



## Examining the role of social support in treatment for co-occurring substance use disorder and posttraumatic stress disorder

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### ABSTRACT

**Objective:** Social support may be a critical mechanism in the treatment of co-occurring substance use disorder (SUD) and posttraumatic stress disorder (PTSD). However, no studies have examined how social support changes as a function of treatment or predicts treatment outcome in a Veteran population with co-occurring SUD and PTSD.

**Method:** The current study is a secondary analysis that examined social support over the course of treatment for co-occurring SUD and PTSD (N = 81). Analyses were conducted to examine if a) social support predicts change in substance use and PTSD symptoms, respectively, over the course of treatment and during follow-up, and b) substance use and PTSD symptoms, respectively, predicts change in social support over treatment and during follow-up.

**Results:** The findings revealed that between-person social support moderated decreases in substance use ( $B = -0.17$ ,  $SE = 0.07$ ,  $p = 0.017$ ) and PTSD symptom severity ( $B = -0.12$ ,  $SE = 0.05$ ,  $p = 0.009$ ) during treatment but not during follow-up. Within-person substance use and PTSD symptom severity predicted social support but substance use and PTSD symptoms did not moderate changes in social support during treatment or follow-up.

**Conclusions:** The findings highlight the critical role of social support during treatment in enhancing outcomes for individuals with co-occurring SUD and PTSD.

### 1. Introduction

Posttraumatic stress disorder (PTSD) commonly co-occurs with substance use disorder (SUD) (Mills, Teesson, Ross, & Peters, 2006; Pietrzak, Goldstein, Southwick, & Grant, 2011). Recent efforts have focused on developing treatments to target this dual condition. Among these efforts are integrated trauma-focused therapies, such as Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure (COPE) (Back et al., 2014). COPE combines Relapse Prevention (RP) for SUD (Carroll, 1998) with Prolonged Exposure (PE) for PTSD (Foa, Hembree, Rothbaum, & Rauch, 2019). COPE yields significantly greater reductions in PTSD symptoms than comparison interventions, and tends to show similar reductions in substance use as compared to cognitive behavioral therapies for substance use (Back et al., 2019; Mills et al., 2012; Norman et al., 2019). Identifying moderators of treatment response to interventions for co-occurring SUD and PTSD may help further amplify treatment effects. Social support plays a

critical role in both SUD and PTSD and may boost treatment outcomes (e.g., Dobkin, Civita, Paraherakis, & Gill, 2002; Scoglio et al., 2020). Thus, the current study examined the effects of social support on SUD and PTSD treatment outcome among U.S. Military Veterans.

#### 1.1. PTSD and social support

Social support has been defined in the literature in various ways and often incorporates multiple dimensions. The current study uses a global measure of social support that encompasses tangible support (e.g., material aids), appraisal support (e.g., discussing one's problems with other people), self-esteem support (e.g., perceiving peers think highly of them), and belonging support (e.g., believing there are people with whom one can connect). A recent review of 26 studies examining social functioning among individuals with PTSD found that despite different measurements and definitions of social functioning across studies, individuals with PTSD tended to have poor social functioning (Scoglio

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et al., 2020). The review noted this pattern across sub-populations, including Veterans, survivors of interpersonal violence, and those with chronic PTSD. Veterans with PTSD tend to report more interpersonal difficulties in social relationships, less family cohesion, lower social support, and poorer social functioning than other treatment-seeking Veterans (Tsai, Harpaz-Rotem, Pietrzak, & Southwick, 2012).

There may be a couple of mechanisms by which social support is linked to PTSD. First, social causation theory posits that social support is an antecedent to well-being and thus lack of social support may exacerbate PTSD symptom severity over time because individuals do not have the social interactions to encourage exposure to avoided situations (Cohen & Wills, 1985; Kaniasty & Norris, 1993; Shallcross, Arbis, Polusny, Kramer, & Erbes, 2016). Social erosion theory suggests that PTSD symptoms, such as avoidance, feelings of detachment, and anger may reduce social support available to individuals with PTSD (Kaniasty & Norris, 2008; Shallcross et al., 2016). Studies are mixed in finding support for either theory, suggesting that the association between social support and PTSD is likely bidirectional (Shallcross et al., 2016; Wagner, Monson, & Hart, 2016).

Comparatively fewer studies have considered social support in the context of PTSD treatment. Some studies have found that greater baseline social support is associated with better PTSD treatment outcomes among individuals receiving PTSD treatment (Price, Gros, Strachan, Ruggiero, & Acierno, 2013; Thrasher, Power, Morant, Marks, & Dalgleish, 2010). A more recent study examined if changes in PTSD symptoms were moderated by changes in social support (Price et al., 2018). The authors found social support increased during treatment and mitigated changes in PTSD symptoms; however, changes in social support were not moderated by PTSD symptoms. Likewise, another study found increases in perceived social support preceded reductions in PTSD symptoms during PE, and changes in social support mediated PTSD symptom reductions (Bourassa et al., 2020). Thus, consistent with the social causation model (Cohen & Wills, 1985; Kaniasty & Norris, 1993; Shallcross et al., 2016), social support may be a mechanism for strengthening treatment response. Further, social support may buffer against some of the challenges that come with engaging in treatment for PTSD. Alternatively, other research has found evidence that PTSD treatment impacts social support or social functioning. Among women with chronic PTSD, PTSD treatment was associated with improvement in social functioning and accounted for 30% of the variance in improvement of social functioning (Rauch et al., 2009). Another study found that both a medication treatment (i.e., sertraline) and behavioral therapy (i.e., PE) for PTSD yielded improvements in receipt of social support and social functioning, though individuals who received the behavioral therapy noticed these improvements more quickly (Graham, Garcia, Bergman, Feeny, & Zoellner, 2020). Thus, PTSD treatment may enhance social support.

### 1.2. SUD and social support

Research examining the effects of social support on SUD is more mixed than the literature on social support and PTSD. Overall, research finds that positive social support reduces substance use. This may occur because individuals with SUD are spending time with non-substance using others or talking to others to manage distress instead of using. Among individuals in outpatient treatment for SUD, greater social support predicts greater treatment retention and reductions in alcohol use (Dobkin et al., 2002). Individuals in inpatient and outpatient settings frequently cite mutual support groups (e.g., Alcoholics Anonymous; AA) as a source of social support and means for building connection (Brooks, Magaña López, Ranucci, Krumlauf, & Wallen, 2017; Dekkers, Vos, & Vanderplasschen, 2020). Increased AA attendance is associated with abstinence at 3- and 15-month follow-up, and AA affiliated support predicts greater abstinence among men living in recovery houses (Humphreys, Blodgett, & Wagner, 2014; Stevens, Jason, Ram, & Light, 2015). In a study of 231 participants in an online SUD forum, receiving

emotional support was associated with less illicit drug use at 6- and 12-month follow-ups (Liu et al., 2020).

Close friends or family members can sometimes serve as a trigger for substance cravings and use, however. Family time and obligations, and interpersonal conflict with others are often associated with substance use or craving (Flanagan, Jarnecke, Leone, & Oesterle, 2020; Preston et al., 2018). Also, having social network members that use substances increase risk of substance use (Tracy et al., 2016). In a study examining the role of different forms of social support in treatment outcome, “negative support” (i.e., having substance users or individuals who encouraged substance use in the social network) was associated with more frequent substance use at 6-week, 6-month, and 12-month follow-ups (Buckman, Bates, & Morgenstern, 2008). Thus, the type and quality of social support one receives may be integral to consider for SUD outcomes. However, studies have not yet examined whether social support modulates SUD treatment outcomes or if SUD symptoms moderate changes in social support during treatment.

### 1.3. Co-occurring SUD and PTSD and social support

Individuals with co-occurring SUD and PTSD tend to report lower family support and greater apprehension about being close with others (Dutton, Adams, Bujarski, Badour, & Feldner, 2014). Some research has started to examine the links underlying the association between co-occurring SUD and PTSD and social support. For instance, in a study of undergraduate students (N = 101), relationship quality with an intimate partner buffered the association between alcohol use and PTSD symptoms (Paltell et al., 2020). Another study of undergraduate women who survived sexual assault (N = 147) found that when substances were used to cope, the association between social support and PTSD symptoms weakened (Dworkin, Ojalehto, Bedard-Gilligan, Cadigan, & Kaysen, 2018). Among women in treatment for SUD, those with comorbid psychiatric disorders and greater trauma symptoms reported lower quality of life; however, greater social support for abstinence predicted better quality of life, suggesting social support may enhance recovery even when trauma symptoms are present (Brown, Jun, Min, & Tracy, 2013). In a previous analysis using the data used in the current study, greater baseline post-deployment social support was associated with greater baseline alcohol use and lower baseline PTSD symptoms among Veterans, while accounting for symptoms of the other disorder (Gros et al., 2016). These results run somewhat counter to what other literature has shown, suggesting the associations between social support and co-occurring SUD and PTSD may be complex and dependent on factors such as Veteran status, age, and/or the measure of social support used.

### 1.4. Current study

No studies to date have examined how social support predicts or changes as a function of SUD and PTSD symptoms over the course of treatment and follow-up in a dually diagnosed sample. Thus, the current study examined the associations between social support, substance use (alcohol and drug use), and PTSD symptoms throughout treatment and follow-up among Veterans with co-occurring SUD and PTSD. By examining both SUD and PTSD outcomes in a dually diagnosed sample, the current study will expand on the work of Price and colleagues (2018), who found that, aligned with the social causation theory, social support moderated changes in PTSD symptoms during treatment but PTSD symptoms did not moderate changes in social support. Consistent with Price and colleagues' (2018) findings, it was hypothesized that social support would moderate changes in substance use and PTSD symptoms over treatment, but substance use and PTSD symptoms would not moderate changes in social support over treatment or during follow-up. Even though we expected that social support would modulate changes in both substance use and PTSD treatment outcomes but not vice versa, we tested both models to extend this work to SUD treatment outcomes in a novel sample.

## 2. Material and methods

### 2.1. Participants

The data for this secondary analysis was obtained from a larger randomized controlled trial examining the efficacy of COPE (Back et al., 2019). Participants (N = 81) were treatment-seeking, U.S. Military Veterans, ages 18–65 years old who 1) met DSM-IV diagnostic criteria for current alcohol use disorder and/or SUD on the MINI International Neuropsychiatric Interview (Sheehan et al., 1998) and endorsed alcohol or drug use in the past 90 days, and 2) met DSM-IV diagnostic criteria for current PTSD and scored  $\geq 50$  on the DSM-IV Clinician Administered PTSD Scale (CAPS; Blake et al., 1995). The average age of participants was 40.4 years old ( $SD = 10.73$ ); the majority of participants identified as male (90.1%) and white (60.5%) or Black (37.0%) (see Table 1).

### 2.2. Measures

#### 2.2.1. PTSD symptoms

PTSD symptom severity was assessed with the CAPS, a semi-structured interview for PTSD (Blake et al., 1995). The Life Events Checklist (Gray, Litz, Hsu, & Lombardo, 2004) was used to assess lifetime exposure to traumatic events, identify a Criterion A trauma event for all participants, and was used in the CAPS interview. Symptom severity scores on the CAPS for DSM-IV range from 0 to 136 ( $\alpha = 0.85$ ). This interview was administered at baseline, 6 weeks, 12 weeks, and at follow-ups. In the current analysis, this interview was examined at baseline, end-of-treatment (session 12), and at 3- and 6-month follow-ups.

#### 2.2.2. Substance use

Substance use was assessed using the Timeline Follow-back (TLFB; Sobell & Sobell, 1992). The TLFB is a calendar-based instrument used to measure substance use quantity and frequency. This measure was administered at baseline, weekly during treatment, and at follow-up assessments. For the current study, percent days used (PDU) of any substance (e.g., alcohol, marijuana, cocaine) was examined at baseline,

**Table 1**

Clinical and demographic characteristics of the sample (N = 81).

Characteristic	M (SD) or N (%)
Condition	
COPE	54.00 (66.7%)
RP	27.00 (33.3%)
Number of sessions completed	8.36 (4.45)
Age	40.40 (10.73)
Gender	
Male	73.00 (90.1%)
Female	8.00 (9.9%)
Race	
White/Caucasian	49.00 (60.5%)
Black/African-American	30.00 (37.0%)
More than one race, or other racial identity	2.00 (2.5%)
Baseline PTSD Symptom Severity (CAPS)	79.81 (18.22)
End-of-treatment PTSD Symptom Severity (CAPS)	34.34 (23.67)
3-mo Follow-up PTSD Symptom Severity (CAPS)	45.27 (24.77)
6-mo Follow-up PTSD Symptom Severity (CAPS)	50.14 (24.26)
Baseline Substance Use (PDU; TLFB)	48.00 (35.15)
End-of-treatment Substance Use (PDU; TLFB)	22.43 (30.48)
3-mo Follow-up Substance Use (PDU; TLFB)	23.79 (25.80)
6-mo Follow-up Substance Use (PDU; TLFB)	30.03 (31.81)
Baseline Social Support (ISEL)	62.93 (22.15)
End-of-treatment Social Support (ISEL)	69.16 (22.67)
3-mo Follow-up Social Support (ISEL)	68.29 (25.21)
6-mo Follow-up Social Support (ISEL)	64.72 (23.53)

Note. COPE = Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure; RP = Relapse prevention; PTSD = posttraumatic stress disorder; CAPS = Clinician Administered PTSD Scale; PDU = percent days used; TLFB = Timeline Followback; ISEL = International Support Evaluation List.

end-of-treatment, and 3- and 6-month follow-ups.

#### 2.2.3. Social support

Social support was assessed using the International Support Evaluation List, General Population (ISEL-40 v. GP), a scale composed of 40 statements concerning perceived availability of potential social resources (Cohen & Hoberman, 1983). Items assessed four dimensions of social support (i.e., tangible, appraisal, self-esteem, belonging support) and were rated on a 4-point scale from “definitely false” to “definitely true.” Items were summed to yield a measure of global support ( $\alpha = 0.94$ ). Higher scores reflect greater social support. This instrument was collected and examined at baseline, end-of-treatment, and 3- and 6-month follow-ups.

### 2.3. Procedures

All study procedures were approved by the Medical University of South Carolina’s Institutional Review Board (IRB). A detailed description of study procedures can be found elsewhere (Back et al., 2019). Following informed consent, participants completed baseline assessments, including a clinical interview and self-report measures. Eligible participants were randomized (2:1) to receive 12 individual, 90-min sessions of COPE or RP. In both conditions, abstinence was encouraged but not required. Follow-up assessments were conducted at 3- and 6-months.

### 2.4. Data analysis

Given that analyses were conducted on secondary data, a power analysis was not conducted; rather, recommended procedures for reporting statistics were used (Dziak, Dierker, & Abar, 2020). All analyses were conducted in SPSS v. 25 (IBM, 2017) on the full, randomized intent-to-treat sample. Because the treatment and follow-up phases of the study represent distinct periods, piecewise linear mixed effects models were used to allow slopes to differ for the treatment phase and follow-up phase. That is, models contained a slope representing change from baseline to end-of-treatment and a slope representing change from end-of-treatment to 6-month follow-up. The intercept represented end-of-treatment. Time was scaled in months (-3 = baseline, 0 = end of treatment, 3 = 3-month follow-up, and 6 = 6-month follow-up).

Mixed models account for missing data and use the full data available using maximum likelihood procedures. Assessment timepoints were nested within individual participants. To disaggregate within-person and between person effects (Curran & Bauer, 2011; Wang & Maxwell, 2015), participants’ aggregate scores on the predictor variable (e.g., social support) was grand mean centered and included in the model at level 2 to estimate between-person effects. This provides an estimate of how an individual’s level of social support is associated with the outcome variable. A time-varying social support variable was group mean centered and included at level 1 to estimate within-person effects. This provides an estimate of how an individual’s deviations from their average level of social support are associated with the outcome variable.

Models accounted for condition (RP = -1; COPE = 1), specified as a categorical variable. In the first set of models, within-person and between-person social support were entered as predictors of substance use and PTSD symptom severity, respectively. Next, interaction terms were added to the models to assess the effects of condition and within-person and between-person social support on change in outcomes during 1) the treatment phase and 2) the follow-up phase. Unstructured covariance matrices were specified in all models. Intercepts and the slope variance for the level 1 predictor variable were allowed to vary in all models, except models predicting substance use (these models did not converge when the level 1 predictor variable was included as a random effect so only intercepts were allowed to vary and an identity covariance matrix was specified). Next, substance use and PTSD symptom severity, respectively, were entered as predictor variables, estimating social

support. These models were specified in the same manner as those described above.

Additional interaction terms of condition by predictor variable by each slope were initially included in the models but were not significant and subsequently removed to increase parsimony. Given social support and collective care practices may differ by ethno-racial group, race was tested as a covariate but was not statistically significant in any model and thus removed. Likewise, number of treatment sessions completed was also considered as a potential covariate but it was not significant and not retained.

### 3. Results

#### 3.1. Descriptive Statistics

Demographic and clinical characteristics for the sample are presented in Table 1. On average, participants completed 8.36 sessions of treatment (*SD* = 4.45). Examining means of clinical characteristics,

average substance use and PTSD symptom severity appeared to decrease from baseline to end-of-treatment then increased somewhat during follow-up. Average social support increased from baseline to end-of-treatment and decreased from end-of-treatment through follow-up.

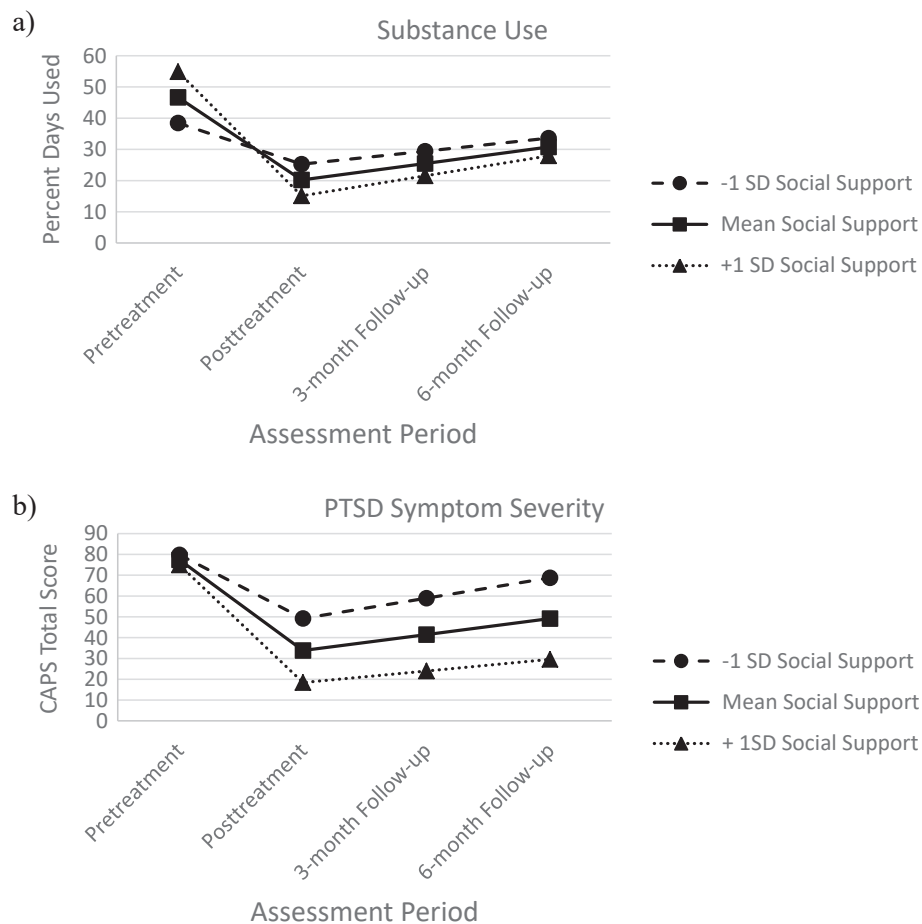
#### 3.2. Social support predicting substance use and PTSD symptom severity

Results from the models examining social support predicting substance use and PTSD symptom severity are presented in Table 2. Results from the main effects model with substance use as the outcome suggest that the effect of within-person social support on substance use approached significance. When interaction terms were added to the model, this main effect no longer trended toward significance; a significant effect of between-person social support on the treatment phase slope emerged. This suggests that individuals with higher levels of social support reported greater decreases in substance use over the course of treatment than individuals with lower social support (see Fig. 1a). No other main or interaction effects were found.

**Table 2**  
Results from piecewise models predicting substance use and PTSD symptom severity.

Main Effects Models	Substance Use						PTSD Symptom Severity					
	B	SE	t or Wald Z	p-value	95% CI		B	SE	t or Wald Z	p-value	95% CI	
					Lower	Upper					Lower	Upper
<b>Fixed Effects</b>												
Intercept	<b>20.98</b>	<b>4.90</b>	<b>4.28</b>	<b>0.000</b>	<b>11.29</b>	<b>30.67</b>	<b>35.29</b>	<b>3.04</b>	<b>11.62</b>	<b>0.000</b>	<b>29.29</b>	<b>41.29</b>
Treatment Phase Slope	<b>-8.49</b>	<b>1.51</b>	<b>-5.63</b>	<b>0.000</b>	<b>-11.48</b>	<b>-5.51</b>	<b>-13.35</b>	<b>1.08</b>	<b>-12.36</b>	<b>0.000</b>	<b>-15.49</b>	<b>-11.22</b>
Follow-up Slope	<b>9.62</b>	<b>2.18</b>	<b>4.42</b>	<b>0.000</b>	<b>5.31</b>	<b>13.94</b>	<b>15.42</b>	<b>1.58</b>	<b>9.79</b>	<b>0.000</b>	<b>12.31</b>	<b>18.54</b>
Condition	-3.38	6.60	0.51	0.610	-9.78	16.54	-10.63	3.66	2.91	0.005	3.33	17.93
Within Person Social Support	-0.27	0.14	-1.94	0.055	-0.54	0.01	-0.42	0.12	-3.68	0.001	-0.66	-0.18
Between Person Social Support	0.26	0.16	1.66	0.102	-0.05	0.57	-0.31	0.09	-3.49	0.001	-0.48	-0.13
<b>Random Effects</b>												
Intercept Variance	<b>486.31</b>	<b>131.34</b>	<b>3.70</b>	<b>0.000</b>	<b>286.43</b>	<b>825.67</b>	<b>100.00</b>	<b>40.78</b>	<b>2.45</b>	<b>0.014</b>	<b>44.96</b>	<b>222.40</b>
Slope Variance for Within Person Social Support	-	-	-	-	-	-	0.06	0.09	0.61	0.544	0.00	1.43
Intercept - Slope Covariance	-	-	-	-	-	-	-0.98	1.56	-0.63	0.527	-4.03	2.06
Residual Variance	<b>525.95</b>	<b>73.91</b>	<b>7.12</b>	<b>0.000</b>	<b>399.32</b>	<b>692.73</b>	<b>281.11</b>	<b>41.59</b>	<b>6.76</b>	<b>0.000</b>	<b>210.35</b>	<b>375.66</b>
<b>Fit Statistics</b>												
-2LL	1754.15	-	-	-	-	-	1625.10	-	-	-	-	-
AIC	1758.15	-	-	-	-	-	1633.10	-	-	-	-	-
BIC	1764.53	-	-	-	-	-	1645.89	-	-	-	-	-
Interaction Effects Models	B	SE	t or Wald Z	p-value	95% CI		B	SE	t or Wald Z	p-value	95% CI	
					Lower	Upper					Lower	Upper
<b>Fixed Effects</b>												
Intercept	<b>20.19</b>	<b>5.41</b>	<b>3.73</b>	<b>0.000</b>	<b>9.50</b>	<b>30.87</b>	<b>33.80</b>	<b>3.39</b>	<b>9.97</b>	<b>0.000</b>	<b>27.11</b>	<b>40.49</b>
Treatment Phase Slope	<b>-8.82</b>	<b>1.83</b>	<b>-4.82</b>	<b>0.000</b>	<b>-12.45</b>	<b>-5.20</b>	<b>-14.52</b>	<b>1.26</b>	<b>-11.52</b>	<b>0.000</b>	<b>-17.02</b>	<b>-12.03</b>
Follow-up Slope	<b>10.58</b>	<b>2.69</b>	<b>3.93</b>	<b>0.000</b>	<b>5.24</b>	<b>15.91</b>	<b>17.08</b>	<b>1.86</b>	<b>9.18</b>	<b>0.000</b>	<b>13.40</b>	<b>20.77</b>
Condition	-7.30	9.41	0.78	0.439	-11.29	25.89	-16.78	5.89	2.85	0.005	5.14	28.42
Treatment Phase Slope × Condition	-1.16	3.17	0.36	0.716	-5.13	7.44	-3.12	2.20	1.42	0.158	-1.23	7.47
Follow-up Slope × Condition	3.15	4.60	-0.69	0.495	-12.26	5.96	4.67	3.19	-1.46	0.146	-10.98	1.65
Within Person Social Support	-0.36	0.31	-1.19	0.237	-0.97	0.24	-0.51	0.21	-2.40	0.018	-0.94	-0.09
Treatment Phase Slope × Within Person Social Support	-0.08	0.14	-0.54	0.592	-0.36	0.20	-0.17	0.10	-1.76	0.080	-0.36	0.02
Follow-up Slope × Within Person Social Support	0.11	0.20	0.53	0.598	-0.29	0.51	0.13	0.14	0.98	0.328	-0.14	0.41
Between Person Social Support	-0.03	0.23	-0.15	0.884	-0.49	0.42	-0.45	0.14	-3.13	0.002	-0.73	-0.17
Treatment Phase Slope × Between Person Social Support	<b>-0.17</b>	<b>0.08</b>	<b>-2.15</b>	<b>0.034</b>	<b>-0.32</b>	<b>-0.01</b>	<b>-0.11</b>	<b>0.05</b>	<b>-2.13</b>	<b>0.035</b>	<b>-0.22</b>	<b>-0.01</b>
Follow-up Slope × Between Person Social Support	0.17	0.12	1.49	0.139	-0.06	0.40	0.10	0.08	1.27	0.208	-0.06	0.26
<b>Random Effects</b>												
Intercept Variance	<b>491.73</b>	<b>132.65</b>	<b>3.71</b>	<b>0.000</b>	<b>289.81</b>	<b>834.34</b>	<b>118.41</b>	<b>43.37</b>	<b>2.73</b>	<b>0.006</b>	<b>57.76</b>	<b>242.75</b>
Slope Variance for Within Person Social Support	-	-	-	-	-	-	0.05	0.10	0.48	0.634	0.00	2.84
Intercept - Slope Covariance	-	-	-	-	-	-	-0.24	1.68	-0.14	0.888	-3.54	3.06
Residual Variance	<b>519.67</b>	<b>74.98</b>	<b>6.93</b>	<b>0.000</b>	<b>391.66</b>	<b>689.52</b>	<b>252.91</b>	<b>40.28</b>	<b>6.28</b>	<b>0.000</b>	<b>185.10</b>	<b>345.55</b>
<b>Fit Statistics</b>												
-2LL	1753.18	-	-	-	-	-	1620.01	-	-	-	-	-
AIC	1757.18	-	-	-	-	-	1628.01	-	-	-	-	-
BIC	1763.49	-	-	-	-	-	1640.67	-	-	-	-	-

Note. PTSD = posttraumatic stress disorder. *p* < 0.05 is considered statistically significant. Significant effects are in bold.



**Fig. 1.** Note. a) Estimated change in substance use across treatment phase and follow-up by social support, averaged over condition. b) Estimated change in PTSD symptom severity across treatment phase and follow-up by social support, averaged over condition. Values are plotted at mean level of social support and at  $\pm 1$  standard deviation (SD) of social support.

In the main effects model examining social support on PTSD symptom severity, there was a significant main effect of condition on PTSD symptom severity, such that individuals in the COPE condition had lower PTSD symptom severity. There were also a significant negative effects of within-person social support and between-person social support on PTSD symptom severity. Thus, when individuals reported greater than average social support their PTSD symptom severity was lower; likewise, individuals who had greater social support than others had lower PTSD symptom severity. When interaction terms were included in the model, the main effects persisted and a significant interaction of between-person social support and treatment phase slope emerged. This suggests that individuals with greater social support saw greater decreases in PTSD symptom severity over the course of treatment than individuals with lower social support (see Fig. 1b). No other main or moderating effects were found in this model.

### 3.3. Substance use and PTSD symptom severity predicting social support

Results from the models examining substance use and PTSD symptom severity as the predictors of social support are presented in Table 3. In the main effects model examining substance use as a predictor, a significant effect of within-person substance use on social support emerged. This effect suggests that when individuals had greater than average substance use they reported lower social support. When interaction terms were added to the model, this main effect persisted and no interaction terms were statistically significant. In the main effects model examining PTSD symptom severity as a predictor, significant main effects of within-person and between-person PTSD symptoms emerged. That is,

on days in which individuals reported greater PTSD symptoms their social support was lower greater and individuals with greater PTSD symptom severity had lower social support than individuals with less severe PTSD symptoms. When interaction terms were included in the model, the main effect of within-person PTSD symptom severity on social support persisted but the main effect of between-person PTSD symptoms did not reach statistical significance. No interaction terms included in the model were statistically significant. Altogether, these models suggest that substance use and PTSD symptom severity did not predict changes in social support as a function of treatment or follow-up.

## 4. Discussion

Few studies have examined social support among individuals with co-occurring SUD and PTSD (Brown et al., 2013; Dworkin, Ojalehto, et al., 2018; Gros et al., 2016), and no studies have looked at the role of social support during active treatment and follow-up for this dual condition. This is the first study to examine the effect of social support on two treatment outcomes—substance use and PTSD symptom severity—among individuals with co-occurring SUD and PTSD. The results both add to and extend the earlier findings of Price et al. (2018), who examined social support during PE among patients with PTSD. The present findings revealed that, while controlling for the type of treatment, within- and between-person social support had main effects on PTSD symptom severity. Further, between-person social support moderated change in substance use and PTSD symptom severity during the treatment phase of the study. This moderation was not found in follow-up, and the reverse relationship—where substance use and PTSD

**Table 3**  
Results from piecewise models predicting social support.

Substance Use							PTSD Symptom Severity					
	Main Effects Models		t or Wald Z	p-value	95% CI				t or Wald Z	p-value	95% CI	
	B	SE			Lower	Upper	B	SE			Lower	Upper
<b>Fixed Effects</b>												
Intercept	<b>68.05</b>	<b>3.60</b>	<b>18.91</b>	<b>0.000</b>	<b>60.94</b>	<b>75.17</b>	<b>59.09</b>	<b>3.86</b>	<b>15.30</b>	<b>0.000</b>	<b>51.46</b>	<b>66.72</b>
Treatment Phase Slope	1.06	1.15	0.92	0.357	-1.21	3.33	-2.61	1.36	-1.92	0.058	-5.30	0.09
Follow-up Slope	-1.24	1.60	-0.77	0.442	-4.41	1.94	3.22	1.79	1.80	0.074	-0.32	6.76
Condition	1.35	4.72	-0.29	0.776	-10.74	8.05	-2.71	4.69	0.58	0.565	-6.63	12.05
Within Person Predictor	<b>-0.15</b>	<b>0.07</b>	<b>-2.28</b>	<b>0.043</b>	<b>-0.30</b>	<b>-0.01</b>	<b>-0.35</b>	<b>0.08</b>	<b>-4.09</b>	<b>0.000</b>	<b>-0.52</b>	<b>-0.18</b>
Between Person Predictor	0.13	0.08	1.70	0.092	-0.02	0.28	<b>-0.35</b>	<b>0.10</b>	<b>-3.41</b>	<b>0.001</b>	<b>-0.55</b>	<b>-0.15</b>
<b>Random Effects</b>												
Intercept Variance	<b>260.88</b>	<b>64.11</b>	<b>4.07</b>	<b>0.000</b>	<b>161.16</b>	<b>422.30</b>	<b>254.48</b>	<b>60.66</b>	<b>4.20</b>	<b>0.000</b>	<b>159.50</b>	<b>406.02</b>
Slope Variance for Within Person Predictor	0.01	0.04	0.15	0.879	0.00	2171.57	0.04	0.04	1.01	0.311	0.01	0.26
Intercept - Slope Covariance	-0.75	1.17	-0.64	0.520	-3.04	1.53	0.31	1.12	0.27	0.784	-1.89	2.51
Residual Variance	<b>247.09</b>	<b>40.59</b>	<b>6.09</b>	<b>0.000</b>	<b>179.07</b>	<b>340.94</b>	<b>205.53</b>	<b>33.78</b>	<b>6.08</b>	<b>0.000</b>	<b>148.93</b>	<b>283.64</b>
<b>Fit Statistics</b>												
-2LL	1628.19	-	-	-	-	-	1629.23	-	-	-	-	-
AIC	1636.19	-	-	-	-	-	1637.23	-	-	-	-	-
BIC	1648.94	-	-	-	-	-	1654.02	-	-	-	-	-
<b>Interaction Effects Models</b>												
	B	SE	t or Wald Z	p-value	95% CI		B	SE	t or Wald Z	p-value	95% CI	
					Lower	Upper					Lower	Upper
<b>Fixed Effects</b>												
Intercept	<b>66.35</b>	<b>4.35</b>	<b>15.26</b>	<b>0.000</b>	<b>57.74</b>	<b>74.95</b>	<b>58.32</b>	<b>5.53</b>	<b>10.55</b>	<b>0.000</b>	<b>47.40</b>	<b>69.25</b>
Treatment Phase Slope	0.67	1.51	0.45	0.656	-2.32	3.67	-1.86	2.00	-0.93	0.355	-5.82	2.10
Follow-up Slope	-0.91	2.18	-0.42	0.676	-5.24	3.41	2.14	2.86	0.75	0.456	-3.52	7.80
Condition	1.35	6.83	-0.20	0.843	-14.85	12.14	-4.44	7.06	0.63	0.531	-9.55	18.42
Treatment Phase Slope × Condition	-0.84	2.29	0.37	0.714	-3.69	5.37	-1.46	2.36	0.62	0.537	-3.21	6.12
Follow-up Slope × Condition	-0.10	3.26	0.03	0.975	-6.35	6.56	1.17	3.37	-0.35	0.729	-7.85	5.51
Within Person Predictor	<b>-0.31</b>	<b>0.14</b>	<b>-2.14</b>	<b>0.042</b>	<b>-0.60</b>	<b>-0.01</b>	<b>-0.35</b>	<b>0.18</b>	<b>-1.98</b>	<b>0.050</b>	<b>-0.71</b>	<b>0.00</b>
Treatment Phase Slope × Within Person Predictor	-0.10	0.06	-1.61	0.115	-0.23	0.03	-0.09	0.09	-1.08	0.281	-0.26	0.08
Follow-up Slope × Within Person Predictor	0.08	0.09	0.95	0.347	-0.09	0.26	0.06	0.12	0.48	0.629	-0.18	0.29
Between Person Predictor	0.04	0.13	0.31	0.753	-0.22	0.30	-0.36	0.20	-1.80	0.075	-0.76	0.04
Treatment Phase Slope × Between Person Predictor	-0.03	0.04	-0.69	0.489	-0.12	0.06	-0.05	0.07	-0.68	0.497	-0.19	0.09
Follow-up Slope × Between Person Predictor	0.07	0.07	1.06	0.292	-0.06	0.20	0.04	0.10	0.41	0.685	-0.16	0.24
<b>Random Effects</b>												
Intercept Variance	<b>250.94</b>	<b>63.18</b>	<b>3.97</b>	<b>0.000</b>	<b>153.20</b>	<b>411.03</b>	<b>249.14</b>	<b>61.44</b>	<b>4.05</b>	<b>0.000</b>	<b>153.65</b>	<b>403.98</b>
Slope Variance for Within Person Predictor	0.03	0.04	0.61	0.540	0.00	0.63	0.04	0.04	1.06	0.287	0.01	0.27
Intercept - Slope Covariance	-1.80	1.36	-1.32	0.187	-4.47	0.87	-0.27	1.21	-0.23	0.820	-2.64	2.09
Residual Variance	<b>245.74</b>	<b>40.44</b>	<b>6.08</b>	<b>0.000</b>	<b>177.99</b>	<b>339.28</b>	<b>208.07</b>	<b>35.76</b>	<b>5.82</b>	<b>0.000</b>	<b>148.56</b>	<b>291.42</b>
<b>Fit Statistics</b>												
-2LL	1635.36	-	-	-	-	-	1635.41	-	-	-	-	-
AIC	1643.36	-	-	-	-	-	1643.41	-	-	-	-	-
BIC	1655.97	-	-	-	-	-	1656.07	-	-	-	-	-

Note. PTSD = posttraumatic stress disorder.  $p < 0.05$  is considered statistically significant. Significant effects are in bold.

symptoms moderated social support—was not supported. Accounting for condition, participants who reported greater levels of social support showed *greater* reductions in substance use and PTSD symptom severity during treatment compared to those reporting lower levels of support. Social support may be crucial across treatment modalities, leveraging greater reductions in substance use and PTSD symptom severity.

The current findings are consistent with the PTSD literature showing that greater social support is predictive of less severe PTSD and greater reductions in symptoms throughout treatment (Bourassa et al., 2020; Price et al., 2018). Social support mitigates the development and severity of PTSD as well as enhances treatment outcomes and therapeutic alliance (Campbell & Renshaw, 2018; Dworkin, Ullman, Stapenbeck, Brill, & Kaysen, 2018; Gros et al., 2016; Price et al., 2013). The finding that not only are differences in between-person social support associated with PTSD symptom severity but that within-person social support is as well suggests that individuals with greater social support are likely to have less severe PTSD and individuals' fluctuations in perceived social support is key in predicting their level of PTSD

symptom severity. However, only between-person social support moderated the treatment phase slope. Thus, examining differences between individuals in social support may be key to predicting changes in PTSD treatment outcome.

The current study extends the literature by showing that between-person social support is also associated with greater decreases in substance use over the course of treatment. There was a trend of the main effect of within-person social support on substance use but was this effect was not significant when the interaction terms were added to the model. Other research has found that certain social relationships and forms of support, such as abstinent social network members and individuals who provide support for not using, have been identified as reducing substance use and enhancing SUD recovery outcomes (Liu et al., 2020; Pettersen et al., 2019; Stevens et al., 2015). Our finding that individuals with greater social support showed greater reductions in substance use during treatment aligns with the social causation theory, suggesting social support is an antecedent to well-being (Cohen & Wills, 1985; Kaniasty & Norris, 1993; Shallcross et al., 2016). Strong social

support may be a helpful precursor to treatment for dually diagnosed individuals.

Although the current study did not find that substance use or PTSD symptom severity moderated changes in social support as a function of treatment or follow-up, within-person variability on these constructs predicted level of social support. That is, when individuals had greater than their average levels of substance use or PTSD symptom severity, they reported lower social support. Thus, it may be important for clinicians to attend to how clinical symptoms impact individuals' ability to attend to, seek, or receive social support from others.

Because enhanced social support is associated with SUD and PTSD outcomes, it may be beneficial for clinicians to incorporate social opportunities into treatment for individuals with co-occurring SUD and PTSD. Such opportunities could include home practice activities that involve social interaction which may improve interpersonal functioning (King, Taft, King, Hammond, & Stone, 2006). For example, components of RP include calling a loved one and generating a list of support people that can be available in times of crisis. For COPE, a support system is encouraged from the start (e.g., sharing the treatment rationale and common reactions to trauma with close others). Other ways to boost social support during treatment might include having a clinician accompany the patient during a particularly challenging in vivo exercise (Gloster et al., 2011), recruiting the support of family and friends in completing therapy homework, encouraging patients to engage in social activities during in vivo exposures, encouraging participation in mutual support groups, and inviting a loved one to a therapy session to better understand treatment. Additionally, encouraging couples and family-based therapies may boost perceived social support while targeting SUD and PTSD symptoms (e.g., Shnaider, Sijercic, Wanklyn, Suvak, & Monson, 2017; Wanklyn, Brankley, Laurence, Monson, & Schumm, 2017).

Although between-person social support moderated changes in substance use and PTSD symptom severity during the treatment phase, it had no significant effect during the follow-up phase. Social support decreased somewhat while substance use and PTSD symptom severity increased during follow-up (though not significantly). This may be because the therapist acted as a support person during the treatment or because the therapies incorporated skills and activities that increased social interaction or social support (e.g., calling a friend when experiencing a craving, in vivo exposures that involved going into social settings). Perhaps these types of activities were not continued after treatment completion. It may be crucial for clinicians to plan with patients how support systems can be cultivated and sustained following treatment to preserve treatment gains. Additionally, occasional "booster" sessions following a full course of manualized psychotherapy may maintain perceptions of elevated social support and keep SUD and PTSD symptoms in remission.

Although race was not a significant covariate in these models, the role of social support and community may differ across ethno-racial groups and have differential impacts for seeking and engaging in treatment. For instance, individuals who identify as Black, Indigenous, or People of Color (BIPOC) tend to value interconnectedness (Constantine, Gainor, Ahluwalia, & Berkel, 2003; Odafe, Salami, & Walker, 2017). Special consideration of social support systems may include family members, friends, coworkers, counselors, religious leaders, church and other community members (Hall, 2007; Pittman, Quayson, Rush, & Minges, 2019; Ruglass & Yali, 2019). Examining the role of social support in the treatment of co-occurring SUD and PTSD by racial and cultural identity is an important area for future research.

There are several limitations to the current study. The sample size consisted of primarily male Veterans who identified as white or Black. Given the small number of women in the sample, the current study was not powered to examine effects of sex. Male Veterans, in particular, may endorse more masculine norms and struggle to form meaningful social supports; thus, results may look different in other samples with co-occurring SUD and PTSD (Neilson, Singh, Harper, & Teng, 2020).

Future research is needed to examine how social support impacts treatment for co-occurring SUD and PTSD in larger and more diverse samples. Data collection for this study began in 2011; thus, DSM-IV criteria were used to diagnose SUD and PTSD. Results will need to be replicated with consideration to DSM-5 criteria. Also, this study focused on perceptions of overall social support. It did not examine different facets of social support, assess the quality of social support by type of relationship (e.g., friends, intimate partners, family members, etc.), or assess the social network. Another important area of future work will be understanding what forms of social support were ameliorative in this study and if this varied by trauma type (e.g., interpersonal versus non-interpersonal trauma).

## 5. Conclusions

The current study adds to our understanding of how social support is associated with treatment outcomes for individuals with co-occurring SUD and PTSD. Findings suggest social support facilitates reductions in substance use and PTSD symptom severity during treatment. Thus, assessing social support before treatment initiation and finding ways to attend to, promote, and strengthen social support during the treatment process may prove beneficial in enhancing treatment outcomes.

## 6. Author Note

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## Declaration of Competing Interest

Two of this manuscript's authors (TK and SB) disclose that they are authors on the as Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure (COPE) therapy manual. The other authors declare that they have no conflicts of interest to disclose.

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