., 2010). Prevalence rates for SUDs among Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans have been estimated at 21%, and approximately 15% to 20% of OEF/OIF military troops meet criteria for PTSD post-deployment (Bray & Houranni, 2007; Hoge, et al., 2004; Seal, Berthenhal, Miner, Sen, & Marmar, 2007; Thomas et al., 2010). Research also documents high rates of comorbid PTSD/SUD among Veterans (Centers for Disease Control and Prevention, 1988; Shipherd, Stafford, & Tanner, 2005). A recent study (Petrakis, Rosenheck, & Desai, 2011) using national administrative data from the Department of Veterans Affairs indicated that, among Veterans who had served in Vietnam era or later, almost half (41.4%) with an SUD were dually diagnosed with PTSD.

Etiology and Order of Onset

Several theories have been posited to explain the functional association between PTSD and SUDs. The *self-medication theory* (Khantzian, 1985, 1990, 1997; Reed, Anthony, & Breslau, 2007), perhaps the most prominent theory, postulates that substance use serves as an attempt to alleviate PTSD symptoms. In support of this theory, one study (Saladin, Brady, Dansky, & Kilpatrick, 1995) found that hyperarousal and avoidance symptoms were more prominent among individuals with comorbid PTSD/SUD, as compared to those with PTSD alone. Further, among individauls with comorbid PTSD/SUD, alcohol dependence was more strongly associated with hyperarousal cluster (Criterion D) symptoms than cocaine dependence. Therefore, an individual's drug of choice, either central nervous system depressant or stimulant, in comorbid PTSD/SUD cases may reflect an attempt to alleviate a particular cluster of symptoms. Experimental findings among individuals with comorbid PTSD/SUD demonstrate a consistent increase in substance craving in response to presentation of personalized trauma cues (Coffey et al., 2002). Furthermore, increase in craving is predicted by severity of PTSD symptoms (Saladin et al., 2003), and trauma-cue elicited craving is reduced following trauma-focused imaginal exposure (Coffey, Stasiewicz, Hughes, & Brimo, 2006). Adding to this complex relationship, withdrawal from substances may closely mimic some symptoms of PTSD (e.g., sleep disturbance, difficulty concentrating, feelings of detachment, irritability) and contribute to a reinforcing cycle of self-medication that fosters the development of an SUD. Although the direction of the causal relationship between comorbid PTSD and SUDs is likely to vary from one individual to another, in the majority of cases the development of PTSD precedes the development of the SUD, providing temporal support for the self-medication hypothesis (Back, Brady, Sonne, & Verduin, 2006; Back, Jackson, Sonne, & Brady, 2005; Chilcoat & Breslau, 1998; Compton, Cottler, Phelps, Abdallah, & Sptiznagel, 2000; Jacobsen, Southwick, & Kosten, 2001; Stewart & Conrod, 2003). More recently, Ouimette and colleagues (2010) followed 35 outpatients with comorbid PTSD and SUDs and tracked weekly fluctuations in symptoms over a 26-week period in order to examine dynamic interactions between symptoms of PTSD and SUDs. Overall, the findings support the self-medication hypothesis and suggest that PTSD and SUD symptoms co-vary concurrently and over time, such that increases in PTSD symptoms are associated with increases in symptoms of substance dependence. Several studies investigating patients' perceptions of the interrelationship of their PTSD and SUD symptoms also provide support for the self-medication hypothesis (Back, Brady, Jaanimagi & Jackson, 2006; Brown, Stout, & Gannon-Rowley, 1989).

Alternatively, competing theories hypothesize that SUDs precede and increase risk of the development of PTSD. Assuming this order of onset, the probability of developing PTSD is increased via two potential causal pathways. First, the *high-risk hypothesis* (Chilcoat & Breslau, 1998; Acierno, Resnick, Kilpatrick, Saunders, & Best, 1999) posits that the lifestyle of a substance abuser, which typically involves significant time spent in dangerous environments or engaging in high-risk behaviors associated with obtaining or using alcohol or drugs, may increase the likelihood of experiencing a traumatic event and subsequently developing PTSD. Second, the *susceptibility hypothesis* proposes that the increased anxiety and arousal that often accompanies chronic substance abuse, in addition to poor coping skills, may increase biologic vulnerability to developing PTSD subsequent to trauma exposure (Jacobsen, Southwick, & Kosten, 2001; Sharkansky, Brief, Peirce, Meehan, & Mannix, 1999; Stewart, Conrod, Samoluk, Pihl, & Dongier, 2000). Lastly, although not a leading theoretical perspective, there is some evidence that other common factors may play a role in the development of comorbid PTSD and SUD. Plausible factors that have been investigated include genetics, common neurophysiologic systems, and prior exposure to traumatic events (Norman et al., 2012; Khoury, Tang, Bradley, Cubells, & Ressler, 2010; Kingston & Raghavan, 2009; Stewart & Conrod, 2008).

In summary, the comorbidity of PTSD and SUDs is striking, particularly among treatment seeking and military populations. The mechanisms underlying the interplay between PTSD and SUD symptoms are multifaceted and complex. Whereas the majority of research supports the primacy of PTSD with respect to order of onset, empirical evidence also exists to lend support to an array of etiological theories. Finally, the comorbid presentation of PTSD and SUDs is associated with a more severe clinical presentation and poorer treatment prognosis. Given the frequent co-occurrence of PTSD and SUDs, and the negative impact of this comorbidity on treatment outcome, much recent attention has been given to the development and evaluation of improved assessment and treatment options. These are discussed in the following sections.

Assessment of Comorbid PTSD and SUD

The thorough assessment of symptoms is an essential component in the effective treatment of comorbid PTSD and SUDs. The primary goals of the assessment include the detection of trauma exposure and problematic substance use behaviors, evaluation of DSM PTSD and SUD diagnoses, and ongoing assessment of symptom severity during treatment (Steenkamp, McLean, Arditte, & Litz, 2011; Tucker, Murphy, & Kertesz, 2011). Assessment procedures may involve several steps, ranging from the initial screening typically conducted in non-specialty clinics to lengthy diagnostic interviews, self-report monitoring forms and symptom questionnaires, and biological tests (Tucker et al., 2011). Together, the information gathered through these various assessments provides invaluable information to inform treatment planning and monitor progress. Numerous assessment tools have been developed and investigated for PTSD and SUDs, many of which are beyond the scope of this review. Thus, the following sections on assessment focus on the most common and empirically-supported measures relevant to diagnostics, treatment planning, and treatment monitoring for comorbid PTSD and SUDs. Assessment tools are summarized in Table 1.

Initial Screening

Several brief tools have been developed to screen for exposure to a DSM Criterion A traumatic event and problematic substance use behaviors in order to permit rapid identification of persons at-risk for PTSD and SUDs. These screening tools are especially relevant to settings that necessitate that a large amount of data be collected in a short period of time, such as in primary care clinics (Bufka & Camp, 2011). Although there is no standard trauma-exposure screener (Steenkamp et al., 2011) several options with growing

support in the literature exist (Gray, Elhai, Owen, & Monroe, 2009; Kubany et al., 2000). Potential screeners with psychometric support include the *Trauma Assessment of Adults* (Gray et al., 2009), *Life Events Checklist* (Gray, Litz, Hsu, & Lombardo, 2004), and the *Trauma Life Events Questionnaire* (Kubany et al., 2000). In addition to trauma exposure screeners, PTSD symptom screeners frequently used to indicate the need for further structured assessment include the *Primary Care PTSD Screen* (PC-PTSD; Prins et al., 2003), the *Short Form of the PTSD Checklist-Civilian Version* (Lang & Stein, 2005), *Trauma Screening Questionnaire* (TSQ; Brewin et al, 2002), and the *Short Post-Traumatic Stress Disorder Rating Interview* (SPRINT; Connor & Davidson, 2001).

Screening measures for SUDs have been studied extensively and are far more commonly used (Tucker et al., 2011). Popular alcohol screening measures include the *Alcohol Use Disorders Identification Test* (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993), *CAGE Questionnaire* (Cooney, Zweben & Fleming, 1995), and the *Michigan Alcoholism Screening Test* (MAST; Selzer, 1971). In addition, parallel versions of these screening measures have been developed for drug abuse: the *Drug Use Disorder Identification Test* (DUDIT; Berman, Bergman, Palmsteirna, & Schlyter, 2005) and the *Drug Abuse Screening Test* (DAST; Gavin, Ross, & Skinner, 1989). The *Alcohol, Smoking, and Substance Involvement Screening Test* (ASSIST; Humeniuk et al., 2008), developed by the World Health Organization, is recommended by the National Institute on Drug Abuse as a comprehensive screener to aid primary health care professionals in the detection and management of a range of SUDs and related problems.

Biological tests for alcohol and drug use (e.g., breathalyzer test, blood tests, and urinalysis) are another set of useful screening procedures due to the ease of data collection in medical settings. Patients that screen positive should be referred to specialty services. Several biological assessment options exist for use as either adjunctive or alternative assessments of SUD. Urine drug screening, or urinalysis, is perhaps the most common and preferred method for detecting illicit drug use (Richter & Johnson, 2001; Wolff, Welch, & Strang, 1999). Urinalysis is cost-effective, minimally-invasive, and quantitative systems exist for measuring the pattern, frequency, and amount of use (e.g., Preston, Silverman, Schuster, & Cone, 1997). Urinalysis is one of the most longstanding biological assessments of use and, as such, many of its drawbacks have been identified and, in some cases, addressed. Limitations include its relatively narrow window of detection (usually 3 days or less for most substances), easy alteration with chemicals or clean urine samples, and susceptibility to false positives (Jaffe, 1998; Widdop & Caldwell, 1991).

Although urinalysis is the predominant and often preferred biological method of assessment, SUD screening may also involve testing other bodily fluids, such as blood and saliva (Wolff et al., 1999). These methods of testing are less often used due to higher cost of administration, increased invasiveness, and narrow detection windows; however, *percent carbohydrate-deficient transferrin* (CDT), a blood-based testing method, is increasingly considered one of the preferred modes of assessing for chronic heavy alcohol use (Arndt, 2001). CDT testing is particularly useful when used in combination with other indicators such as liver enzymes (Aithal et al., 1998). Finally, hair analysis techniques also exist, but are less often used in isolation due to numerous identified biases and limitations (Wolff et al., 1999).

Diagnosis

After initial screening, more advanced assessment procedures should be conducted to establish clinical diagnosis of PTSD and SUDs based on DSM-IV diagnostic criteria. In general, these diagnostic assessments can take several hours to complete and require significant training to administer. Although excellent disorder-specific interviews exist for

both PTSD (*Clinician Administered PTSD Scale*; Blake et al., 1995) and SUDs (*Alcohol Use Disorders and Associated Disabilities Interview Schedule*; Grant & Hasin, 1990), general psychiatric diagnostic interviews that assess the DSM Axis I mental disorders may be better suited for assessing for comorbidity. One of the best examples of this is the *Structured Clinical Interview of DSM-IV Axis I Disorders* (SCID; First, Spitzer, Gibbon, & Williams, 1996). The SCID has been shown to provide valid and reliable diagnostics for PTSD and SUDs as well as most other Axis I disorders. Other semi-structured interviews include the *Anxiety Disorder Interview Schedule for DSM-IV* (Di Nardo, Brown, & Barlow, 1994), which provides a more thorough assessment of disorders and symptom severity, the *Mini International Neuropsychiatric Interview* (MINI; Sheehan et al., 1998), which also provides the DSM diagnoses but takes approximately half the time to administer as the same modules of the SCID, and the *Composite International Diagnostic Interview* version 2 (CIDI-2; Robins et al., 1989), which includes modules assessing all major diagnostic disorders and serving the criteria of both the DSM-IV and the ICD-10.

Symptom Severity and Treatment Tracking

Once the PTSD/SUD diagnoses have been assessed, symptom frequency and severity are the next essential components to treatment planning and monitoring. A large number of measures have been developed for monitoring PTSD and SUDs symptoms. These measures are largely brief, self-report assessments of a wide range of symptoms associated with each of the disorders, and with strong psychometric properties. In PTSD, these measures are fairly straight-forward in that they generally assess symptom severity of the 17 symptoms of PTSD, as defined by the DSM. Popular examples of these include the *PTSD Checklist* (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996), *PTSD Symptom Scale* (Foa, Riggs, Dancu, & Rothbaum, 1993), *Impact of Events Scale-Revised* (Weiss & Marmar, 1996), and the *Purdue PTSD Scale –Revised* (Lauterbach & Vrana, 1996). These measures provide quick feedback regarding symptom severity, are sensitive to changes that occur during treatment, and include cutoff scores to inform diagnostic status (Steenkamp et al., 2011). Separate trauma-specific versions of the various measures also have been developed (e.g., military vs. civilian; Steenkamp et al., 2011).

The assessment of SUDs involves the monitoring of substance use behaviors (frequency and intensity of use) and biological markers of use (Tucker et al., 2011). The *Timeline Followback* (TLFB; Sobell & Sobell, 1995) is a popular monitoring form that uses a calendar to record estimates of daily drinking or other drug use over long periods of time. The TLFB has been used to monitor changes in substance use during the course of treatment (Back et al., 2005; Back et al., 2006; Back, Killeen, Foa, Santa Ana, Gros, & Brady, 2012; Brady, Dansky, Back, Foa, & Carroll, 2001; Brady, Sonne, Anton, Randall, Back,& Simpson, 2005). Additional measures should be completed to assess the severity of use behaviors and consequences on health and psychosocial functioning, including the *Alcohol Dependence Scale* (Skinner & Horn, 1984), *Drinker Inventory of Consequences* (Miller, Tonigan, & Longabaugh, 1995), and the *Addiction Severity Index* (McLellan et al., 1992). These measures have been found to be useful across different levels of SUD severity and can be informative in treatment planning, especially in regards to motivational interventions (Tucker et al., 2011).

Special Considerations for Comorbidity

Due to the high comorbidity and complexity of PTSD and SUDs, additional assessments should be considered that may provide greater information about the relationship between symptoms. For example, several measures have been developed that assess the motivation for alcohol and drug use behaviors, such as the *Inventory of Drinking Situations* (Annis, 1982), *Inventory of Drug Taking Situations* (Annis & Martin, 1985; Annis et al., 1997),

Drinking Motives Questionnaire (Cooper, 1994; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007), *Reasons for Drinking Questionnaire* (Zywiak, Connors, Masito, & Westerberg, 1996) and *Marijuana Motives Questionnaire* (Simons et al., 1998). These measures are all self-report and ask individuals to indicate situations or circumstances during which they are most likely to use substances. For examples, the Inventory of Drinking Situations generates information regarding three global categories and eight subcategories of drinking situations: 1) negative situations (Unpleasant Emotions, Physical Discomfort, Conflict with Others), 2) positive situations (Pleasant Emotions, Pleasant Times with Others), and 3) temptation situations (Social Pressure, Urges/Temptations, Testing Personal Control). Similar subscales for coping with substances have been included in newer measures in the anxiety literature as well (Gros, Simms, Antony, & McCabe, 2012); however, these measures are not specifically for PTSD symptomatology. Self-monitoring and biological tests should be completed throughout treatment to sufficiently monitor treatment response.

The Evolution of Integrated Behavioral Treatments

Both psychosocial and pharmacologic interventions are important for the treatment of comorbid PTSD and SUDs. Historically, the standard of care has been to treat the SUD first and defer treatment of trauma/PTSD (Nace, 1988; Schnitt & Nocks, 1984), despite growing evidence that: (1) trauma exposure is commonplace among SUD populations (Najavits et al., 2003; Wasserman, Havassy, & Boles, 1997); (2) over half of SUD patients also suffer from PTSD (Cottler, Compton, Mager, Spitznagel, & Janca, 1992; Jacobsen et al., 2001; Mills et al., 2006); (3) symptoms of SUDs co-vary concurrently with those of PTSD (Ouimette et al., 2010); and (4) patients perceive an interrelation between their PTSD and SUD symptoms (Back et al., 2006; Brown, Stout, Gannon-Rowley, 1998). In this model, known as the *sequential model* of treatment, the SUD is treated first and trauma-focused work is deferred until a period of sustained abstinence (e.g., 3–6 months) has been achieved. If the patient follows up on trauma/PTSD treatment subsequent to completion of treatment for their SUD, it is usually provided by a different clinician at a separate treatment clinic. Proponents of the sequential model state that continued substance use during therapy will impede therapeutic efforts and/or that PTSD treatment may induce relapse (Nace, 1988; Pitman et al., 1991) and there is some evidence to suggest that PTSD symptoms can be reduced as a function of acute and protracted abstinence attained via SUD treatment (Coffey, Schumacher, Brady, & Cotton, 2007). Proponents of this model operate under *Pandora's Box hypothesis*, which states that efforts to address PTSD symptoms during the early stages of SUD treatment will result in an increase in negative affect and hyperarousal symptoms, with which the patient will be ill-equipped to cope and therefore more likely to relapse (Souza & Spates, 2008). However, there is little empirical data to support these concerns, and there is scant evidence to support the efficacy of the sequential model singularly or in comparison to other treatment models. Furthermore, only a minority of PTSD/SUD patients (under 30%) indicate a preference for the sequential model (Back, Brady, Jaanimagi, & Jackson, 2006; Brown et al., 1998).

In contrast, the *integrated model* of treatment acknowledges the notable interplay between symptoms of PTSD and SUDs and, in response, calls for both disorders to be simultaneously targeted by the same clinician. The integrated model is more closely linked with the self-medication hypothesis, in which the SUD is primarily considered a means of reducing or self-medicating symptoms of PTSD and other negative affect (Khantzian, 1985). The integrated model posits that addressing the trauma early in treatment and providing concurrent relief from PTSD symptoms will likely improve recovery from SUDs (Back, 2010; Brady et al., 2001; Hien et al., 2010; Ouimette et al., 1997). Compelling support for this model is provided by investigations of the temporal course of symptom improvement.

For example, in a study examining the temporal course of improvement in alcohol dependence symptoms and PTSD among 94 outpatients, improvements in PTSD symptoms had a greater impact on improvements in alcohol dependence symptoms, rather than the reciprocal relationship (Back et al., 2006). These findings were replicated by Hien and colleagues (2010) using data from a larger sample ($N = 353$) from a National Institute on Drug Abuse (NIDA) Clinical Trials Network (CTN) study. Only minimal evidence indicates that improvement in SUD symptoms results in improvement in PTSD; however, for every unit of PTSD improvement, the odds of being a heavy substance user at follow up decreases more than fourfold (Hein et al., 2010). In addition to a number of earlier case studies demonstrating that successful treatment of anxiety symptoms of PTSD leads to reductions in substance use (Fairbank & Keane, 1982; Fairbank et al., 1983; Keane & Kaloupek, 1982; Kilpatrick & Amick, 1985), the extant research examining the tolerability and efficacy of addressing PTSD among SUD patients show that substance use typically decreases significantly and does not increase with the addition of trauma-focused interventions (Back et al., 2012; Brady et al., 2001; Hien et al., 2010; McGovern et al., 2009; Mills et al., in press; Najavits et al., 2005; Triffleman, 2000). Furthermore, a large proportion of patients with comorbid PTSD and SUDs indicate that they would prefer to receive integrated treatment (Back, et al., 2006; Brown, et al., 1998; Najavits, Sullivan, Schmitz, Weiss, Lee, 2004). Given this growing evidence base and patient preference, the integrated model has received increasing support over the past decade (van Dam, Vedel, Ehring, & Emmelkamp, 2012). The subsequent sections on behavioral treatment will focus on two main types of integrated treatments: non exposure-based and exposure-based treatments (see Table 2).

Non Exposure-Based Integrated Treatments

Although *Prolonged Exposure Therapy* (Foa, Hembree, & Rothbaum, 2007) has been deemed one of the treatments of choice for PTSD (IOM, 2008), there is limited research exploring its efficacy in substance-abusing populations. As such, the majority of integrated treatment interventions that have been developed generally do not emphasize revisiting of traumatic memories (i.e., imaginal exposures) or confrontation of safe but anxiety producing situations in real life that are avoided by the patient (e.g., *in vivo* exposures). Rather, treatment tends to focus on the responses to the trauma and the impact of trauma symptoms. Treatment consists of psychoeducation, exploring the relationship between PTSD symptoms and substance use, self-management of symptoms and negative emotions, and development of cognitive behavioral coping skills. Some of these treatments separate the addiction treatment from the trauma work by the use of treatment phases, with the first phase dedicated to stabilizing the addiction in preparation for the second phase of working on the trauma. Examples of non exposure-based integrated treatments include *Addictions and Trauma Recovery Integrated Model* (*ATRIUM*; Miller & Guidry, 2001), *CBT for PTSD* (McGovern et al., 2009), and *Trauma Affect Regulation: Guidelines for Education and Therapy* (*TARGET*; Ford & Russo, 2006). Despite preliminary support for their efficacy in uncontrolled trials, limited empirical support exists to support the efficacy of these protocols in producing sustained improvements with respect to PTSD and SUD symptoms (SAMHSA, 2007).

Trauma-informed treatment in community substance abuse treatment programs is typically conducted in a group format and is often gender specific. The *Trauma Exposure and Empowerment Model* (*TREM*) was originally developed for women with trauma and severe mental disorders, including SUDs (Harris, 1998). The TREM intervention takes into account the differences in the way women experience and subsequently cope with trauma. Amaro et al. (2007) compared a comprehensive women's substance abuse and co-occurring disorder treatment model that included a 25 session TREM intervention to treatment-as-usual in 342 women with a trauma history and SUD. Women in the intervention group showed

significantly greater reductions in drug use and PTSD symptoms at the 12-month follow-up as compared to women in usual care. However, the study had limitations such as lack of randomization and lack of biological measures to verify abstinence. Because the TREM intervention was delivered as part of a comprehensive treatment package, it was difficult to attribute outcomes to the trauma intervention component.

Transcend, a 12-session manualized group treatment, consists of emphasis on the development of coping skills during the initial 6 sessions, followed by trauma processing conducted in the final 6 sessions (Donovan, Padin-Rivera, Kowaliw, 2001). Throughout treatment, substance use education, relapse prevention techniques, peer support, and 12 Step attendance is encouraged. In an open pilot trial among 46 male Vietnam Veterans participating in a partial hospitalization program, *Transcend* participants demonstrated significant improvement from baseline with respect to PTSD symptoms at post-treatment, 6, and 12 month follow-up. *Transcend* participants also experienced improvements in SUD symptoms, including decreased alcohol consumption, decreased polysubstance drug use, and decreased episodes of drinking to intoxication. Although these findings are promising, they remain preliminary, as *Transcend* has yet to be evaluated in a randomized controlled trial.

More rigorous research has been conducted with *Seeking Safety* (SS), a non exposure-based, manualized cognitive behavioral intervention for comorbid PTSD and SUDs (e.g., Najavits, 1998; Hien et al., 2004; 2008; additional studies summarized in Table 2). SS is a 24 session manualized therapy that prioritizes establishing and maintaining safety. Other key concepts include anticipating dangerous situations, setting boundaries, anger management and affect regulation. SS was compared to relapse prevention in a community sample of 107 women with SUDs and either PTSD or sub-threshold PTSD (Hien et al., 2004). Women were randomized to one of the two interventions and individual sessions were delivered twice weekly for 12 weeks. Compared to a nonrandomized community care group, both treatment interventions had improved substance use and PTSD severity outcomes at the end of treatment, and at 6 and 9 months follow-up. Of note, PTSD symptom severity scores as measured by the CAPS were still in the moderate severity range (score range 48–60) post treatment, and no significant differences in PTSD or SUD symptoms between the SS and relapse prevention groups were observed.

In a larger national multisite community study, SS was compared to a women's health education (WHE) control group (Hien et al., 2009). Three hundred and fifty three women receiving standard community treatment as usual were randomized to 12 twice-weekly sessions of SS or WHE. Both interventions were delivered in a group format to more closely resemble how treatment is delivered in community programs. Both the SS and WHE groups significantly reduced PTSD symptoms. However, neither of the therapy groups had a significant impact upon abstinence rates over time. Interestingly, among women who had the largest reduction in PTSD symptom severity at the 12 month follow-up, those who received SS were more than twice as likely to be abstinent from substances than those who received WHE (43% versus 19%, respectively).

Non exposure-based integrated therapies have been more widely used in substance abuse community treatment programs, clearly indicating that clinicians see the necessity of addressing both SUDs and PTSD in the same treatment episode. However, treatment outcomes for both disorders have been modest at best and there is a need for improvement in treatment options.

Exposure-Based Integrated Treatments

Research has demonstrated that addressing trauma/PTSD among SUD patients is both tolerable and beneficial (Weis, 2010). Exposure-based therapies have been identified as one

of the most effective forms of evidenced-based treatments available for PTSD (Ballenger et al., 2000; IOM, 2008). A recent meta-analysis of prolonged exposure therapy for PTSD found large effect sizes for prolonged exposure in comparison to control conditions (Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010) and exposure-based therapies have demonstrated effectiveness in addressing PTSD among a variety of traumatic stress populations, including victims of rape, physical assault, refugees, motor vehicle accidents, combat, terrorism, childhood abuse, and mixed trauma types (Bryant et al., 2008; Foa et al., 2005; McDonagh et al., 2005; Nacasch et al., 2011, van Minnen et al., 2006; Resnick, Williams, Suvak, Monson & Gradus, 2012). A longitudinal study conducted 5–10 years after patients received prolonged exposure (*N*=65) demonstrated maintenance of effects with17.5% of patients meeting diagnostic criteria for PTSD (Resick, Williams, Suvak, Monson & Gradus, 2012).

Recently, prolonged exposure has been incorporated into existing residential SUD treatment with promising preliminary results (Berennz, Stasiewicz, Rowe, Schumacher, & Coffey, 2012; Henslee & Coffey, 2010). Berenz and colleagues (2012) completed a case series following outcomes of four individuals with PTSD in a residential substance use treatment facility. In addition to their standard residential SUD treatment, these individuals received 9 bi-weekly sessions of prolonged exposure, as well as in vivo and imaginal homework assignments between sessions. Post-treatment evaluations indicated that none of the individuals met criteria for PTSD, and this finding was maintained at 3 and 6-month follow-up. In addition, incorporation of prolonged exposure did not lead to increased rates of treatment dropout or relapse. Although preliminary, the findings support the feasibility of integrating prolonged exposure into residential SUD treatment facilities (see Henslee & Coffey, 2010).

In addition to the incorporation of prolonged exposure therapy into residential SUD treatment, two integrated treatments that incorporate exposure-based techniques have been tested among individuals with PTSD and SUDs. Triffleman and colleagues (1999 PTSD and SUDs. Triffleman and colleagues (2000) developed an integrated treatment, *Substance Dependence Posttraumatic Stress Disorder Therapy (SDPT)* delivered as a five-month intervention, including twice-weekly sessions. SDPT incorporates a two-phased approach that includes an integration of cognitive-behavioral treatment for SUD with *in vivo* exposure for PTSD. When compared to a Twelve-Step Facilitation Therapy which did not address trauma, among a sample of 19 methadone-maintained patients, improvements were observed with respect to both SUD and PTSD symptom severity; however, no between group differences were observed. Several reasons were posited for the lack of differential findings, including the small sample size, the short follow-up period (1 month) and the fact that SDPT did not incorporate imaginal exposure (i.e., exposure to the memories of past trauma), and instead only integrated *in vivo* exposure.

Subsequent to the evaluation of SDPT, Brady and colleagues developed a concurrent treatment for PTSD and co-occurring cocaine dependence (Brady et al., 2001; Back et al., 2001). The treatment, currently referred to as COPE (Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure) is the first treatment to combine evidence-based cognitive behavioral therapy for SUDs (Carroll, 1998) with the key components of prolonged exposure for PTSD (Foa et al., 2007), which includes both *in vivo* and imaginal exposure techniques. The PTSD treatment component of COPE is designed to help patients understand the relationship between PTSD and substance use, normalize common reactions to trauma, and reduce PTSD symptoms via exposure techniques, whereas the substance use treatment component of COPE is designed to help patients recognize and manage cravings and urges to use alcohol or drugs, manage thoughts about substance use, identify and plan for “high-risk” situations in which vulnerability to relapse is heightened,

and effectively manage a potential lapse (Carroll, 1998). COPE was initially trialed as an individual, 16-session intervention, which included in vivo exposure (sessions 6–15) and imaginal exposure (sessions 7–15), in an uncontrolled psychotherapy development study among patients ($N = 39$) presenting with comorbid PTSD and cocaine dependence (Brady et al., 2001). In this preliminary study, participation in exposure-based techniques was not associated with escalation of substance use or increased risk of relapse; however, attrition was high, as with other studies employing only substance abuse treatments in this population (Chris-Christoph et al., 1999). Interestingly, the majority of participants who dropped out of treatment (75% of dropouts) did so before the initiation of exposure procedures. Fifteen participants (38.5%) were categorized as treatment completers, defined a priori as patients who attended at least 10 sessions (63% of sessions) and received at least 3 imaginal exposures. The average number of sessions attended was 14.7 for treatment completers and 4.1 for treatment non-completers. Completers of the program demonstrated significant improvements in all PTSD symptom clusters (i.e., re-experiencing, avoidance, hyperarousal) and reduction of cocaine use from baseline to end of treatment (Brady et al., 2001). Further, reductions in PTSD and SUD symptoms were maintained at 6-month follow-up and COPE also produced significant sustained reductions in depression.

Mills and colleagues (in press) recently completed a randomized control trial of COPE plus treatment as usual (TAU) vs. TAU alone. TAU consisted of detoxification and inpatient and/or outpatient drug counseling. Participants were 103 patients (62.1% female) with civilian PTSD and SUDs. Most patients evidenced poly-substance use (using a median of 4.0 different drug classes in the preceding month). The most commonly reported substances were heroin (21.4%), cannabis (19.4%), amphetamines (17.5%), benzodiazepines (15.5%). For this trial, COPE consisted of 13, individual, 90-minute sessions. Treatment components included: motivational interviewing and CBT for substance use; psychoeducation regarding to both disorders and their interaction; *in vivo* exposure (sessions 5–12); imaginal exposure (sessions 6–12); and cognitive therapy for PTSD. The final session (session 13) provided a review of the treatment and developed an after care plan. From baseline to 9-month follow-up, significant reductions in PTSD symptom severity were found for both groups, however, the COPE group demonstrated a significantly greater reduction in PTSD symptom severity (mean difference −16.09) and lower rates of PTSD diagnosis as compared to the control group (56.4% vs. 79.2%). No significant between group differences in rates of abstinence or number of SUD dependence criteria met were observed. At the 9-month follow-up visits, rates of SUD diagnosis had dropped to 45.4% in the COPE group and 56.2% in the control group. Retention did not differ by group. In sum, findings from this first randomized controlled trial of COPE demonstrate that treatments utilizing prolonged exposure therapy for PTSD: (1) can be used safely with patients with co-occurring SUDs and do not lead to an increase in substance use; (2) demonstrate sustained improvements across all outcome domains; and (3) produce greater improvements in PTSD than treatment as usual.

Currently, COPE is being evaluated versus standard cognitive-behavioral relapse prevention in a randomized controlled trial among OEF/OIF Veterans. Since its inception, the intervention has been modified to address all substances of abuse and currently consists of 12 individual, 90-minute sessions that include a substance abuse and PTSD component (Back et al., 2012; Killeen, Back, & Brady, 2011). *In vivo* exposures are now conducted in sessions 3–11 and imaginal exposures in sessions 4–11. Although preliminary, initial findings demonstrate COPE's ability to produce significant and sustained symptom reduction, and lend support for the acceptability and tolerability of the COPE treatment among a Veteran population (Back et al., 2012).

In summary, PTSD and SUDs commonly co-occur and both non exposure-based and exposure-based integrated interventions have been shown to be safe and effective. Although

non exposure-based treatments offer some PTSD symptom reduction, exposure-based treatments including both *in vivo* and imaginal exposure techniques may offer greater symptom reduction. The recent evidence showing improvement in PTSD positively impacting substance use outcomes clearly supports a more rigorous approach to assessing and treating PTSD among patients with SUDs. It is important to note that, at present, the variables which may predict a more favorable response to integrated treatment (including patient, trauma, or substance related variables) are unclear. In selecting a treatment approach, a number of factors may be considered (see Killeen et al., 2011 for more details), such as, patient preference, history of treatment and treatment response, severity of SUD, withdrawal symptom severity and need for medically supervised detoxification, and ability of the patient to recall the trauma memory (necessary for exposure-based treatments). In addition, clinicians should consider the functional relationship between PTSD and SUD symptoms for each patient. Clinicians will want to obtain information regarding the exact reasons why each patient reports using substances (e.g., to sleep better and not remember trauma-related memories, to block out memories or flashbacks, to be able to engage in social interactions) and use this information to inform treatment selection and implementation.

Pharmacological Treatment of PTSD and SUDs

Studies of medications in the treatment of co-occurring PTSD and SUDs are lacking. Sertaline, a serotonin-reuptake inhibitor which has received FDA-approval for the treatment of PTSD, was investigated in a double-blind, placebo-controlled, 12-week trial (Brady et al., 2005). The study demonstrated that individuals with early age of onset PTSD (i.e., childhood trauma) and less severe alcohol dependence demonstrated more favorable improvements in alcohol use severity when treated with sertraline as compared to placebo. In contrast, individuals with later age of onset PTSD and more severe alcohol dependence evidenced more favorable alcohol use outcomes when treated with placebo as compared to sertraline. The sertraline-treated group also showed a trend toward greater PTSD improvement as compared to the placebo-treated group. Petrakis and colleagues (2005) investigated the use of two agents which target alcohol consumption, disulfiram and naltrexone, alone or in combination, in a 12-week controlled trial in outpatients with alcohol dependence (AD) and a variety of comorbid psychiatric disorders (42.9% met DSM-IV criteria for comorbid PTSD). Patients treated with either medication evidenced more consecutive weeks of abstinence and fewer drinking days as compared to patients on placebo. Individuals treated with disulfram reported less craving from pre to post treatment as compared to naltrexone-treated individuals. In addition, individuals receiving active medication demonstrated greater symptom improvement (e.g., less anxiety) pre to post treatment as measured by the Brief Symptom Inventory. No advantage of combining disulfiram and naltrexone was reported. In a more recent study (Petrakis et al., 2011), the serotonin uptake inhibitor, paroxetine, was compared to the norepinephrine uptake inhibitor, desipramine in 88 male veterans who met current diagnostic criteria for both AD and PTSD. Subjects were randomly assigned under double-blind conditions to one of four groups: paroxetine + naltrexone; paroxetine + placebo; desipramine + naltrexone; desipramine + placebo.

Paroxetine did not show statistical superiority to desipramine for the treatment of PTSD symptoms. However, desipramine was superior to paroxetine with respect to study retention and alcohol use outcomes. Naltrexone reduced alcohol craving relative to placebo, but it conferred no advantage on drinking use outcomes. Although the serotonin uptake inhibitors are the only FDA-approved medications for the treatment of PTSD, the current study suggests that norepinephrine uptake inhibitors may present clinical advantages when treating male veterans with PTSD and AD. Further investigation of the use of medications as an

adjunct to psychotherapeutic treatment in the treatment of co-occurring PTSD and SUDs are needed.

Conclusions

The comorbid presentation of PTSD and SUDs is remarkably common, and in comparison to patients presenting with either PTSD or SUD alone, PTSD/SUD patients often report greater functional impairment and experience poorer treatment outcomes –including treatment failure and dropout. Several mechanisms have been posited to explain the co-occurrence of PTSD and SUDs, including the self-medication hypothesis, the high-risk hypothesis, the susceptibility hypothesis. The majority of research to date supports the self-medication hypothesis.

At present, a wide array of assessment tools exist that allow for the efficient and effective screening, diagnosis and symptom monitoring. The availability of such a range of assessment options make both the regular integration of trauma screening into traditional SUD treatment settings, as well as the integration of SUD screening into traditional trauma-focused treatment settings, a viable and worthwhile standard operating procedure among practitioners.

In addition, there is a growing arsenal of available treatment options to concurrently address PTSD and SUD symptoms. Whereas PTSD and SUD have historically been treated using the sequential treatment model, the integrated treatment model has garnered increasing empirical support over the past decade. A handful of integrated treatments have been evaluated in uncontrolled and randomized controlled trials with overall promising findings. In addition to being well tolerated by patients, integrated treatments have demonstrated the ability to significantly reduce symptoms of PTSD, SUD and associated pathology such as depression. Perhaps most promising are integrated treatments that incorporate exposure-based techniques – the recognized “gold standard” in PTSD treatment (IOM, 2008) – with cognitive behavioral treatment of substance use disorders. It is important to note, however, that while evidence for the efficacy and effectiveness of integrated, exposure-based treatments (such as COPE) is growing, the research in this area is still in a nascent state. Continued research is needed in the form of randomized controlled efficacy trials among variant high-risk populations. In line with recommendations from a recent systematic review of integrated treatments for PTSD/SUD (vanDam et al., 2012), future research should attend to the methodological rigor of clinical trials by ensuring adequate randomization, using an active comparison condition, and including long-term follow-ups to establish the sustainability of treatment outcomes. Further, research on the exportability and effectiveness of integrated treatments is needed in a range of settings (e.g., Veterans Administration hospitals, SUD treatment facilities, traditional mental health departments) to ensure that evidence-based best practices are widely accessible.

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Table 1

Screening, Diagnostic and Symptom Tracking Measures for PTSD and Substance Use Disorders

Measure	Purpose	Admin Time (Appx. Mins.)	Source Reference
Screening Measures			
Trauma Life Events Questionnaire	Trauma/PTSD Screening	10–15	Kubany et al., 2000
Primary Care – PTSD Screen (PC-PTSD)	PTSD Screening	1–2	Prins et al., 2003
Short Form of the PTSD Checklist – Civilian Version	PTSD Screening	1–2	Lang & Stein, 2005
Short Posttraumatic Stress Disorder Rating Interview (SPRINT)	PTSD Screening	2–3	Connor & Davidson, 2001
Trauma Screening Questionnaire (TSQ)	PTSD Screening	2–3	Brewin et al., 2002
Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST)	SUD Screening	7–10	Humeniuk et al., 2008
Alcohol Use Disorders Identification Test (AUDIT)	SUD Screening	2–3	Saunders et al., 1993
CAGE	SUD Screening	< 1	Cooney et al., 1995
Drug Abuse Screening Test (DAST)	SUD Screening	5	Gavin et al., 1989
Drug Use Disorders Identification Test (DUDIT)	SUD Screening	5–10	Berman et al., 2005
Diagnostic Measures			
Clinician Administered PTSD Scale (CAPS)	PTSD Diagnosis	45–60	Blake et al., 1995
Alcohol Use Disorders and Associated Disabilities Interview Schedule	DSM Diagnosis	60	Grant & Hasin, 1990
Anxiety Disorder Interview Schedule for DSM-IV (ADIS)	DSM Diagnosis	≤ 120	DiNardo et al., 1994
Composite International Diagnostic Interview, version 2 (CIDI-2)	DSM and ICD-10 Diagnosis	≤ 75	Robins et al., 1989
Structured Clinical Interview for DSM-IV Axis I Disorders (SCID)	DSM Diagnosis	Varies Based on Modules Delivered	First et al., 1996
Mini International Neuropsychiatric Interview (MINI)	DSM Diagnosis	15	Sheehan et al., 1998
Treatment Planning Measures			
Drinking Motives Questionnaire (DMQ)	Motives for Use	5–10	Cooper, 1994
Inventory of Drinking Situations	Motives for Use	15–20	Annis, 1982
Inventory of Drug Taking Situations (IDTS)	Motives for Use	10	Annis & Martin, 1985
Marijuana Motives Questionnaire	Motives for Use	5–10	Simons et al., 1998
Reasons for Drinking Questionnaire	Motives for Use	5	Zwyiak et al., 1996
Symptom Tracking Measures			
Impact of Events Scale-Revised (IES-R)	PTSD Symptom Severity	5–10	Weiss & Marmar, 1996
PTSD Checklist (PCL)	PTSD Symptom Severity	5	Blanchard et al., 1996
PTSD Symptom Scale (PDS)	PTSD Symptom Severity	20	Foa et al., 1993
Purdue PTSD Scale-Revised	PTSD Symptom Severity	10–15	Lauterbach & Vrana, 1996
Addiction Severity Index (ASI)	SUD and Associated Symptom Severity	50–60	McLellean et al., 1992
Alcohol Dependence Scale	SUD Symptom Severity	5	Skinner & Horn, 1984

Measure	Purpose	Admin Time (Appx. Mins.)	Source Reference
Drinker Inventory of Consequences	SUD Symptom Severity	10–15	Miller et al., 1995
Timeline Followback (TLFB)	SUD Symptom Frequency and Severity	≤ 30	Sobell & Sobell, 1995

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Table 2

Integrated Treatments for Comorbid PTSD and Substance Use Disorders

Treatment	Exposure	Trial Design	Sample	Outcomes	Reference(s)
TREM	None	**Quasi- Experimental, Non-Equivalent Group** TREM as part of a larger comprehensive treatment model v. TAU at community substance use treatment program; 6 and 12 month follow-up	342 women with a trauma history and SUD, presenting for SUD treatment	Significantly greater reduction in drug use and PTSD symptoms among integrated treatment (including TREM) group compared to TAU	Harris, 1998; Amaro et al., 2007
CBT for PTSD	None	**Open Pilot Trial** Post-treatment and 3 month follow-up	11 patients in community addictions treatment	Significant impact on PTSD symptoms and substance use; demonstrated feasibility of delivery in community addictions treatment facility	McGovern et al., 2009
Transcend	None	**Open Pilot Trial** 6 and 12 month follow-up	46 male Vietnam Veterans with PTSD and SUDs, presenting in partial hospitalization program	Significant improvements in PTSD symptoms across all follow- ups; Decreased substance use at follow-up	Donovan et al., 2001
Seeking Safety	None	**Uncontrolled Trial** 3 month follow-up	27 females with trauma history and SUD, recruited from the community	Among completers (n=17), significant improvements in substance use, trauma-related symptoms, suicide risk, depression, social adjustment, problem solving, family functioning, and cognitions about substance use.	Najavits, 1998
		Uncontrolled Trial 3 month follow-up	17 females with PTSD and SUD, incarcerated sample	Significant improvement in PTSD symptoms (53% no longer met criteria at post- treatment); Improvement in PTSD maintained at follow-up; Significant reductions in SUD symptoms, with only 35% reporting use within 3 months of prison release.	Zlotnick et al., 2003
		Uncontrolled Trial Pre and Post only	25 male and female Veterans with PTSD and SUD, presenting in outpatient Veterans Administration clinic	Significant improvements in self-reported PTSD symptoms, quality of life, communication, problem solving skills and abstinence at post- treatment	Cook et al., 2006
		RCT SS and standard community care v. Relapse prevention and standard community care; 6 and 9 month follow- up	107 females with PTSD or sub-threshold PTSD and SUD, presenting in community clinic	Significant reductions in SUDs and PTSD for both groups; PTSD symptoms still in moderate severity range; No group differences at follow-up	Hien et al., 2004
		Uncontrolled Pilot SS plus Prolonged Exposure	5 men with comorbid PTSD and substance dependence presenting at outpatient clinic	Significant improvements in drug use, trauma symptoms, psychosocial functioning, anxiety, & feelings/thoughts related to safety	Najavits et al., 2005
		RCT SS and standard community care v. standard community care; 3 month follow-up	33 adolescent girls with PTSD and SUD, recruited from community and community clinics	Significantly improved outcomes among SS group regarding attitudes toward substance use, some trauma- related symptoms, and associated pathology	Najavits et al., 2006
		Quasi- Experimental SS v. wait list control	107 females with PTSD or sub-threshold PTSD and SUD, low- income sample	Significant reductions in PTSD symptoms and alcohol use among SS v. wait list control; trend toward significant decrease in drug use for SS group	Cohen et al., 2006

Treatment	Exposure	Trial Design	Sample	Outcomes	Reference(s)
		Quasi- Experimental SS group v. TAU	313 women with trauma history, substance use disorder and comorbid Axis I or Axis II disorder	SS group showed greater treatment retention over 3 months and greater improvement in PTSD symptoms and coping skills than TAU	Gatz et al., 2007
		RCT SS and TAU v. TAU	49 females with PTSD or sub- threshold PTSD and SUD, incarcerated sample	No significant differences between groups on all key domains; Both conditions showed significant improvements in PTSD and SUD symptoms across time	Zlotnick et al., 2009
		RCT SS v. Women's Health Education; 6, 9, and 12 month follow-up	353 females with PTSD or sub-threshold PTSD and SUD, from national, multi-site community sample	Significant reduction in PTSD for both groups; No group differences on PTSD outcomes; No significant impact on abstinence at follow-up	Hien et al., 2009
		Uncontrolled Pilot	14 male OEF/OIF Veterans	Preliminary findings show significant reductions in PTSD symptoms and alcohol use	Norman et al., 2010
		Controlled Trial SS v. wait list control	114 incarcerated women reporting trauma history, history of SUD, and at least moderate PTSD symptoms	SS group demonstrated decreased depression, improved interpersonal functioning, and decreased maladaptive coping compared to control	Lynch et al., 2012
		RCT SS v. TAU; 3 month follow-up	98 male Veterans with PTSD and SUD (treatment as usual did not have to meet criteria for PTSD), presenting in outpatient Veterans Administration clinic	Significantly better drug use outcomes among SS than TAU; No differences between groups in alcohol use or PTSD symptom improvement	Boden et al., 2012
		RCT SDPT v. 12 Step Facilitation; 1 month follow-up	19 men and women with PTSD or sub-threshold PTSD and SUD, presenting in Methadone clinic	Significant improvement in SUD and PTSD severity for both groups; No differences between groups	Triffleman et al., 2000
SDPT	In vivo	**Open Pilot Trial** 6 month follow-up	39 men and women with PTSD and cocaine dependence, presenting for SUD treatment	Significant improvement in PTSD and cocaine dependence symptoms for completers; Improvements maintained at follow-up	Back et al., 2001; Brady et al., 2001
COPE	In vivo & Imaginal	**RCT** COPE plus TAU v. TAU; 3 and 9 month follow-up	103 men and women with PTSD and drug dependence, presenting for SUD treatment in Australia	Significant improvement in SUD and PTSD severity for both groups; Greater reduction in PTSD among treatment group	Mills et al., in press
		Case Study 3 and 6 month follow-up	OEF/OIF male Veteran with PTSD and alcohol dependence	Preliminary findings show significant improvement in SUD and PTSD at end of treatment and both follow-up time points	Back et al., 2012

Note. TAU = Treatment as usual. Table does not represent an exhaustive review of all published trials of integrated treatment models.