SHORT COMMUNICATION

Impact of hazardous alcohol use on intensive PTSD treatment outcomes among veterans

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ABSTRACT

Background: Intensive treatment programmes (ITPs) for posttraumatic stress disorder (PTSD) produce large symptom reductions and have generally higher completion rates compared to traditional weekly care. Although ITPs do not appear to increase substance use, it has yet to be determined whether their effectiveness differs for veterans with and without hazardous alcohol use (HAU).

Objective: This study examined the effectiveness of a 3-week Cognitive Processing Therapy-based ITP for 538 veterans with PTSD (66.0% male; mean age = 41.22 years) and with (n = 193) or without HAU (n = 343) for reducing PTSD and depression symptoms.

Method: Veterans’ PTSD (PCL-5) and depression (PHQ-9) symptoms were assessed at pre-treatment, during treatment, and at post-treatment. HAU (AUDIT-C total score ≥4 for males; ≥3 for females) was measured at intake.

Results: Treatment completion rates were high for both individuals who endorsed HAU (92.68%) and those who did not (93.37%), likely due to veterans being housed near the treatment facility. Mixed effects regression models revealed a significant time by alcohol use interaction when predicting both PCL-5 (p < .001) and PHQ-9 (p = .003), suggesting time-trends over the course of the ITP differed based on alcohol use. Veterans who endorsed HAU improved to a statistically significantly lesser extent. However, endpoint differences between groups for both outcomes were small (Cohen’s ds between 0.15 and 0.20).

Conclusions: Veterans with and without HAU reported significant reductions in PTSD and depression symptoms and completed the ITP at comparably high rates. Findings support the effectiveness of intensive PTSD treatment programmes for individuals with PTSD and HAU. Future studies should utilize controlled designs to evaluate whether intensive PTSD treatment can reduce HAU.

Impacto del uso nocivo de alcohol sobre los resultados del tratamiento intensivo para el TEPT en veteranos

Antecedentes: Los programas de tratamiento intensivo (ITPs, por sus siglas en inglés) para el trastorno de estrés postraumático (TEPT) producen grandes disminuciones sintomáticas generalmente tienen tasas más altas de finalización comparadas con los tratamientos tradicionales semanales. A pesar de que los ITPs no parecen aumentar el uso de sustancias, se debe aún determinar si su efectividad difiere para los veteranos con y sin consumo nocivo de alcohol (HAU, por sus siglas en inglés).

Objetivo: Este estudio evaluó la efectividad para la reducción de síntomas del TEPT y la depresión de un ITP de tres semanas basado en la terapia de procesamiento cognitivo en 538 veteranos con TEPT (66,0% varones; promedio de edad = 41,22 años) con (n = 193) o sin HAU (n = 343).

Método: Se evaluaron a veteranos con síntomas del TEPT (PCL-5) y depresión (PHQ-9) antes del tratamiento, durante el tratamiento y después del tratamiento. El HAU (puntaje total del AUDIT-C ≥4 para varones; ≥3 para mujeres) fue medido al ingreso.

Resultados: Los modelos de regresión de efectos mixtos revelaron una interacción significativa en el periodo en el que se consume alcohol y la predicción tanto de los puntajes en la PCL-5 (p < .001) como en el PHQ-9 (p = .003), sugiriendo que en el curso del ITP existen tendencias de temporalidad basadas en el uso de alcohol. Los veteranos que aceptaron presentar un HAU mejoraron en menor grado.

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PALABRAS CLAVE

TEPT; uso indebido de alcohol; uso nocivo de alcohol; tratamiento Intensivo; veteranos; tratamiento de procesamiento cognitivo

HIGHLIGHTS

• Veterans who endorsed hazardous alcohol use (HAU) reported large PTSD and depression symptom reductions during a 3-week intensive PTSD treatment programme.
• This study provides support for the effectiveness of intensive treatment for individuals with PTSD and HAU.

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1. **Introducción**

El trastorno por estrés postraumático (PTSD) y el uso de alcohol (AUD) a menudo co-ocurren. Entre los veteranos con PTSD, 55–68% muestran evidencia de AUD (Dworkin, Bergman, Walton, Walker, & Kaysen, 2018; McDevitt-Murphy, et al., 2010). Las formas co-occurridas de PTSD y AUD (PTSD/AUD) suelen estar asociadas con más complejos perfiles clínicos y niveles inferiores de funcionamiento que las formas no asociadas. (Norman, Haller, Hamblen, Southwick, & Pietrzak, 2018; Ouimette, Goodwin, & Brown, 2006; Straus et al., 2019). Entre los veteranos tratados en tratamiento, AUD ha sido asociado con un mayor nivel de PTSD y los síntomas depresivos (Kaysen et al., 2014).

Individuos con historia de PTSD/AUD que han recibido tratamiento basado en PTEP, como terapia cognitivo-conductual (CPT; Resick, Monson, & Chard, 2016), han reportado disminuciones significativas en PTSD y en los síntomas depresivos (Dondanville et al., 2019). Reducciones en PTSD se han relacionado con disminuciones en el consumo de alcohol, lo cual sugiere la importancia de abordar PTSD en individuos que usan alcohol de manera peligrosa (Hien et al., 2010). Sin embargo, también se ha demostrado que las tasas de dropout para tratamientos de PTSD/AUD van de 32–61% (Back et al., 2019; Szafranski et al., 2018).

Los tratamientos de PTSD incluyen programas intensivos (ITPs), que consisten en intervenciones basadas en evidencia que se ofrecen diariamente durante tres semanas. Estas intervenciones han demostrado reducciones significativas en PTSD y en los síntomas depresivos en veteranos y no-veteranos (Back et al., 2019; Szafranski et al., 2018). Los recientes estudios muestran que PTSD y AUD a menudo co-ocurren, y que PTSD puede predecir el consumo de alcohol, pero remain scarce (Back et al., 2019; Szafranski et al., 2018).

1. **Method**

2.1. **Participants**

El estudio incluyó a 538 miembros de servicio activo (5,3%) y veteranos (93.8%) con PTSD, que posteriormente fueron referidos como ‘veteranos’. De ellos, 195 (n = 343) se sometieron a tratamiento con PTSD (Held et al., 2020a) y completaron por lo menos un mes de tratamiento en el estudio. La mayoría de los participantes se sometieron a un tratamiento de PTSD de tres semanas a finales de abril de 2016 y en febrero de 2020. El 81% de la muestra presentó PTSD moderada o severa y el resto presentó PTSD leve. Los datos se presentan en la tabla 1 para un análisis descritivo de la muestra.
As all assessments were collected as part of routine clinical care, a waiver of consent was obtained. All veterans underwent a clinical intake evaluation, which included the Clinician Administered PTSD Scale for DSM-5 to confirm a diagnosis of PTSD (CAPS-5; Weathers et al., 2018). Veterans were deemed ineligible if they were actively suicidal/homicidal, engaged in severe non-suicidal self-harm in the past three months, or were diagnosed with mania/psychosis. Exclusion criteria also included alcohol or substance use that would have required medical observation due to potential lethality if discontinued or if use prevented participation in ITP programming during the day. See Held et al. (2020a) and Zalta et al. (2018) for more information about the intake process.

During 15 days of PTSD-focused clinical programming, veterans received 14 individual CPT and 13 group CPT sessions, as well as 13 mindfulness groups.

Table 1. Demographic characteristics.

| Variable                          | No Hazardous Alcohol Use | Hazardous Alcohol Use | p     |
|-----------------------------------|--------------------------|-----------------------|-------|
|                                   | n                        | M (SD)                | n     | M (SD) |     |
| Age                               | 538                      | 41.73 (9.45)          | 40.33 | (9.29)  | .097 |
| Sexa                             |                          |                       |       |        | .001 |
| Male                              | 208                      | 60.6                  | 135   | 75.4    | .353 |
| Ethnicity                         |                          |                       |       |        | .101 |
| Not Hispanic or Latinx            | 270                      | 78.7                  | 160   | 82.1    |     |
| Race                              |                          |                       |       |        |     |
| American Indian/Alaskan Native    | 7                        | 2.0                   | 3     | 1.5     |     |
| Asian                             | 5                        | 1.5                   | 1     | 0.5     |     |
| Black or African American         | 71                       | 20.7                  | 31    | 15.9    |     |
| Native Hawaiian/Pacific Islander  | 4                        | 1.2                   | 0     | 0       |     |
| Other                             | 35                       | 10.2                  | 11    | 5.6     |     |
| Refusal                           | 1                        | 0.3                   | 0     | 0       |     |
| Unknown                           | 1                        | 0.3                   | 0     | 0       |     |
| White                             | 219                      | 63.8                  | 149   | 76.4    | .457 |
| Marital Status                    |                          |                       |       |        |     |
| Divorced                          | 73                       | 21.3                  | 42    | 21.5    |     |
| Domestic Partner                  | 2                        | 0.6                   | 0     | 0       |     |
| Legally Separated                 | 15                       | 4.4                   | 12    | 6.2     |     |
| Married                           | 179                      | 52.2                  | 97    | 49.7    |     |
| Single                            | 73                       | 21.3                  | 41    | 21.0    |     |
| Widowed                           | 1                        | 0.3                   | 3     | 1.5     |     |
| Military Service Branchb          |                          |                       |       |        | .787 |
| Air Force                         | 28                       | 8.3                   | 14    | 7.2     |     |
| Army                              | 225                      | 66.4                  | 125   | 64.1    |     |
| Coast Guard                       | 4                        | 1.2                   | 2     | 1.0     |     |
| Marines                           | 47                       | 13.9                  | 34    | 17.4    |     |
| Navy                              | 35                       | 10.3                  | 20    | 10.3    |     |
| Military Pay Gradeb               |                          |                       |       |        | .195 |
| E1-E3                             | 42                       | 12.4                  | 17    | 8.7     |     |
| E4-E9                             | 267                      | 78.8                  | 166   | 85.1    |     |
| Officer                           | 30                       | 8.8                   | 12    | 6.2     |     |
| Discharge Statusc                 |                          |                       |       |        | .109 |
| Active Duty                       | 9                        | 2.7                   | 7     | 3.6     |     |
| Discharged                        | 228                      | 67.5                  | 132   | 67.7    |     |
| Inactive Ready Reserve            | 1                        | 0.3                   | 2     | 1.0     |     |
| Medically Retired                 | 70                       | 20.7                  | 28    | 14.4    |     |
| National Guard                    | 2                        | 0.6                   | 3     | 1.5     |     |
| Reserves                          | 0                        | 0                     | 3     | 1.5     |     |
| Retired                           | 28                       | 8.3                   | 20    | 10.3    |     |
| Discharge Characterizationd       |                          |                       |       |        | .051 |
| General                           | 11                       | 3.3                   | 4     | 2.1     |     |
| Honourable                        | 255                      | 75.7                  | 157   | 80.5    |     |
| Medical                           | 60                       | 17.8                  | 20    | 10.3    |     |
| Not Applicable                    | 8                        | 2.4                   | 11    | 5.6     |     |
| Other than Honourable Conditions  | 3                        | 0.9                   | 3     | 1.5     |     |
| Service Era                       |                          |                       |       |        |     |
| Post-9/11                         | 309                      | 91.4                  | 174   | 89.2    | .404 |
| Deployed                          |                           |                       |       |        | .049 |
| Yes                               | 260                      | 75.8                  | 162   | 83.1    |     |
| Primary Trauma Type               |                           |                       |       |        | <.001 |
| Combat Trauma                     | 181                      | 52.8                  | 134   | 69.7    |     |
| Military Sexual Trauma            | 162                      | 47.2                  | 59    | 30.3    |     |
| AUDIT-C Score                     |                           | 1.06 (0.98)           | 6.47  | (2.66)  | <.001 |
| Endpoint PCL-5 Below 33           |                           |                       |       |        | .109 |
| Yes                               | 142                      | 44.2                  | 66    | 36.9    |     |
| Treatment days completed          |                           | 14.02 (1.96)          | 13.86 | (1.92)  | .348 |
| Programme completion              |                           |                       |       |        | .835 |
| Yes                               | 320                      | 93.3                  | 181   | 92.8    |     |

*a41.41% of all males and 26.23% of all females were above AUDIT-C cut-offs representing alcohol abuse/misuse. *n = 534, *n= 533, *n = 532
and 12 yoga groups. All veterans also participated in 18 psychoeducation groups on various topics including two groups on the impact substance use can have on health and PTSD recovery. CPT providers completed the official 2-day CPT training and consultation; mindfulness and yoga providers were certified to teach respective classes. All veterans were required to stay in the same hotel (unaffiliated with the ITP) and were not monitored outside of treatment hours. Alcohol use outside of programming was discouraged but not prohibited.

2.3. Measures

2.3.1. The PTSD Checklist for DSM-5 (PCL-5)
The PCL-5 (Bovin et al., 2016) is a 20-item self-report measure of PTSD symptom severity based on DSM-5 diagnostic criteria. A cut-off score of ≥33 is used to indicate probable PTSD (Bovin et al., 2016). The PCL-5 was administered at intake, days 2, 3, 5, 6, 8, 10, 11, 13, and 14 (post-treatment). At intake, veterans reported their symptom severity for the past month. During and post-treatment, symptom severity over the past week was assessed. Cronbach’s alpha = .89-.96.

2.3.2. Patient Health Questionnaire (PHQ-9)
The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a 9-item self-report measure of depression symptoms occurring during the past two weeks. This measure was administered at intake, days 3, 5, 6, 8, 10, 11, 13, and 15 (post-treatment). Cronbach’s alpha = .81-.89.

2.3.3. Alcohol Use Disorder Identification Test (AUDIT-C)
The AUDIT-C (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) is a self-report measure of alcohol consumption during the past year. Recommended cut-off scores of ≥4 for males and ≥3 for females were used to detect HAU (Bush et al., 1998). This measure was administered at intake. Cronbach’s alpha = .87.

2.4. Statistical analysis

Linear mixed effects regression models (LMMs) were used to assess PCL-5 and PHQ-9 changes over the course of the ITP due to their less restrictive assumptions regarding variances and covariance structure over time, ability to accommodate missing data, and treatment of random effects. Models were adjusted for age, sex, and cohort type (combat or military sexual trauma). Conditionally independent errors were selected for LMMs based on Akaiake Information Criteria (AIC) values, and both random intercept and slope components were included due to improved model fit in likelihood ratio tests (ps<.001). Effect sizes for pre-post and endpoint differences in outcomes by group were illustrated via standardized difference (d) between means, and Gibbons’ within-subjects variant of d was utilized for pre-post comparisons (Gibbons, Hedeker, & Davis, 1993).

3. Results

LMMs indicated significant symptom reductions across time (ps<.001). A significant quadratic time trend existed for PCL-5 (p < .001) but not PHQ-9 (p = .487). No differences in either outcome were found based on sex, age, or cohort type (ps>.5). No overall differences were found between veterans with and without HAU across time for PCL-5 (p = .230) or PHQ-9 (p = .052). A time by alcohol use interaction was significant in predicting both PCL-5 (p<.001) and PHQ-9 (p = .005). Although average PCL-5 and PHQ-9 scores across time did not significantly differ, time-trends over the course of the ITP differed based on HAU. Individuals who endorsed HAU at intake showed less improvement than individuals who did not (see Figures 1 and 2). There were no significant group differences in the percentage of individuals who fell below the probable PTSD cut-off, completed the ITP, and the number of ITP days attended (see Table 1). The amount of PCL-5 and PHQ-9 change over the course of the programme was large and clinically meaningful across the entire sample (see Table 2).

4. Discussion

Veterans who reported HAU endorsed significantly higher pre-treatment PTSD and depression symptoms compared to those who did not, supporting previous notions that veterans with PTSD and HAU generally present with more severe symptomatology (Kaysen et al., 2014). However, veterans with HAU experienced large PTSD and depression symptom reductions. Both groups reported similar post-treatment symptom severity levels. It appears that the ITP was generally effective, including for individuals with HAU upon entering the programme. Symptom change generally occurred following the first ITP week. It is possible that the cognitive restructuring during the first ITP week led to a loosening of cognitive patterns and incorporation of newly acquired information about their traumatic experiences, which led to subsequent symptom reductions (Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007). In line with findings from a recent meta-analysis (Straud, Siev, Messer, & Zalta, 2019), fewer individuals fell below the suggested PTSD cut-off compared to civilian ITP participants (Voordenonk et al., 2020). Treatment completion was high and did not significantly differ for veterans with and without HAU, and both groups attended most treatment days, possibly aided by the structure of ITPs, where common barriers were reduced by housing individuals near the treatment facility. Despite the promising effects, there is room to further improve treatment for
individuals who endorse HAU. It is possible that incorporating non-psychoeducation alcohol-specific interventions into the curriculum could further reduce symptoms.

The present study has several limitations. In this study AUDs were not diagnosed. We instead relied on a broader measure of past year hazardous drinking, which makes it difficult to compare findings to prior studies.

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**Figure 1.** PTSD symptom change over time by hazardous alcohol use endorsed at intake. PCL-5: PTSD Checklist for DSM-5. Treatment Day: Treatment day during the ITP. Without hazardous alcohol use: $n = 343$. With hazardous alcohol use: $n = 195$. Error bars represent standard error.

**Figure 2.** Depression symptom change over time by hazardous alcohol use endorsed at intake. PHQ-9: Patient Health Questionnaire. Treatment Day: Treatment day during the ITP. Without hazardous alcohol use: $n = 343$. With hazardous alcohol use: $n = 195$. Error bars represent standard error.

**Table 2.** PTSD and depression symptom reduction by hazardous alcohol use.

| Variable | No Hazardous Alcohol Use | Hazardous Alcohol Use |
|----------|--------------------------|-----------------------|
|          | Intake $M$ (SD) | Post $M$ (SD) | $d$ | $p$ | Intake $M$ (SD) | Post $M$ (SD) | $d$ | $p$ |
| PCL-5    | 55.26 (11.82) | 33.26 (18.70) | 1.41 | <.001 | 56.41 (12.72) | 36.12 (19.94) | 1.21 | <.001 |
| PHQ-9    | 17.45 (4.92)  | 11.96 (6.31)  | 0.97 | <.001 | 18.12 (5.30)  | 13.21 (6.42)  | 0.83 | <.001 |

$d$ represents Cohen’s $d$, the standardized difference between group means. By convention, all pre-post changes are considered large (>$0.8$). Effect sizes for the differences between the two groups at endpoint were small for both PCL-5 ($d = 0.13$) and PHQ-9 ($d = 0.20$).
treatment studies on PTSD/AUD. As is common in clinical programmes, all measures involved self-report, possibly introducing reporting bias. Additionally, the PCL-5 was not originally developed for daily assessment of PTSD symptoms. The lack of a control group prevents us from attributing changes in symptoms solely to the ITP. Veterans in the ITP received a number of interventions and we are not able to determine which of the programme components contributed to treatment response. Moreover, the ITP did include substance use-specific interventions as part of the comprehensive programming. Alcohol use during the programme was not assessed. This precluded us from examining whether alcohol use improved as a function of PTSD symptom reductions and whether improvements in alcohol use impacted changes in PTSD or depression. This study did not assess symptoms following the ITP, which makes it impossible to determine longer-term outcomes. Lastly, findings from the present study may not be applicable to non-veterans or individuals with more severe alcohol use, as this was one of the exclusion criteria.

Findings suggest intensive PTSD treatment can achieve comparable outcomes as have been reported for traditionally delivered/weekly outpatient care while ensuring much greater completion rates. Results also suggest that veterans with PTSD and HAU may not need to be excluded from participation in ITPs, although additional research is warranted. ITPs may be a viable alternative to lengthier speciality and residential PTSD treatments for some veterans with co-occurring PTSD and HAU (Haller et al., 2016; Walter, Varkovitzky, Owens, Lewis, & Chard, 2014). Future studies should utilize controlled designs to evaluate whether intensive PTSD treatment can reduce HAU.

Note

1. Tests of non-inferiority of endpoint PCL-5 and PHQ-9 scores using the TOST procedure (Schurmann, 1987) with equivalence margins of 10-point and 5-point, respectively, indicated that the two groups can be considered equivalent at endpoint in both measures.

Data availability statement

Datasets generated and analyzed during the current study are not publicly available because they contain more than two indirect identifiers of human research participants that cannot be sufficiently anonymized for a public repository. The datasets are available from the corresponding author on reasonable request.

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