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Publisher Citation

Correlates of improvement in substance abuse among dually diagnosed veterans with post-traumatic stress disorder in specialized intensive VA treatment. Coker KL, Stefanovics E, Rosenheck R. *Psychol Trauma*. 2016 Jan;8(1):41-8. doi: 10.1037/tra0000061. Epub 2015 Jun 29.

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**Correlates of Improvement in Substance Abuse among Dually Diagnosed Veterans
with Post-Traumatic Stress Disorder in Specialized Intensive VA Treatment**

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Acknowledgement: Dr. Coker is supported by National Institute of Health grant T32DA007238

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Abstract

Substantial rates of substance use comorbidity have been observed among veterans with PTSD highlighting the need to identify patient and program characteristics associated with improved outcomes for substance abuse. Data were drawn from 12,270 dually diagnosed veterans who sought treatment from specialized intensive Veterans Health Administration PTSD programs between 1993 and 2011. The magnitude of the improvement in Addiction Severity Index (ASI) alcohol and drug use composite scores from baseline was moderate, with effect sizes (*ES*) of $-.269$ and $-.287$, respectively. Multivariate analyses revealed that treatment in longer-term programs, being prescribed psychiatric medication, and planned participation in reunions were all associated with slightly improved outcomes. Reductions in substance use measures were associated with robust improvements in PTSD symptoms and violent behavior. These findings suggest not only synergistic treatment effects linking improvement in PTSD symptoms with substance use disorders among dually diagnosed veterans with PTSD but also to improvement in violent behavior. Furthermore, the findings indicate that proper discharge planning in addition to intensity and duration of treatment for dually diagnosed veterans with severe PTSD may result in better outcomes. Further dissemination of evidence-based substance abuse treatment may benefit this population.

Keywords: Veterans, PTSD, Substance Use, Treatment, Violence

INTRODUCTION

Many veterans who suffer from Post-Traumatic Stress Disorder (PTSD) also experience comorbid substance use (Jacobsen, Southwick, & Kosten, 2001). Although conclusive data on causal relationships are not available (Fontana, Rosenheck, & Desai, 2012), there is clear empirical evidence showing the association of PTSD with poorer substance use outcomes (Jacobsen et al., 2001) with some studies indicating that trauma cues increased cravings for addictive substances (Coffey et al., 2002; Saladin et al., 2003). The combination of PTSD and substance use is associated with especially complex clinical challenges because of the adverse synergies of addictive disorders and PTSD (Back, Waldrop, & Brady, 2009; van Dam, Ehring, Vedel, & Emmelkamp, 2013).

Some studies suggest that dually diagnosed PTSD patients have worse outcomes than those with either diagnosis alone including higher rates of substance-related relapses and substance-related hospital admissions, more severe PTSD symptoms, shorter periods of abstinence, and poorer adherence to follow-up treatment (Brown, Read, & Kahler, 2003; Paige Ouimette, Moos, & Brown, 2003; Schafer & Najavits, 2007). Furthermore, dually diagnosed PTSD patients report greater efforts to obtain illicit substances, higher likelihood of use to the point of intoxication, higher levels of substance use in response to negative interpersonal emotions (P. Ouimette, Coolhart, Funderburk, Wade, & Brown, 2007), and poorer physical health outcomes (P. Ouimette, Goodwin, & Brown, 2006). However, other studies suggests that patients with co-morbid substance use treated in specialized intensive treatment programs may show greater improvement in PTSD symptoms than veterans without substance use co-morbidity, apparently due to reduced substance use through such treatment (Fontana et al., 2012). With high rates of comorbid PTSD and substance use among war zone veterans, the

Department of Veterans Affairs has devoted considerable resources to help these veterans (Bohnert et al., 2013; Fontana & Rosenheck, 1997).

Studies have suggested that among dually diagnosed veterans with PTSD, comprehensive care targeted to treat substance abuse comorbidity may lead to significant reductions in PTSD symptoms (Hien et al., 2010). Consistent with this suggestion, one large scale Veterans Health Administration (VHA) study found that veterans admitted into VHA specialized inpatient/residential PTSD programs with co-morbid PTSD and substance use disorder showed greater improvement, albeit modest in magnitude, in PTSD symptoms than veterans with PTSD without a comorbid substance use disorder (Fontana et al., 2012). These findings were most likely attributed to improvement in substance use disorders being associated with greater improvement in PTSD symptoms after discharge (Fontana et al., 2012).

Despite encouraging outcomes found in these studies, no specific pharmacotherapies or psychotherapies have been clearly demonstrated to improve substance use outcomes among individuals with PTSD (van Dam et al., 2013) with limited exceptions (P. Ouimette, Moos, & Finney, 2003; Petrakis et al., 2006; Possemato et al., 2012). This lack of specific demonstrably effective treatments is even more concerning since large numbers of veterans are now returning home from war in the middle east with high rates of PTSD and associated substance abuse problems (Jacobson et al., 2008; Stecker, Fortney, Hamilton, Sherbourne, & Ajzen, 2010). Previous research has highlighted the need for studies to identify factors responsible for the synergistic treatment effects linking improvement in PTSD symptoms with improvement in substance use disorders (Fontana et al., 2012). Studies have found that over time substance dependence and PTSD symptoms co-vary concurrently (P. Ouimette, Read, Wade, & Tirone, 2010). Furthermore, greater severity of the traumatic exposure can negatively impact substance

use outcomes (Read et al., 2012). However, to the authors' knowledge, no paper has systematically identified predictors or correlates of improvement in substance abuse among veterans with PTSD and comorbid substance abuse in real-world clinical settings. Moreover, with the rising demand for services among veteran personnel returning home from the middle east (Hermes, Rosenheck, Desai, & Fontana, 2012) and published concerns about the cost of caring for them (Bilmes & Stiglitz, 2008) studies are needed that identify treatment elements associated with positive substance use outcomes (Rosenheck & Fontana, 2001).

From 1992 to 2011, the VHA used a consistent system to monitor veteran outcomes in its specialized intensive inpatient, residential, and day treatment programs for veterans with PTSD (Fontana & Rosenheck, 2008). In this exploratory study, we examined data from a large cohort of veterans with comorbid PTSD and substance abuse treated in these programs to identify baseline characteristics, program characteristics, and features of their status at the time of discharge that are associated with improvement in substance abuse outcomes four months after discharge. In addition, we examined the association of reduction in alcohol and drug use problems with improvement with other outcomes such as employment, PTSD, and violent behavior. This study thus seeks to illuminate veteran characteristics and treatment elements associated with superior outcomes of comorbid substance abuse among dually diagnosed veterans with PTSD. This study also attempts to further elucidate the association of improvement in substance abuse with other important outcomes among veterans whose problems are severe enough to require intensive treatment. Identification of such characteristics and treatment elements in this high risk population may suggest areas for future treatment development and dissemination.

METHOD

Participants

Data were drawn from administrative evaluation data collected by the VA's Northeast Program Evaluation Center (NEPEC) on all veterans who sought treatment from specialized intensive PTSD programs between 1993 and 2011. The number of sites vary from year to year due to programs closing or being converted to non-intensive treatment programs. On an annual basis, there were between 33 and 53 programs included in the program evaluation initiative. The cohort for this analysis was limited to patients diagnosed with both PTSD and Alcohol or Drug Use Disorders (N=12, 270).

Measures

Measures available from the specialized PTSD program monitored variables such as socio-demographic characteristics, clinical diagnoses, severity of clinical status as measured by standardized scales, treatment program characteristics, and discharge status (i.e. successfully completed the program, left prematurely or left following program rule violations). Outcomes were measured as changes from the admission assessment to four months after discharge based on continuous measures of substance use, PTSD symptoms and other clinical variables. Variables which assessed baseline clinical status included clinical diagnoses of alcohol use disorders, drug use disorders and other Axis I and/or Axis II diagnoses comorbid with PTSD. In addition VA service connected disability status for PTSD, for psychiatric disorders other than PTSD, and for non-psychiatric medical disorders were all documented at the time of program entry along with severity of drug and alcohol use, PTSD symptoms, current medical problems, and recent violent behavior.

Clinical status was measured by the Short Form of the Mississippi Scale for PTSD (MISS) (Fontana & Rosenheck, 1994) (range = 15 – 55) which was developed to assess combat related PTSD symptoms. These symptoms include avoiding reminders of the war, symptoms of irritability, feeling numb and emotionally distant from others, sleep disturbances, intrusive thoughts, flashbacks and nightmares, and hyperarousal. Research has shown the coefficient alpha for the MISS between .83 and .96 (Fontana & Rosenheck, 1994; T. M. Keane, Caddell, & Taylor, 1988). Composite indices from the Addiction Severity Index (ASI) (McLellan et al., 1985) were used to assess alcohol and drug use. Studies have shown the average concordance rates for the ASI to be as high as .89 (McLellan et al., 1985). Violent behavior was assessed by averaging 4 items from the National Vietnam Veterans Readjustment Study (Kulka, 1990) (range = 0 – 4). Employment was measured as the number of days employed during the past 30 days.

Treatment programs were characterized as one of four program types to which veterans were admitted: 1) Evaluation/Brief Treatment PTSD Units (EBTPUs), short term units with lengths of stay (LOS) targeted at less than 14 days which typically offer acute stabilization, PTSD evaluation, psycho-education, medical assessment, psychotropic medication and brief supportive psychotherapy; 2) Specialized Inpatient PTSD Units (SIPUs), with LOS of 28-90 days or longer which typically include acute hospital care, intensive trauma-focused evaluation, education, and intensive group and individual psychotherapy along with medical assessment and psychotropic medication; 3) PTSD Residential Rehabilitation Programs (PRRPs), with LOS similar to SIPUs but is less intensively supervised, and are less medically-oriented “halfway-house” settings offering PTSD evaluation, psycho-education, group and individual psychotherapy and counseling, and case management with an emphasis on resuming productive involvement in community life; and 4) Day Hospital PTSD Programs, which are “therapeutic

communities” similar to PRRPs where veterans can engage in counseling, social, recreational, and vocational activities several times a week but reside in the community in their usual residence or in a “residential” program elsewhere within the VHA facility.

Status at discharge documented the veteran’s reason for leaving the program as assessed by their primary treatment provider, which included: 1) a mutually agreed upon discharge plan between the staff and patient (successful program completion); 2) the veteran initiated choice to leave the program on his/her own; 3) veteran departed for reasons related to rule violations such as substance abuse or violent behavior; or 4) whether the veteran was deemed by staff to be too sick to continue in the program. Discharge status was further assessed by tracking each veteran’s disposition which included: 1) being sent to another institution/program for further treatment; 2) to his/her own residence; or 3) to share someone else’s residence in the community. Veterans were also asked about their expectations for employment post-discharge.

Several measures documented at admission and discharge represented program participation: LOS in the program, direct transfer into the program from the community (as contrasted to transfer from another program), level of reported commitment to the program (reflecting clinician judgment on a 0-4 scale at the time of discharge), and plans to participate in program “reunions” for post-discharge support.

Analyses

First, a bivariate correlation table was constructed to identify the associations between changes in alcohol and drug use status and individual sociodemographic characteristics, psychiatric diagnoses, clinical status variables, program characteristics, and discharge status indicators, controlling for potentially confounding baseline clinical status measures including

severity of alcohol and drug use, violent behavior, PTSD symptoms, and employment, using linear regression. Thus, bivariate relationships were assessed net of major baseline clinical status indicators. In addition, the association of change from baseline to follow-up on substance abuse measures was examined in relationship to change in other outcomes including PTSD symptoms, violent behavior, and days of employment. Based on the large number of statistical variables being assessed and the large sample size, a stringent alpha level of .001 was adopted to test for statistical significance.

Next, stepwise linear regression including all variables significant on bivariate analysis was used to determine which baseline variables were the strongest independent predictors of *changes* in alcohol and drug use severity, again controlling for baseline measures of alcohol and drug use and PTSD symptom severity. These analyses established a parsimonious set of independent baseline correlates of change in alcohol and drug use indicators net of baseline status on other clinical status measures.

Multivariate analysis was then conducted to examine the association of change in alcohol and drug use indicators with change in other clinical variables of interest (PTSD symptoms, violent behavior, and employment) net of baseline characteristics found to be significant in the previous analyses. Changes in days of employment, violence and two measures of PTSD were examined in a separate set of multivariate analysis in order to prevent these variables from confounding the analysis of the effect of baseline and treatment element predictors. Again because of the large sample size vastly enhancing statistical power, a standardized regression estimate of .02 was used as the threshold value for meaningful associations.

RESULTS

General characteristics of the sample

The sample consisted of 12,270 veterans with an average age of 50.2 years (SD= 8.7) (Table 1). A majority of the sample had an Alcohol Abuse/Dependence diagnosis (91%), followed by Drug Abuse/Dependence (60%) (51% had both alcohol and drug Abuse/Dependence), an Affective Disorder (33%), or an Anxiety Disorder diagnosis (14%) other than PTSD. On average, veterans in this sample had an average of 3.1 psychiatric co-morbid diagnoses (SD= 1.0), which included a diagnosis of PTSD. The average length of stay in these programs was 51.4 days (SD= 32.9 days).

Bivariate changes in ASI alcohol abuse and ASI drug abuse composite scores

At baseline, the mean ASI alcohol score was .22 (SD= .27) and the mean ASI drug score was .09 (SD= .12). The magnitude of the improvement in ASI alcohol abuse composite scores from baseline was small to moderate with an effect size (*ES*) of -.269. The magnitude of the improvement in ASI drug abuse composite scores from baseline was also small to moderate (*ES* = -.287). Bivariate correlation analysis identified several variables that were associated with change (improvement) in the ASI alcohol and ASI drug composite indices controlling for measures of baseline clinical status (Table 1). In these analyses, positive coefficients represent an association with increased substance abuse and a negative association with decreased substance use. Age ($t = -3.55$, $\beta = -.022$, $p < .001$) and being prescribed psychiatric medication in the past 30 days ($t = -3.79$, $\beta = -.023$, $p < .001$) were both associated with a significant, albeit small, decrease in ASI alcohol severity. Age was also associated with a significant decrease in ASI drug severity ($t = -4.48$, $\beta = -.026$, $p < .001$). However, a history of incarceration was associated with a relative increase in ASI drug severity ($t = 4.19$, $\beta = .025$, $p < .001$). Among the co-morbid psychiatric

diagnoses, drug abuse/dependence was associated with a significant relative reduction ($t = -5.83$, $\beta = -.037$, $p < .001$) in ASI alcohol severity whereas an alcohol abuse/dependence diagnosis was related to a significant relative increase ($t = 4.98$, $\beta = .032$, $p < .001$). Alcohol abuse/dependence was associated with a significant relative reduction ($t = -5.19$, $\beta = -.033$, $p < .001$) in ASI drug severity while a drug abuse/dependence diagnosis ($t = 10.42$, $\beta = .063$, $p < .001$) and total number of diagnoses ($t = 5.16$, $\beta = .030$, $p < .001$) were related to a significant increase in ASI drug severity. Length of stay in the program ($t = -4.86$, $\beta = -.029$, $p < .001$), direct transfer into the program from another program ($t = -4.23$, $\beta = -.027$, $p < .001$) were significantly associated with a reduction in ASI alcohol severity but not for ASI drug severity. Level of reported commitment to the program ($t = -5.23$, $\beta = -.031$, $p < .001$) and planned participation in reunions ($t = -8.09$, $\beta = -.048$, $p < .001$) were significantly associated with a reduction in ASI alcohol severity and a reduction in ASI drug severity ($t = -3.88$, $\beta = -.022$, $p < .001$) and ($t = -7.01$, $\beta = -.040$, $p < .001$), respectively.

In comparison to the veterans in the short-term EBTPUs (the reference condition), veterans in the SIPUs ($t = -3.91$, $\beta = -.031$, $p < .001$) and in PRRPs ($t = -3.57$, $\beta = -.032$, $p < .001$) demonstrated significant relative improvements in ASI alcohol severity in bivariate analysis. Similarly, veterans admitted to SIPUs ($t = -3.37$, $\beta = -.026$, $p < .001$) and PRRPs ($t = -3.89$, $\beta = -.034$, $p < .001$) demonstrated significant relative improvements in ASI drug severity. With regard to discharge status, only being transferred to another program was significantly associated with a reduction in ASI alcohol severity. In comparison to veterans who were discharged to another program or institution, veterans who were discharged to their own residence ($t = 5.95$, $\beta = .046$, $p < .001$) or to share someone else's residence ($t = 5.72$, $\beta = .042$, $p < .001$) showed significant relative increases in ASI alcohol severity, most likely because they had more opportunities for

substance use at those residences. Similarly, veterans who were discharged to someone else's residence showed significant increases ($t= 3.39$, $\beta = .024$, $p < .001$) in ASI drug severity, again potentially due to greater availability of drugs. Veterans who chose to leave the program without staff concurrence demonstrated significantly poorer ASI alcohol severity outcomes ($t= 3.53$, $\beta = .021$, $p < .001$) than veterans who had a mutually agreed upon a discharge plan with staff. Veterans who left the program for reasons associated with rule violations demonstrated significantly poorer ASI alcohol severity outcomes ($t= 6.07$, $\beta = .036$, $p < .001$) and poorer ASI drug severity outcomes ($t= 7.05$, $\beta = .040$, $p < .001$) than veterans who had a mutually agreed upon a discharge plan with staff. Plans for employment post-discharge were also associated with significant relative reductions in ASI alcohol severity ($t= -2.78$, $\beta = -.017$, $p < .001$).

There was a significant positive relationship between reduction in violence with ASI alcohol reduction ($t= 25.66$, $\beta = .199$, $p < .001$) and with ASI drug reduction ($t= 21.33$, $\beta = .161$, $p < .001$). The mean Short Mississippi PTSD score was 40.2 (SD= 5.6) and the changes revealed an overall moderate effect size ($ES = .46$). The Short Mississippi PTSD scores were significantly associated with ASI alcohol reduction ($t= 24.37$, $\beta = .142$, $p < .001$) and ASI drug reduction ($t= 17.95$, $\beta = .102$, $p < .001$). These findings mean that as alcohol and drug problems declined so did PTSD symptoms and violent behavior. There were no significant associations between ASI alcohol or drug severity with changes in days of employment.

Stepwise multiple linear regression analyses predicting ASI alcohol and drug composite score changes

The stepwise linear regression revealed several baseline variables that were significant independent predictors of ASI alcohol and drug change (Table 2). Being prescribed psychiatric

medication in the past 30 days was associated with small reductions in ASI alcohol severity scores from baseline. Planned participation in reunions and enrollment in either the SIPUs or PRRPs were associated with significant reductions in ASI alcohol and ASI drug severity scores from baseline. However, discharge associated with rule violations or discharge to one's own place or someone else's place were all associated with a significant relative increase in ASI alcohol and ASI drug severity scores from baseline. A history of incarceration was associated with a significant relative increase in ASI drug severity scores, but not ASI alcohol scores, from baseline. Further, a separate stepwise linear regression confirmed that reductions in alcohol and drug use were positively associated with reductions in violence and PTSD symptoms as measured by the Short Form of the Mississippi Scale for PTSD and these were the strongest observed associations.

DISCUSSION

This study of a large sample of veterans with severe PTSD requiring specialized intensive treatment, examined baseline and programmatic correlates of improvement in substance use and concurrent changes between substance use and in other important outcomes. Previous studies have demonstrated high rates of comorbidity between PTSD and substance use disorders (Terence M. Keane & Wolfe, 1990) and the additive negative effects of additional Axis I diagnoses on their psychopathology (Cacciola, Koppenhaver, Alterman, & McKay, 2009). These prior studies highlight the synergistic adverse relationship between trauma and substance use and the need for research to identify effective programs and/or related factors targeted to address this area of critical importance. In our multivariate analysis, several program participation indicators had significant, albeit small, associations with substance abuse outcomes. Treatment in longer term programs (PRRPs and SIPUs) with longer lengths of stay, being prescribed medication, and

planned participation in program reunions were associated with slightly improved alcohol outcomes. Similar results were found for illicit drug use measures with the exception that total number of diagnoses and prior history of incarceration were related to poorer outcomes. Although the effect sizes in our study were small to moderate, research shows that effect sizes observed in real word observational studies are generally smaller than those seen in highly controlled clinical studies, or observational studies in which the service providers are specifically trained in delivery of the intervention and monitored for treatment fidelity (Eftekhari et al., 2013; Karlin et al., 2010).

Examination of clinical correlates of substance use change showed far stronger associations such that as alcohol and drug composite scores improved, reductions were also observed in violent behavior and PTSD symptoms. Research has documented the symptom improvement in specialized intensive VHA programs for veterans with PTSD however, comparisons between the long term units and the short term units have yielded mixed results (Fontana & Rosenheck, 1997; Rosenheck, Fontana, & Errera, 1997). The findings from the current study are generally consistent with past research. This study revealed greater efficacy for the longer term PTSD programs than shorter term ones and an association of length of stay with reduced alcohol and drug use indicators on bivariate analysis, suggesting that length of stay may mediate the benefits of treatment in SIPUs and PRRPs. Prior studies comparing long term and short term residential treatment programs for dual diagnosis patients have also found that patients in long term programs had significantly better outcomes which included enhanced treatment engagement and maintained abstinence from substances (Brunette, Drake, Woods, & Hartnett, 2001). However, improvement may be more influenced by overall treatment duration and intensity as contrasted with specific length of stay in the residential component of treatment.

We do not have enough detail on services delivered in SIPUs and PR RTPs to determine whether the critical element is length of stay, concomitant treatment intensity, or specific treatment elements.

Our study also revealed that in comparison to those discharged based on a mutually agreed upon plan between staff and the patient, those discharged under less desirable circumstances had poorer substance use outcomes. It is unclear whether the availability of a well-worked out treatment plan in itself improves substance use outcomes, or whether this is a proxy for other critical factors such as the veteran's motivation to reduce their substance use, or previous degree of benefit from program participation up to the time of discharge. We also found that veterans discharged to another institution had better outcomes than veterans discharged to their own homes in the community or to someone else's residence. This finding allows a more straightforward interpretation as greater substance use among veterans discharged to community settings, as contrasted to institutions (institutions that are likely to have rules forbidding substance use and staff to supervise these rules, as well as a stronger patient-maintained culture of abstinence) may provide veterans with extra time to develop the skills and confidence necessary for prolonged sobriety (Brunette et al., 2001; Rosenheck & Fontana, 2001). This point cannot be understated because once patients leave a treatment program they will again have greater exposure to sources of alcohol and illicit substances as well as to peers who may encourage substance use.

This is the first study we know of that examined data from a large cohort of veterans in specialized intensive treatment programs over an extended period to identify baseline and program characteristics associated with improvement in substance abuse outcomes, employment, PTSD, and violent behavior. Our findings are consistent with existing literature documenting that

improvements in substance abuse are associated with reductions in PTSD symptoms (Fontana et al., 2012). The findings from this study also revealed that among veterans diagnosed with PTSD severe enough to warrant specialized intensive treatment, improvement in substance use was associated with reductions in violent behavior. These results are largely consistent with literature regarding the strong connection between substance use, PTSD, and the perpetration of violence (Barrett, Mills, & Teesson, 2011; Barrett, Teesson, & Mills, 2014). Our findings are also consistent with the more general association of violence with co-morbid substance use and mental illness, even among recently discharged inpatients (Steadman et al., 1998).

There are several limitations to this study that require comment. First, the current data is associational and based on a specialized group. Thus we cannot ascertain whether the PTSD preceded the substance use or vice versa. However, prior research suggests that traumatized individuals may turn to illicit substances in an attempt to self-medicate due to the calming effects of the substances (Jacobsen et al., 2001; P. Ouimette et al., 2010). Furthermore, studies have shown that traumatic symptoms are associated with subsequent risk for substance use (P. Ouimette et al., 2003; Read et al., 2012). Given the complex nature of the synergistic effects of trauma and substance use, studies stress the need for on-going research to examine the best interventions for dually-diagnosed PTSD patients (Hruska, Fallon, Spoonster, Sledjeski, & Delahanty, 2011). Another limitation is the lack of available information on the use of treatment elements such as the specific evidence-based psychotherapies that may have been offered and specific medications or medication classes that were prescribed. This limited our ability to identify specific interventions that may have been associated with increased clinical benefit. However, as noted in prior research studies of this type, VA administrative databases often do not provide specific details on the exact content of therapeutic sessions and applied interventions

and identification of specifically effective interventions should be the focus of future studies (P. Ouimette et al., 2003). Also, the design of this study made examining cohort effects difficult to evaluate. By examining the linear effect of the year, the data revealed that veterans experienced an overall slight improvement in outcomes over the years. However, the population changed over the years which can impact outcomes and treatment may have changed in the various programs over time and we do not have documentation how it changed from facility to facility over time. Furthermore, this was an observational study such that participants were not randomly assigned either to the various treatment programs or to receive specific treatments. Our findings are associational which limits casual inferences about the impact of specific treatment elements or programs. We attempted to address this limitation to the extent possible by adjusting our multivariate analyses to control for potentially confounding baseline factors.

Despite these limitations, the current study was based on data collected over many years from a comprehensive national set of VHA programs designed to treat the most seriously ill veterans with PTSD and co-morbid substance use disorders -- veterans who are in need of treatment in specialized intensive (mostly inpatient or residential) programs. We were able to identify some treatment elements associated with small, but significant, improvements in drug/alcohol use and important clinical correlates of improvement on measures of violence and PTSD symptoms.

This study thus confirms previous research (Fontana et al., 2012) emphasizing the importance and broad benefits of improving substance abuse outcomes among dually diagnosed veterans with PTSD and draws attention to the need to develop and disseminate more effective treatments for this population. While there have been extensive efforts in VHA to disseminate evidence-based treatments for PTSD in recent years (Eftekhari et al., 2013; Karlin et al., 2010)

there has been far less research on the use and dissemination of psychotherapies for co-morbid substance use disorders in PTSD. Treatments such as contingency management (Higgins, Silverman, & Heil, 2008), cognitive behavioral therapy (Beck, 1999; Wright, 2001), motivational interviewing (Martino, Carroll, Kostas, Perkins, & Rounsaville, 2002; Martino, Carroll, O'Malley, & Rounsaville, 2000) and computerized therapies for substance use disorders (Carroll et al., 2008) may all have a role in the treatment of substance use in dually diagnosed patients with PTSD in specialized intensive PTSD programs. Further studies of effective medications (Sofuoglu, Rosenheck, & Petrakis, 2014) and of combinations of medications and psychotherapies (Roman, Abraham, & Knudsen, 2011) are also needed. This study emphasizes the need for and potential benefits of research and dissemination efforts to provide more effective substance abuse treatments for this especially vulnerable population of veterans with specialized treatment needs.

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Table 1: Bivariate Correlations with ASI Alcohol and ASI Drug Change Net of Baseline Status on Alcohol, Drug, Violent Behavior, Mississippi Score, PTSD, and Year of Admission (N=12, 270)

Variable	%	M	SD	ASI Alcohol Standardized Estimate	ASI Alcohol <i>t</i>	ASI Drug Standardized Estimate	ASI Drug <i>t</i>
Socio-demographic Characteristics							
Age	--	50.2	8.7	-.022	-3.55*	-.026	-4.48*
Sexual Trauma During Military	4.6	--	--	.002	0.29	.016	2.68
Service Connected (PTSD)	43.3	--	--	.017	2.89	-.005	-0.82
Service Connected (Other Psychiatric)	0.5	--	--	.003	0.59	-.002	-0.33
Service Connected (Medical)	40.3	--	--	.007	1.15	-.001	-0.22
Service Connected (Any Diagnosis)	62.4	--	--	.014	2.35	-.000	-0.06
Incarceration History	63.0	--	--	.012	1.99	.025	4.19*
Prescribed Psychiatric Medication (last 30 days)	85.1	--	--	-.023	-3.79*	-.015	-2.65
Co-morbid Diagnosis							
Alcohol Abuse/Dependence	90.9	--	--	.032	4.98*	-.033	-5.19*
Drug Abuse/Dependence	59.5	--	--	-.037	-5.83*	.063	10.42*
Affective Disorder	33.1	--	--	-.018	-3.05	-.007	-1.31
Anxiety Disorder	13.6	--	--	.004	0.73	-.003	-0.59
Total Number of Diagnoses	3.1	1.0	--	-.002	-0.33	.030	5.16*
Program Characteristics							
Length of Stay in Program (Days)	--	51.4	32.9	-.029	-4.86*	-.011	-2.01
Direct Transfer	25.1	--	--	-.027	-4.23*	.004	0.73
Commitment	--	2.6	0.9	-.031	-5.23*	-.022	-3.88*
Reunions	66.6	--	--	-.048	-8.09*	-.040	-7.01*
Specialized Inpatient PTSD Units (SIPUs)*	22.3	--	--	-.031	-3.91*	-.026	-3.37*
PTSD Residential Rehabilitation Programs (PRRPs)*	54.3	--	--	-.032	-3.57*	-.034	-3.89*
Day Hospital*	7.6	--	--	.005	0.67	.007	1.05
Discharge Status							

Discharged to His/Her Own Residence ^b	67.0	--	--	.046	5.95*	.016	2.16
Discharged to Share Someone Else's Residence ^b	14.5	--	--	.042	5.72*	.024	3.39*
Transferred to Another Program ^c	5.1	--	--	-.021	-3.55*	-.016	-2.71
Chose to Leave Program ^c	4.8	--	--	.021	3.53*	.015	2.68
Left the Program (Related to Rule Violation) ^c	5.4	--	--	0.36	6.07*	.040	7.05*
Too Sick to Continue Program ^c	0.0	--	--	.014	2.45	.016	2.74
Plan for Employment Post-discharge	22.3	--	--	-.017	-2.78	-.017	3.11
Associated Changes							
ASIEMPLOYMENT CHANGE	--	0.0	0.2	-.015	-2.31	-.017	-2.56
VIOLENCE CHANGE	--	-0.7	1.5	.199	25.66*	.161	21.33*
MISS CHANGE	--	-2.6	7.1	.142	24.37*	.102	17.95*

*p < .001; ^aRepresents the program in which treatment was delivered and the reference group is Evaluation/Brief Treatment PTSD Units (EBTPUs); ^bReference group is discharged to another institution or program; ^cReference group is mutually agreed upon discharge plan between staff and patient (successful program completion).

Table 2: Stepwise regression model predicting ASI Alcohol and ASI Drug Change

Variable*	ASI Alcohol Standardized Estimate	ASI Alcohol <i>t</i>	ASI Drug Standardized Estimate	ASI Drug <i>t</i>
Prescribed Psychiatric Medication	-.024	-4.00	.026	4.32
Reunions	-.029	-4.53	-.024	-4.00
Specialized Inpatient PTSD Unit ^a	-.023	-2.72	-.025	-3.50
PTSD Residential Rehabilitation Program ^a	-.023	-2.35	-.041	-5.62
Discharged to His/Her Own Residence ^b	.043	5.28	.027	3.20
Discharged to Share Someone Else's Residence ^b	.037	4.97	.020	2.67
Left the Program (Related to Rule Violation) ^c	.028	4.48	.035	6.02
VIOLENCE_CHANGE (reduction) ^d	.126	14.85	.111	13.51
MISS_CHANGE (reduction) ^d	.127	19.13	.081	12.37

*These variables were the significant predictors of ASI alcohol change based on a standardized estimate cutoff of $\geq .02$ ($N = 12,270$); ^aRepresents the program in which treatment was delivered and the reference group is EBTPUs; ^bReference group is discharged to another institution or program; ^cReference group is mutually agreed upon discharge plan between staff and patient (successful completion); ^dRepresents a separate multivariate stepwise linear regression model which included these associated change variables to minimize the confounding effect on the model of baseline predictors.