Title

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Journal

Psychological Trauma Theory Research Practice and Policy, 14(2)

ISSN

1942-9681

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Publication Date

2022-02-01

DOI

10.1037/tra0001066

Peer reviewed

Published in final edited form as:
Psychol Trauma. 2022 February ; 14(2): 178–185. doi:10.1037/tra0001066.

Diagnosing Obstructive Sleep Apnea in a Residential Treatment Program for Veterans with Substance Use Disorder and PTSD

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Abstract

Background: Obstructive sleep apnea (OSA) is often comorbid with both substance use disorders (SUD) and posttraumatic stress disorder (PTSD), yet frequently goes undiagnosed and untreated. We present data on the feasibility and acceptability of objective OSA diagnosis procedures, findings on OSA prevalence, and the relationship between OSA and baseline SUD/PTSD symptoms among veterans in residential treatment for comorbid PTSD/SUD.

Methods: Participants were 47 veterans admitted to residential PTSD/SUD treatment. Participants completed questionnaires assessing PTSD and sleep symptoms, and filled out a sleep diary for 7 days. Apnea-hypopnea index (AHI) was recorded using overnight Home Sleep Apnea Test (HSAT; OSA was diagnosed with AHI >= 5).

Results: Objective OSA diagnostic testing was successfully completed in 95.7% of participants. Of the 45 veterans that went through HSAT 46.7% had no OSA, 35.6% received a new OSA diagnosis, and 8.9% were previously diagnosed with OSA and were using positive airway pressure treatment (PAP), and an additional 8.9% were previously diagnosed with OSA, reconfirmed with the HSAT, but were *not* using PAP. 100% of respondents during follow-up deemed the testing protocols usefulness as “Good” or “Excellent”.

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Conclusion: OSA diagnostic testing on the residential unit was feasible and acceptable by participants and was effective in diagnosing OSA. OSA testing should be considered for everyone entering a SUD and PTSD residential unit.

Keywords

Veteran; PTSD; SUD; OSA; CPAP

Introduction

Substance use disorders (SUD) and posttraumatic stress disorder (PTSD) are highly comorbid (Kessler et al., 2005; Najavits et al., 2010) and this comorbidity is associated with worse treatment outcomes for both disorders, greater risk of homelessness, increased disease burden, higher suicidal ideation and attempted suicide (Norman et al., 2018), and greater functional disability than having a single disorder (Calabrese et al., 2011; Driessen et al., 2008; Norman et al., 2016; Possemato et al., 2010). In addition, both Veterans Affairs (VA) and community clinicians report significant challenges in treating comorbid SUD/PTSD individuals due to higher drop out rates, more severe symptoms, and lower motivation (Najavits et al., 2010). Residential treatment is an appropriate level of care for individuals with severe PTSD and/or SUD (Haller et al., 2019) with upward of 40% of individuals seeking SUD treatment receiving residential care at some point (Stahler et al., 2016; Walker et al., 2008). A residential setting offers an array of integrated treatment options to patients at a critical time in recovery and may be an optimal place to diagnose and treat comorbid disorders that can negatively affect both SUD and PTSD outcomes such as obstructive sleep apnea (OSA). Unfortunately, OSA diagnostic testing is not a part of standard care in PTSD, SUD, or residential treatment. Our study presents data on the feasibility and acceptability of implementing objective OSA diagnostic testing on a residential SUD treatment program for veterans with PTSD.

Sleep disordered breathing is a spectrum (Schwab et al., 1998) ranging from mild upper airway resistance (e.g., snoring) to severe OSA. OSA is associated with sleep fragmentation and is defined by repeated episodes of apneas (pauses in breathing) and hypopneas (shallow breathing) with decreases in blood oxygenation during sleep. The apnea-hypopnea index (AHI) is derived by calculating the number of apneas and hypopneas per hour of sleep, and is the most commonly used metric of OSA severity, with mild OSA starting at AHI >= 5. OSA in veterans is associated with neurocognitive decline, hypertension, increased cardiovascular mortality, stroke, heart attacks, and financial burden on the health care system (Jennum & Kjellberg, 2011; Redline et al., 2010; Young et al., 2008). Further, OSA is associated with more depression, anxiety, PTSD, SUD, psychosis, suicidal ideation, bipolar disorder, and dementia compared to veterans without OSA (Sharafkhaneh et al., 2005).

A systematic review of OSA prevalence in the general population found OSA ranged from 9% to 38%, and OSA risk increased with age and higher body mass index (BMI; Senaratna et al., 2017). Rates of OSA are significantly higher among veterans with studies indicating diagnostic rates ranging between 67% to 83% (Krakow et al., 2006; Lettieri et al., 2016; Yesavage et al., 2012). Further, both SUD and PTSD increase risk of OSA. A

meta-analysis of veterans with PTSD found OSA prevalence was 75.7% (AHI >= 5; Zhang et al., 2017). Among individuals with any SUD, 53.3% were screened as being high-risk for OSA (Mahfoud et al., 2009), with increased substance use severity increasing risk of OSA (Rose et al., 2014).

While it is not entirely clear why veterans with PTSD present with higher rates of OSA compared to non-veterans without PTSD (Colvonen et al., 2015), there is convincing evidence that long-term alcohol ingestion and opioid use are important factors in pathogenesis of OSA (Le Bon et al., 1997; Vitiello et al., 1990; Wang & Teichtahl, 2007). For example, even after a single drink, normal sleepers can develop snoring and even exhibit breathing events resulting in oxygen desaturations (Block & Hellard, 1987). Alcohol relaxes upper airway dilator muscles, which increases airway obstruction and increases nasal and pharyngeal resistance (Scanlan et al., 2000; Young et al., 2002) and prolongs the time required to arouse or awaken after an apnea occurs (Dawson et al., 1993; Robinson et al., 1985). Even during abstinence, individuals with SUD are more likely than controls to have OSA (Le Bon et al., 1997; Mamdani et al., 1989; Robinson et al., 1985).

Research has demonstrated the detrimental impact of OSA on both SUD and PTSD outcomes. A retrospective study of veterans who had completed cognitive processing therapy (CPT), an evidence based treatment for PTSD, found that those with untreated OSA (n = 69) showed less PTSD symptom improvement than those without OSA *(N* = 276; Mesa et al., 2017). However, those with OSA treated with positive airway pressure (PAP) showed more improvement in PTSD symptoms than those who were not treated (Reist et al., 2017). Both studies suggest that OSA screening/diagnostic testing and treatment should be part of the first-line treatment for individuals with PTSD.

There have been no studies examining the effect of untreated or treated OSA on relapse. However, there is circumstantial evidence that OSA my influence relapse rates. First, OSA is strongly linked to fragmented sleep (Antic et al., 2011), and it has been shown that disrupted sleep architecture predicts relapse among individuals abstinent from alcohol (Brower et al., 2001) and other substances (e.g., opioids and methamphetamines; Angarita et al., 2016). Second, OSA is linked with other factors involved in relapse including deficits in most aspects of executive functioning, decreased processing speed, increased perseverative responses or behaviors, impulsivity, and difficulty with problem solving (Gagnon et al., 2014). Finally, untreated OSA is linked to lower sleep efficiency (Williams et al., 2015), which is associated with more frequent and larger mood fluctuations (El-Ad & Lavie, 2005), thus potentially placing SUD patients further at risk for relapse (Brower, 2003). Studies are needed to clarify how OSA may influence relapse rates.

Despite the detrimental effects of untreated OSA, it continues to be undiagnosed and untreated in many veterans, with estimates of 80% to 90% of veterans with OSA remaining undiagnosed (Alexander et al., 2016). There are two reasons for this: First, the symptoms of OSA (e.g., daytime fatigue, poor concentration, trouble sleeping, irritability) are often mistaken for the “primary disorder” (e.g., SUD or PTSD) and, thus, OSA is not even considered as a contributor (Colvonen, Straus, et al., 2018). Second, there is substantial evidence that OSA is increasing in younger veterans with co-occurring mental health

disorders who do not have the classic risk factors (e.g., older age, overweight or obese per BMI), so OSA becomes difficult to identify (Colvonen et al., 2015; Rezaeitalab et al., 2018; Williams et al., 2015). As such, self-report OSA screening questionnaires, like the STOP-BANG or Berlin, that rely heavily on age, blood pressure, and BMI, are shown to be poor predictors of OSA in all veterans (Kunisaki et al., 2014; McMahon et al., 2017) as well as specifically among veterans with PTSD (Lyons et al., Under Review). This suggests the need for objective OSA diagnostic testing among veterans.

The literature suggests that residential treatment is effective in treating mental health disorders (Zhang et al., 2003) and is the appropriate level of care for individuals with severe SUD or PTSD (Haller et al., 2019). More information is needed about specific programmatic elements that could increase effective outcomes and maximize successful long-term continued care (Proctor & Herschman, 2014). Due to the stable environment and frequent contact between the treatment team and the patient, the residential setting may be a more effective environment than outpatient settings for diagnosing and treating co-occurring OSA (Colvonen, Ellison, et al., 2018). Positive airway pressure (PAP) is the gold-standard treatment for OSA, with meta-analytic reports showing decreased sleep fragmentation and improvement in daytime sleepiness and functioning across a host of domains (Patil et al., 2019). Meta-analyses show significant decreases in apnea/hypopneas with PAP use with very large effect sizes (Schwartz et al., 2018). Increasing accessibility to evidence-based care for OSA in a residential setting may be a critical pathway for treating OSA and thereby potentially improving SUD/PTSD treatment outcomes. However, it is unclear whether objective testing of OSA, a necessary first step to treatment, would be feasible on a residential unit for veterans with SUD and PTSD.

Our study examined the feasibility and acceptability of objective OSA diagnostic testing in a residential treatment unit for veterans with SUD and PTSD. We present findings on OSA prevalence and the relation between OSA and SUD/PTSD symptoms. We hypothesized that objective OSA testing would be feasible and acceptable. We also hypothesized that veterans with untreated OSA would have more severe SUD and PTSD symptoms than those without OSA or with treated OSA. Finally, we make suggestions as to how residential units can implement OSA diagnostic testing and integrate PAP treatment.

Methods

Program Description

The study took place in the Substance Abuse Residential Rehabilitation Treatment Program (SARRTP) at the VA San Diego Healthcare System (VASDHS), a 14-bed residential substance use treatment program that also offers PTSD treatment for veterans with comorbid SUD and PTSD. The treatment team consisted of a clinical psychologist, psychiatrist, addiction therapists, nursing staff, and social workers.

The program was 28 to 35 days in duration (7-day extensions were offered to veterans engaging in intensive individual PTSD treatment). Unit programming consists of cognitive-behavioral therapy groups for treating SUD, introducing new skills (e.g., anger management), engaging in experientially based activities (e.g., mindfulness/relaxation), and

other recovery-oriented programming (e.g., living skills, job skills). Patients diagnosed with PTSD related to any trauma type are offered services on the PTSD track and receive psychoeducation about PTSD and the interplay of SUD and PTSD, attend a cognitive restructuring group where PTSD-related beliefs are addressed, and take part in an in-vivo group where they practice group exposures to commonly avoided situations (e.g., sitting in a crowded waiting room). Some veterans are offered intensive individual evidence-based PTSD treatment 3 times a week.

Participants

All veterans participating in the PTSD track on the SARRTP unit at the VASDHS were offered participation in this study. The only exclusion criterion was unmanaged symptoms of psychosis, based on the discretion of the PTSD track clinical psychologist. Recruitment occurred between February 2019 to March 2020. Of the 60 veterans admitted to the unit, 47 veterans (78%) consented. Of the 47 veterans who consented, two veterans stated they did not want to be a part of the study after signing the consent. Data is presented on the remaining 45 veterans who filled out questionnaires and wore the OSA testing equipment. See Table 1 for Demographics.

Procedures

All research was approved by the institutional review board at the VASDHS. Veterans admitted onto the PTSD track on SARRTP were informed about the study from their SARRTP provider during a 1-on-1 treatment planning session. Participants who expressed interest met with a study coordinator to learn more about OSA diagnostic testing procedures and were given the opportunity to ask questions. Veterans who gave written consent to participate were given a home sleep apnea test (HSAT) overnight portable monitor for the diagnosis of OSA. We used the NOX T3 for our HSAT. Participants also filled out, a daily sleep diary for 7 days, and self-report measures (PTSD Checklist, Substance Use Inventory, Alcohol Use Disorder Identification Test, Client Satisfaction Questionnaire, Demographics, Insomnia Severity Index, Epworth Sleepiness Scale and the Pre-sleep arousal scale). Participants were compensated $20.

OSA diagnostic testing procedures were adapted with the help of doctors and staff on the unit to minimize patient burden and disruption of current SARRTP procedures. All consenting and HSAT set-up was done at a time of day when no SARRTP classes were being held. Participants met with a study coordinator to set-up and review procedures for the HSAT. All straps and nose cannulas were adjusted and prepared with study staff prior to the overnight testing and equipment was put at veterans' bedside table. Medical tape was provided to keep the nose cannula and finger clip in place. A pamphlet was given to participants with a step-by-step guide for setting up HSAT equipment. The HSAT was scored and reviewed by study staff using the American Academy of Medicine scoring rules (3% oxygen desaturation). Any participant with AHI >= 5 was asked if they wanted a referral to the Pulmonary Sleep Medicine clinic. If the participant consented to referral, HSAT summary data was sent to Sleep Medicine for review and possible PAP treatment.

Measures

OSA Diagnosis.—OSA was diagnosed using a HSAT portable recorder sleep monitoring systems. The HSAT AHI per hour output has an $r = .93$ when comparing the gold standard polysomnography (PSG; Cairns et al., 2014) and is approved for diagnosis in the American Academy of Sleep Medicine (Kapur et al., 2017). We used the NOX T3 HSAT, which has a simple monitor hook up that the patients can use on their own with rip cords around the chest to measure breathing effort, a nose cannula to measure airflow and pauses in breathing, and a finger clip to measure oxygen desaturation. For individuals wearing a PAP device, the NOX T3 HSAT attaches to the PAP device to capture residual AHI. All recorders were used for 1 night while on the SARRTP unit. An AHI >= 5 is considered to be mild, with those >=15 being deemed moderate, and those >= 30 being severe. Historical OSA diagnosis was also retrieved from medical records to see newly diagnosed compared to previous diagnosis.

Insomnia.—Insomnia Severity Index (ISI; Morin et al., 2011) is a widely used measure of insomnia with well-established reliability and validity. The ISI consists of seven items, three of which assess severity of insomnia (i.e., degree of difficulty falling asleep, staying asleep, and waking too early). The remaining questions tap satisfaction with sleep pattern, effect of sleep on daytime and social functioning, and concern about current sleep difficulties. Scores range from 0 (no clinically significant insomnia) to 28 (severe clinical insomnia), with a cut-off of 11 suggesting a diagnosis of insomnia (Morin et al., 2011).

Daytime Sleepiness.—Epworth Sleepiness Scale (ESS; Johns, 1991) is a validated 8-item questionnaire measuring daytime sleepiness. The questions ask individuals how likely they are to fall asleep, in 8 different situations, on a scale of 0 to 3 (“Would never doze” to “High chance of dozing”). Scores are first totaled, and higher scores indicate higher severity of daytime sleepiness without a cut-off of 10 suggesting clinically significant daytime sleepiness.

Pre-sleep Arousal.—Pre-sleep arousal scale (PSAS; Nicassio et al., 1985) rates the intensity of somatic (8 items) and cognitive (8 items) manifestations of arousal prior to sleep. The PSAS shows strong internal consistency and reliability. The PSAS is a 16-item self-administered measure in which participants rate the intensity (1-not at all to 5-extremely) of experienced arousal for somatic and cognitive subscales. Higher scores indicate higher intensities of pre-sleep arousal.

Daily Sleep Diary.—Veterans completed a daily sleep diary at baseline and one week prior to discharge from the unit. Veterans filled out daily information on bedtime, sleep latency, number and duration of awakenings, wake time, total time in bed, sleep quality, and nightmares. Researchers then calculated two variables (total sleep time and sleep efficiency) based on participant daily entries. The primary outcome measure used for this study was sleep efficiency, defined as the percent time spent sleeping given the number of hours in bed.

PTSD Severity.—PTSD Checklist (PCL-5; Weathers et al., 2013) is a 20-item self-report measure of PTSD symptoms with good psychometric properties. The measure maps directly onto DSM-V diagnostic criteria.

Substance Use.—The Substance Use Inventory (SUI) asks about the participant's use of various substances, including alcohol, cocaine, heroin, marijuana, sedatives, PCP, stimulants, and hallucinogens, in the past 30 days, prior to SARRTP intake. The frequency, amount, and administration route (smoked, oral, injected) were also assessed, along with questions about cravings and urges to use.

Alcohol Use.—Alcohol Use Disorders Identification Test (AUDIT; Saunders, 1989) is a 10-item screening tool assessing alcohol consumption, drinking behaviors, and alcohol-related problems such as dependence or experience of alcohol-related harm in the month before SARRTP admission. Scores above 8 are considered hazardous or harmful alcohol use, while scores above 15 indicate high likelihood of alcohol dependence.

Cannabis use.—The Cannabis Use Disorder Identification Test – Revised (CUDIT-R; Adamson et al., 2010) is an 8-item self-report measuring marijuana use (e.g., yes/no) and behaviors regarding the use of marijuana. Scores above 8 are considered hazardous or harmful cannabis use, while scores above 12 indicate high likelihood of cannabis use disorder.

Feasibility: OSA testing feasibility was assessed via number of veterans that successfully completed OSA diagnostic testing with the HSAT.

Satisfaction.—The Client Satisfaction Questionnaire (CSQ; Larsen et al., 1979) was revised by study staff to assess acceptability of OSA diagnostic testing. Individual questions asked: a) How useful was the Obstructive Sleep Apnea screening (NOX T-3) you received?; b) Did you receive the information you wanted regarding your sleep?; c) Would you recommend this process to other veterans on the unit?; and d) How satisfied are you with the screening process? Results were on a 4-point Likert scale ranging from 1 (Poor/No, Definitely Not/Quite dissatisfied) to 4 (Excellent/Yes, Definitely/Very Satisfied). This instrument was used to measure participants' satisfaction with the intervention following HSAT testing with higher score indicating higher satisfaction.

Demographics.—Demographics questions were used to assess weight, ethnicity, race, height, relationship status, and service history.

Data Analysis

Data were analyzed with descriptive statistics and paired sample t-tests using SPSS version 26.

Results

Feasibility.

95.7% (n = 45) veterans successfully wore the HSAT for the testing night and successfully completed objective OSA diagnosis testing; two veterans withdrew from the study after consenting. 100% of the veterans who attempted the HSAT successfully completed objective OSA testing.

Acceptability.

Of the 45 veterans who wore the HSAT, 82.2% (*n* = 37) stated that both the usefulness of the OSA diagnosis and ease of the testing process was “Excellent”, with the remaining 17.8% veterans (*n* = 8) stating the process was “Good”. 73.3% (*n* = 33) veterans said they would “Definitely” recommend the testing to other veterans, with the remaining 26.6% of veterans (*n* = 12) said they “Probably” would recommend the OSA diagnostic testing. Finally, 44.4% (*n* = 20) veterans stated they were “Very Satisfied” with the process, and 55.6% (*n* = 25) veterans were “Mostly Satisfied”. 0% of respondents stated the process was “Not at all useful/feasible”, “Quite dissatisfied”, or “Would not recommend at all”.

OSA Diagnoses.

Based on the overnight sleep studies, 53.3% of veterans (*n* = 24) met criteria for a diagnosis of OSA, although some veterans were already successfully treating their OSA with a PAP device on the unit. Specifically, 35.6% (*n* = 16) were newly diagnosed, 8.9% (*n* = 4) were previously diagnosed with OSA and were actively using a PAP, 8.9% (*n* = 4) had previously been diagnosed with the current recording confirming the diagnosis but were *not* using PAP, and 46.7% (*n* = 21) had no OSA (See Figure 1). Finally, of the 20 veterans with untreated OSA (16 newly diagnosed and 4 veterans with reconfirmed OSA but not using their PAP treatment), 70.0% (*n* = 14) consented to a pulmonary sleep clinic referral for PAP treatment.

Baseline Differences by OSA Diagnosis.

Although the participants fell into 4 groups (newly diagnosed OSA, previously diagnosed OSA using PAP on unit, previously diagnosed OSA *without* a PAP on unit, and no OSA), we combined them into two groups based on their symptoms: OSA symptomatic group (AHI >= 5) and OSA negative/OSA treated group (AHI < 5). The OSA symptomatic group included the newly diagnosed OSA veterans and the previously diagnosed OSA veterans who were *not* wearing PAP on unit. OSA negative/non-symptomatic group included the veterans negative for OSA or were previously diagnosed with OSA but actively using PAP. We examined baseline differences between these two groups and found no differences in PTSD, ESS, ISI, or sleep efficiency (see Table 2).

Discussion

This study suggests that objective testing for OSA is feasible and acceptable for veterans with SUD and PTSD on a residential setting. Of the 47 veterans consented, only two veterans declined to participate in the study and 45 veterans successfully received testing, showing 95.7% feasibility. We believe that the two veterans who withdrew before the overnight HSAT was scheduled withdrew due to study burden (questionnaires, sleep diary, and HSAT) at a vulnerable time in recovery. Of the veterans who attempted to wear the HSAT, 100% were successful in completing the overnight study and received accurate AHIs. Further, we received positive feedback on the acceptability of the overnight HSAT test, with 100% of respondents saying they were “mostly satisfied” or better with the overall process.

We found that 53.3% of veterans had a diagnosis of OSA. While 55.6% of participants either did not have OSA or were successfully treating it with PAP, 44.5% of veterans would have

been left untreated on the residential unit without HSAT testing. The number veterans on the residential unit with untreated OSA is alarmingly high given the potential detrimental effects of untreated OSA on SUD and PTSD outcomes (Colvonen, Straus, et al., 2018; Wang & Teichtahl, 2007). The large percentage of veterans in residential treatment with untreated OSA also offers a unique opportunity for early evidence-based intervention. While PAP is the gold-standard treatment for OSA, adherence rates are low among veterans with PTSD (Colvonen, Straus, et al., 2018). For example, a recent meta-analysis found that PAP adherence was lower in patients with both OSA and PTSD than OSA alone (Zhang et al., 2017). Early adherence is key to long-term adherence rates for PAP (Budhiraja et al., 2007; Weaver et al., 1997), which suggests that patients should receive follow-ups early after PAP initiation to address any concerns (e.g., claustrophobia) and assist with titration and mask fit (Drake et al., 2003). Due to the dose response of PAP with positive outcomes, increasing adherence to PAP with desensitization to the mask may be essential to help veterans with PTSD (Goldstein et al., 2017). Residential care may be a uniquely stable and supportive environment to initiate PAP therapy due to the reduced external stressors and distractions, controlled environment with professional support, increased structure and accountability (e.g., more likely to attend sessions and follow through on treatment planning), and increasing access to clinicians to help intervene and motivate individuals (Haller et al., 2019). Future studies should examine whether evidence-based treatment for OSA on a residential unit leads to improved SUD/PTSD treatment outcomes.

While we hypothesized that veterans with untreated OSA would have worse SUD, PTSD, and sleep severity, our results did not support this. We found no differences between untreated OSA and the treated or no OSA group on any baseline measures of sleep, substance use, of PTSD severity. We believe that this has to with the ceiling effects of SUD, PTSD, and sleep severity among veterans just entering residential care, minimizing the variability necessary to find associations. Another possibility is our small sample size limiting the power necessary to detect differences. These findings may suggest that, in certain settings, symptom severity cannot be used as an indicator of high risk for OSA.

We recommend integrating objective OSA diagnostic testing into residential care for *all* residents whether or not they show classic risk factors for OSA (e.g., high BMI or older age). First, as previously mentioned, symptom severity does not discriminate between OSA positive/negative. Second, there is increasing evidence that self-report questionnaires for “high risk of OSA” are not accurate as screeners for veterans or PTSD (Kunisaki et al., 2014; Lyons et al., Under Review; McMahon et al., 2017). Together, there are no predictable visual, symptomatic, or self-report screeners to indicate who is in need of PAP treatment.

Our study has several limitations, including the small sample size and lack of follow-up data. As such, the long-term effects of PAP treatment on SUD and PTSD outcomes are unclear. Given these limitations, this study is best viewed as an objective testing protocol development and will require examination of PAP treatment and how that affects SUD and PTSD outcomes. However, this study offers strong support for importance of diagnostic testing for OSA for individuals with SUD and PTSD while in a residential care setting. Objective testing, and possibly treatment, for OSA is feasible and acceptable on a residential care setting.

Acknowledgments:

The views expressed in this paper are those of the authors only and do not reflect the official policy or position of the institutions with which the authors are affiliated, the Department of Veteran's Affairs, nor the United States Government. None of the authors have any competing financial interests to disclose.

This study was funded by VA RR&D CDA Grant #1lK2Rx002120-01 to Peter Colvonen and VA CSR&D merit grant #NURA-011-11F to Sonya Norman. The contents do not represent the views of the U.S. Department of veterans Affairs or the United States Government.

Funding:

This material is the result of work supported a UCSD Academic Senate Pilot Grant. Dr. Peter Colvonen is partly funded by VA RR&D CDA Grant #1lK2Rx002120-01.

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Clinical Impact Statement:

Obstructive sleep apnea (OSA) is very often comorbid with both posttraumatic stress disorder (PTSD) and substance use disorders (SUD). Unfortunately, due to the limitations of self-report OSA screeners and atypical presentation of OSA in individuals with SUD/PTSD, OSA often goes undiagnosed for individuals with SUD/PTSD. Our study found that OSA diagnostic testing was feasible and acceptable to participants in a residential treatment program for SUD/PTSD, and effective in diagnosing OSA. Diagnosing OSA on a residential unit for SUD/PTSD is a necessary first step to treating OSA and may help improve long-term outcomes for individuals with SUD/PTSD.

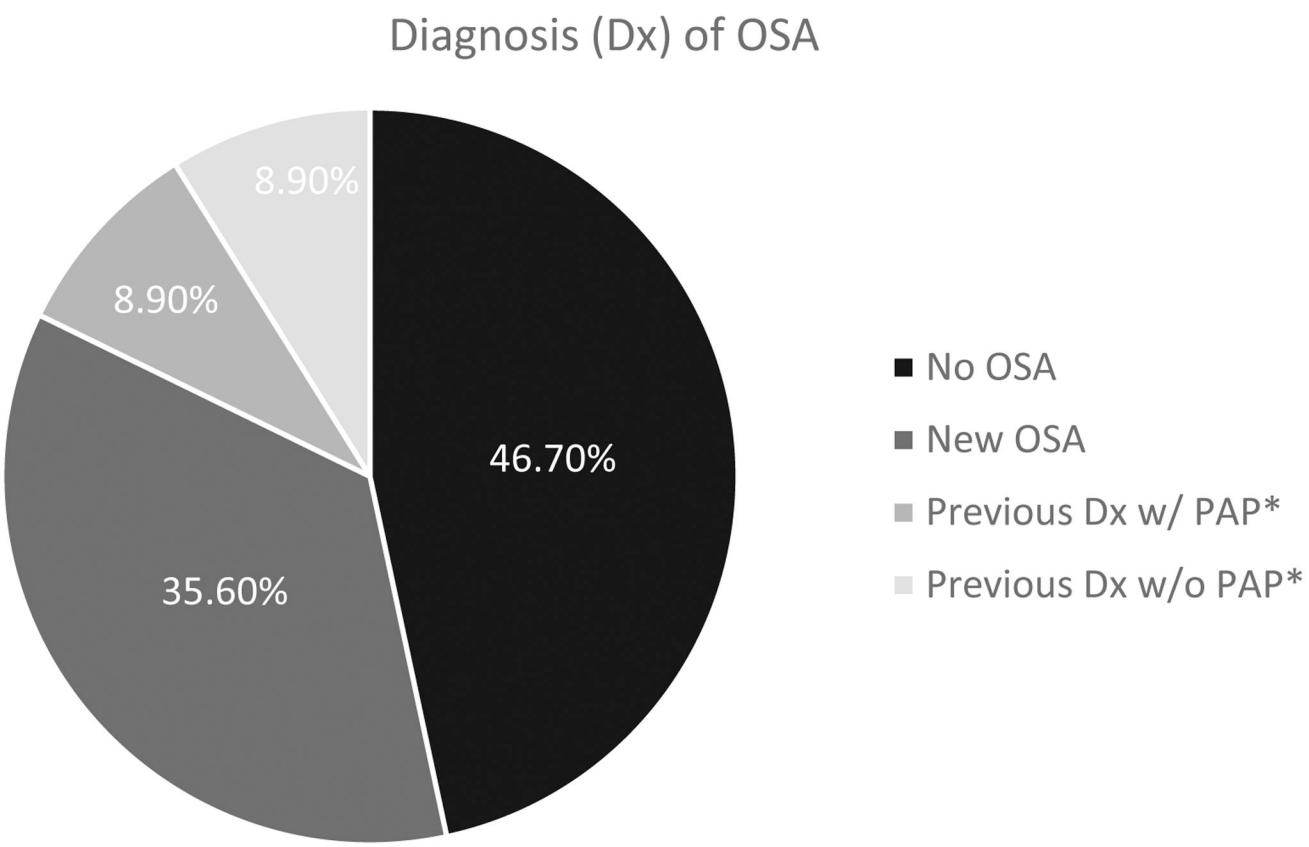

Figure 1.
OSA objective testing with veterans on the SARRTP PTSD Track, including those with * Positive Airway Pressure (PAP) treatment.

Table 1.

Demographic and Baseline Characteristics ($N = 45$)

Demographic Variable	Total % / M (SD)	Demographic Variable	Total % / M (SD)
Age	42.9 (10.4)	**Service/Branch**	
		Army	34.1%
Sex		Navy	25.0%
Men	88.6%	Marines	36.4%
Women	11.4%	Reserves/National Guard	4.5%
Marital status			
Never Married	22.7%	**Ethnicity**	
Married	22.7%	Hispanic	27.3%
Divorced	47.7%	Non-Hispanic	72.7%
Separated	4.5%		
Remarried	2.3%	**Race**	
		White	72.7%
Substances Used		Black	13.6%
Alcohol	68.6%	Bi/Multi-Racial	13.6%
Marijuana	54.3%	Pacific Islander/ Asian	0%
Sedatives/Tranquilizers	15.2%	American Indian/Alaskan	0%
Cocaine/Crack	14.8%	Other	0%
Opiates	17.1%		
IV Opiate Use	6.5%	**Height (inches)**	69.2 (4.4)
		Weight (lbs)	180.8 (33.0)

Table 2:

Clinical variables by Symptomatic and Non-Symptomatic OSA ($N = 45$)

	Symptomatic OSA ($n = 19$)	No OSA Symptoms ($n = 26$)	t	Cohen's d
	M (SD)	M (SD)		
Health Measures				
AHI	12.32 (6.99)	3.59 (7.05)	4.11**	1.24
BMI	27.22 (3.87)	26.51 (3.83)	0.59	0.18
Systolic Blood Pressure	126.95 (21.45)	121.04 (11.04)	1.19	0.35
Diastolic Blood Pressure	78.95 (11.48)	77.80 (8.33)	0.38	0.11
Neck Circumference (cm)	41.22 (3.43)	41.18 (3.47)	0.03	0.01
Questionnaires				
Insomnia Severity Index	16.28 (5.04)	17.83 (5.39)	0.93	0.30
Epworth Sleepiness Scale	9.43 (4.72)	10.57 (5.40)	0.64	0.22
PTSD Checklist	54.11 (12.52)	54.36 (11.61)	0.07	0.02
Beck Depression Inventory	27.17 (9.27)	27.30 (12.27)	0.03	0.01
Alcohol Use Disorders Identification Test	24.59 (7.73)	19.47 (11.66)	1.53	0.52
Cannabis Use Disorders Identification Test	7.00 (9.79)	11.59 (10.30)	1.46	0.46
Sleep Diary Variables				
Sleep Efficiency (%)	77.94% (7.82)	83.96% (8.19)	0.94	0.75
Average Nightmares (per night)	0.73 (0.80)	1.09 (0.89)	1.21	0.35

Note:

** $p < .001$,

AHI = Apnea Hypopnea Index, BMI = Body Mass Index, No OSA Symptoms group consists of OSA negative and OSA positive with active PAP use.