

ORIGINAL ARTICLE

Associations between circadian preferences, sleep quality, dissociation, post-traumatic cognitions, and post-traumatic stress disorder (PTSD) among incarcerated offenders

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ABSTRACT

The aim of this study was to explore whether DSM-5 posttraumatic stress disorder (PTSD) dissociative subtype could be differentiated from non-dissociative PTSD caseness in sleep disturbances, circadian preferences, and posttraumatic cognitions. We also investigated associations of dissociation, sleep quality, insomnia, circadian preferences, and trauma-related negative cognitions with DSM-5 PTSD caseness among prisoners. Data from 399 volunteers (mean age: 34.54±9.93 years) were collected. Using the symptoms clusters measured by the PTSD Checklist for DSM-5 (PCL-5) and Dissociative Experiences Scale (DES), the participants were classified into four subgroups: no dissociation or PTSD, pure dissociative, pure PTSD, and dissociative PTSD. Differences in scale scores across four groups were evaluated using one-way analysis of variance. Logistic regression analysis was utilized to determine predictors of DSM-5 PTSD caseness. Participants with dissociative PTSD reported significantly greater posttraumatic stress reactions in terms of PTSD and dissociative symptomatology, greater number of prior trauma exposure, greater scores on posttraumatic negative cognitions, and a tendency to have eveningness diurnal preferences in comparison to those prisoners classified into other three subgroups (no dissociation or PTSD, pure dissociative, and pure PTSD). However, sleep disturbances in terms of insomnia and poor sleep quality were found to be pronounced among prisoners with PTSD irrespective of levels of dissociation. Dissociative symptomatology, insomnia and poor sleep quality significantly contributed to probable PTSD caseness. Dissociation and sleep disturbances appear to be hallmark for PTSD among prisoners.

Keywords: Dissociative experiences, diurnal preferences, dissociative-PTSD subtype, sleep dissociation

INTRODUCTION

Post-traumatic stress disorder (PTSD) is a clinical syndrome characterized by intrusions, avoidance, and

negative cognitive and emotional changes and increased arousal and startle states that persist for more than 1-month immediate to exposure to an adverse life event (American Psychiatric Association, 2013). Trauma exposure is not rare in general population and estimated lifetime prevalence of posttraumatic stress disorder (PTSD) was 8.7% in the United States population (Kilpatrick et al., 2013).

Individuals involved in the criminal justice system and those with a mental health disorder are at higher risk of trauma exposure, and development and persistence of PTSD compared to prevalence rates in general

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population (Browne, Miller, & Maguin, 1999; Choe, Teplin, & Abram, 2008; Maxfield & Widom, 1996; Mueser et al., 2004; Teplin, McClelland, Abram, & Weiner, 2005). Therefore, PTSD has been increasingly recognized as a major health concern among prison inmates that leads to substantial suffering, debilitating effects, and health care costs in that special population (Goff, Rose, Rose, & Purves, 2007; Moloney, van den Bergh, & Moller, 2009). There has been a vast body of evidence documenting the high prevalence rates among those prisoners with PTSD far exceeds general population, ranging from 3.6% to 75.3% (Akyuz, Kugu, Sar, & Dogan, 2007; Anderson, Geier, & Cahill, 2016; Blonigen, Sullivan, Hicks, & Patrick, 2012; Briere, Agee, & Dietrich, 2016; Cusack, Herring, & Steadman, 2013; Flatt, Williams, Barnes, Goldenson, & Ahalt, 2017; Gibson et al., 1999; Gosein, Stiffler, Frascoia, & Ford, 2016; Henrichs & Bogaerts, 2012; Huang, Zhang, Momartin, Cao, & Zhao, 2006; Jordan, Schlenger, Fairbank, & Caddell, 1996; Komarovskaya, Loper, Warren, & Jackson, 2011; Ruzich, Reichert, & Lurigio, 2014; Teplin, Abram, & McClelland, 1996; Warren, Loper, & Komarovskaya, 2009), in which the wide variation in the rates of probable PTSD caseness among inmate samples appears to be the by-product of distinctions in assessment approach, screening tools and PTSD diagnostic criteria built-on different diagnostic systems. However, incarceration, trauma exposure and lifetime and current PTSD co-vary far more frequently even when controlling for socio-demographic covariates among incarcerated people (Anderson et al., 2016).

Given the compelling evidence, sleep is critical for emotion and behavioral regulation (Goldstein & Walker, 2014; Harvey, 2008). Sleep disturbance is very common in PTSD (Maher, Rego, & Asnis, 2006). Sleep disturbances early after trauma exposure feature an increased risk of meeting criteria for PTSD (Breslau, Roth, Rosenthal, & Andreski, 1996; Bryant, Creamer, O'Donnell, Silove, & McFarlane, 2010; Bryant, Harvey, Guthrie, & Moulds, 2000; Koren, Arnon, Lavie, & Klein, 2002; Mellman, Pigeon, Nowell, & Nolan, 2007; Wright et al., 2011). PTSD patients frequently report poor sleep quality, chronic nightmares, sleep terrors, acting out dreams, sleep movement disorders, and sleep-disordered breathing

(Germain, Buysse, Shear, Fayyad, & Austin, 2004; Germain, Hall, Krakow, Katherine Shear, & Buysse, 2005; Krakow et al., 2004; Krakow et al., 2001; Krakow et al., 2006; Williams, Collen, Orr, Holley, & Lettieri, 2015). Sleep disturbances contribute to manifestation of a more complicated clinical expression of symptoms in PTSD, such as comorbid depression (Krakow et al., 2000), psychiatric distress (Krakow et al., 2007), heightened suicidality and self-injurious behavior (Betts, Williams, Najman, & Alati, 2013; Malik et al., 2014; Pigeon, Pinquart, & Conner, 2012; Short, Ennis, et al., 2015), greater anxiety sensitivity (Babson, Boden, Woodward, Alvarez, & Bonn-Miller, 2013), increased alcohol and drug use (Nishith, Resick, & Mueser, 2001; Saladin, Brady, Dansky, & Kilpatrick, 1995; Short, Babson, Boden, & Bonn-Miller, 2015), and decreased quality of life and functioning (Clum, Nishith, & Resick, 2001; Giosan et al., 2015; Krakow, Melendrez, Johnston, et al., 2002; Short, Allan, & Schmidt, 2017). Poor sleep can significantly contribute to next day affective deterioration, such as increased PTSD symptoms and negative affect (Short et al., 2017; Short et al., 2016). Most notably, sleep disturbances do not remit spontaneously or through treatment and are closely tied to refractory PTSD symptoms (Wright et al., 2011). On the other hand, there have been relatively few studies addressing linkages between circadian preferences and PTSD. It was found that eveningness diurnal preferences are significantly associated with severe PTSD among survivors of the Great Hanshin-Awaji Earthquake (Kuroda, Wada, Takeuchi, & Harada, 2013; Wada, Kuroda, Nakade, Takeuchi, & Harada, 2014). Dell'Osso et al. (2014) identified that dysregulation of circadian/seasonal rhythm and vegetative function as indexed by Mood Spectrum-Self Report (Dell'Osso et al., 2002) was substantial correlate of suicidality in DSM-5 PTSD caseness. Eveningness diurnal preferences were found to be associated with difficulties in emotion regulation and sleep disturbances among those military veterans with varying degrees of PTSD (Hasler, Insana, James, & Germain, 2013).

Arousal regulation and memory consolidation both of which are functions of sleep appear to be crucial in determining the onset and persistence of PTSD (Levin &

Nielsen, 2007; Walker & van der Helm, 2009). Undiminished noradrenergic activity at night, fragmented rapid eye movement (REM) sleep and increased noradrenergic activity during REM sleep phase has found to be significantly linked to increased risk for onset of PTSD and poorer clinical outcomes (Breslau et al., 2004; Habukawa, Uchimura, Maeda, Kotorii, & Maeda, 2007; Mellman, Bustamante, Fins, Pigeon, & Nolan, 2002; Mellman, Knorr, Pigeon, Leiter, & Akay, 2004). A meta-analytic review of 20 studies concerning abnormalities in polysomnograph records reported that PTSD patients are characterized by prolonged stage 1 sleep, less slow wave sleep, and greater rapid-eye movement density compared to people without PTSD (Kobayashi, Boarts, & Delahanty, 2007). Neuroimaging studies depicted that PTSD is associated with increased REM sleep limbic and paralimbic metabolism (Ebdlahad et al., 2013; Germain, Mammen, Price, & Nofzinger, 2011).

Dissociation involves discontinuity in the normal integration of psychological functioning, including consciousness, perception, memory, identity, affect, and motor control (Boysan, Yildirim, Besiroglu, Kefeli, & Kagan, 2018; Krause-Utz, Frost, Winter, & Elzinga, 2017; Spiegel et al., 2011). Dissociation is a multifaceted phenomenon, capturing a wide range of psychological symptoms: absorption and imaginative involvement, dissociative amnesia, and depersonalization / derealization (Armour, Contractor, Palmieri, & Elhai, 2014; C. A. Ross, Joshi, & Currie, 1991; Sanders & Green, 1994; Soffer-Dudek, Lassri, Soffer-Dudek, & Shahar, 2015; Stockdale, Gridley, Balogh, & Holtgraves, 2002). Dissociation is a mundane human experience almost ubiquitous in nonclinical populations and considered to be a buffering response to intense unbearable emotions arise from adverse life events (Butler, Duran, Jasiukaitis, Koopman, & Spiegel, 1996; Oathes & Ray, 2008); contrarily, heightened levels of symptomatology evolves into pathological dissociation that appears to have considerable negative impact exert on affective-cognitive functioning (Boysan, 2014, 2016). Pathological dissociation is a transdiagnostic clinical phenomenon prominent in dissociative disorders, PTSD, obsessive-compulsive disorder, and borderline personality disorder

(Boysan et al., 2018; Gleaves, May, & Cardena, 2001; Haaland & Landro, 2009; Kadak, Nasiroglu, Boysan, & Aydin, 2013; Tapançi, Yildirim, & Boysan, 2018).

Trauma-induced stress and nightmares are critical in the development and persistence of dissociative symptoms (Agargun, Kara, Ozer, Selvi, Kiran, & Kiran, 2003; Agargun, Kara, Ozer, Selvi, Kiran, & Ozer, 2003; Cheung, 2012; Semiz, Basoglu, Ebrinc, & Cetin, 2008). In keeping with the continuity hypothesis, Watson (2001) suggested that dissociative experiences are by-product of labile sleep-wake cycle. Prior trauma was demonstrated to have significant dose-response relationship with dissociation through sleep impairment (van Heugten-van der Kloet, Merckelbach, Giesbrecht, & Broers, 2014). On the other hand, people more prone to dissociation easily overwhelm in the face of daily stressful life events and report more severe sleep-related problems (Soffer-Dudek & Shahar, 2009, 2011). Particularly absorption and/or fantasy proneness have been identified as significant correlates of sleep disturbance (Knox & Lynn, 2014; Simor, Csóka, & Bódizs, 2010; Soffer-Dudek et al., 2017; Yildirim, Boysan, & Yilmaz, 2017).

Dissociative symptomatology has long been construed as a salient feature of trauma-induced reactions in the wake of a traumatic experience and identified as a risk factor for development and maintenance of PTSD (Bryant, 2005; Ozer, Best, Lipsey, & Weiss, 2003; van der Hart, van Ochten, van Son, Steele, & Lensvelt-Mulders, 2008). Recent research interest has placed importance on explicating the role of dissociation in the underlying mechanisms of post-traumatic stress response and identifying a dissociative sub-type through classifying PTSD afflicted individuals into homogenous subgroups. Research utilizing taxometric analysis has identified two to five distinct profiles of which a subgroups of those individuals with PTSD was characterized by a dissociative PTSD profile (Armour, Karstoft, & Richardson, 2014; Blevins, Weathers, & Witte, 2014; Frewen, Brown, Steuwe, & Lanius, 2015; Mullerova, Hansen, Contractor, Elhai, & Armour, 2016; Steuwe, Lanius, & Frewen, 2012; Wolf, Lunney, et al., 2012; Wolf, Miller, et al., 2012; Wolf et al., 2017). Recent revision of the Diagnostic and Statistical Manual of Mental Disorders

(DSM-5) included a dissociative subtype of PTSD, marked by dissociative responses to cues of traumatic events in the form of depersonalization and/or derealization (American Psychiatric Association, 2013). Associated features of dissociative subtype of PTSD include heightened trauma-related symptomatology, increased comorbid psychiatric conditions, more frequency of sleep disturbances and hostility, and multiple traumatization (Armour, Elklit, Lauterbach, & Elhai, 2014; Hansen, Ross, & Armour, 2017; van Huijstee & Vermetten, 2017).

Long-term incarceration probably reflects a traumatization on its own and is associated with PTSD as well as other stressor related disorders which in turn leads to behavioral problems including specifically substance use disorder and aggression, more trauma exposure and criminal recidivism (Ardino, 2012; Cusack et al., 2013; Dudeck et al., 2011; Maschi, Gibson, Zgoba, & Morgen, 2011; Spitzer et al., 2001). In cross-sectional studies undertaken on community dwelling samples, PTSD has been consistently found to be associated with greater rates of self-reported contacts with the criminal justice system (Collins & Bailey, 1990; Donley et al., 2012). More recent research on released prisoners with PTSD showed that a majority of those justice-involved persons with PTSD were more likely to be rearrested within the same year for a new felony charge relative to prisoners without PTSD (Kaba et al., 2015; Peller, Najavits, Nelson, LaBrie, & Shaffer, 2010; Sadeh & McNiel, 2015), indicating that jail inmates with severe PTSD symptoms should be conceived as high risk population requiring more attention.

Even though, in comparison to general and clinical samples, high prevalence rates of PTSD among incarcerated populations have been more recognized and received more research interest, explicating the underlying risk factors and underpinnings of PTSD in these high risk groups requires further attention going beyond presence of or associations with early or prior traumatic experiences. Evidence has emerged in the literature that prison inmates more frequently report remarkable levels of dissociative symptomatology concurrent with multi-traumas and more complicated

clinical manifestation of posttraumatic stress responses (Akyuz et al., 2007; DeCou, Lynch, Cole, & Kaplan, 2016; Salgado, Quinlan, & Zlotnick, 2007; Steiner, Garcia, & Matthews, 1997). On the other hand, there is growing evidence that sleep disruption associated with trauma exposure constitute a specific mechanism causally involved in the onset, maintenance and poor treatment outcomes of PTSD. The fear conditioning and extinction paradigms have been used to elaborate both animal and human models to unravel the role of sleep in PTSD. Fear conditioning, extinction and extinction recall can influence and in turn be influenced by REM sleep (Germain, 2013; Germain, Buysse, & Nofzinger, 2008; Germain et al., 2011). Nevertheless, to date, the association between PTSD, dissociative symptomatology, posttraumatic cognitions, circadian preferences and sleep disturbances in terms of impaired sleep quality and insomnia has not been addressed among high risk populations, particularly among jail inmates. Based on the extant literature, the present study tested the hypothesis that the PTSD among incarcerated adults would likely to be far greater than general population. Second, we aimed to test whether individuals classified in a dissociative-PTSD subtype would exhibit more complicated clinical characteristics marked by more severe PTSD symptoms, greater sleep difficulties, higher scores on trauma-related negative cognitions, and more proneness to evening-type diurnal preferences than prisoners without pathological dissociation or PTSD. Third, we expected that individuals who reported greater levels of dissociative experiences, more severe sleep disturbances, higher levels of posttraumatic cognitions, and a tendency to eveningness diurnal preferences would be at higher risk for probable DSM-5 PTSD caseness.

METHOD

Participants and Procedure

The participants were recruited from adult prisoners in Van M Type Prison, Turkey. Prisoners who completed at least 1 month of their incarceration included in the study. Eight observations were discarded due to

incomplete screening tools. The sample consisted of 399 adult prisoners, aged from 18 to 75 years. The average age of inmates was 34.54 ± 9.93 years. The vast majority of the prisoners were male ($n=389$, 97.5%). 60.2% of the participants were married and 61.9% reported having at least one child. Almost half of the respondents were comprised of sentenced prisoners ($n= 26$, 51.6%).

Considering clinical characteristics of the sample, 59.4% of prisoners were identified as DSM-5 PTSD caseness. Approximately all participants reported at least one type of prior trauma exposure as indexed by the LEC-5 ($n=367$, 91.98%). 36.8 % had pathological levels of

dissociation ($DES \geq 30$) and 31.6% were classified into DES-taxon membership according to the algorithm proposed by Waller, Putnam, and Carlson (1996). Although majority of the respondents consisted of morning- (42.9%) and neither-type (52.6%) individuals, 70.4 % of incarcerated adults were poor sleepers and 37.8% had clinical insomnia. Findings are presented in Table 1.

The study was conducted from May 2017 through August 2017. The surveys were conducted in participants' personal rooms. The participants were informed about the aim and procedure of the study, and then self-

Table 1. Socio-demographic and clinical characteristics of participants

		Mean	SD
Age		34.54	9.93
Duration of incarceration (months)		31.06	27.45
		n	%
Sex	Female	10	2.51%
	Male	389	97.49%
Marital status [†]	Single	159	39.85%
	Married	240	60.15%
Having children		247	61.90%
Education	Uneducated	51	12.78%
	Primary school	88	22.06%
	Secondary school	127	31.83%
	High school	92	23.06%
	College	39	9.77%
	Graduate school	2	0.50%
Incarceration Status	Detainees/ remand	193	48.37%
	Sentenced	206	51.63%
Types of crimes	Sexual crimes	22	5.51%
	Drug crimes	240	60.15%
	Killing	53	13.28%
	Smuggling	24	6.02%
	Forgery	2	0.50%
	Robbery	46	11.53%
	Wounding or causing grievous bodily harm	5	1.25%
	Negligent crimes	2	0.50%
	Bribery	5	1.25%
DSM-5 PTSD diagnosis		237	59.40%
Presence of prior trauma	LEC-5 ≥ 1	367	91.98%
Pathological dissociation	DES ≥ 30	147	36.84%
DES taxon membership		126	31.58%
Poor sleep quality	PSQI ≥ 5	281	70.43%
Clinical insomnia	ISI ≥ 15	151	37.84%
Morning-evening type	Evening type	18	4.51%
	Neither	210	52.63%
	Morning type	171	42.86%

Note. [†]Divorced ($n=15$, 3.76%) and widowed ($n=6$, 1.50%) participant are represented in single marital status. 67 participants (16.79%) who were waiting supreme court are included in detainees group. LEC-5 = Life Event Checklist for DSM-5; DES = Dissociative Experiences Scale; PSQI = Pittsburgh Sleep Quality Index; ISI = Insomnia Severity Index

reported questionnaires were administered to them with the assistance of trained psychologists.

The permission for this study was granted from the Republic of Turkey Ministry of Justice. The study protocol and procedures were approved by the Institutional Review Board of the Van Yüzüncü Yıl University. Written informed consent was obtained from each participant. Participants were not compensated for their involvement in the study.

Instruments

PTSD Checklist for DSM-5 (PCL-5)

The PCL-5 (Blevins, Weathers, Davis, Witte, & Domino, 2015) is a 20-item self-report measure designed to assess severity of DSM-5 PTSD symptoms. Respondents are asked to rate severity of each symptom from 0 (*not at all*) to 4 (*extremely*). There are three versions of the PCL-5: One version assesses symptoms of PTSD without Criterion A, the second one assesses PTSD symptoms including a brief Criterion A, and the third one includes the Life events Checklist for DSM-5 (LEC-5) with a Criterion A section. We administered the third version of the PCL-5 which includes the LEC-5. Turkish version of the instrument was demonstrated to have excellent psychometric properties, with high internal consistency ($\alpha = 0.94$) and test-retest reliability ($r = 0.80$), as well as convergent validity (Boysan et al., 2017).

Dissociative Experiences Scale (DES)

The DES (Carlson & Putnam, 1993) is a 28-item self-report measure designed to screen dissociative experiences in community and clinical populations. Items are scored on a scale ranging from 0 ("not at all") to 100 ("almost every time"), and the summed up scores are averaging to yield an overall severity level in dissociative symptomatology. The Turkish version demonstrated good internal consistency ($\alpha = 0.97$) and test-retest reliability ($r = 0.77$), as well as convergent validity (Yargic, Tutkun, & Sar, 1995).

Posttraumatic Cognitions Inventory (PTCI)

The PTCI (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999)

was developed to assess negative thoughts and beliefs of trauma exposed individuals. The screening tool contains 33 self-report items, yielding three subscales: negative cognitions about self (21 items), negative cognitions about the world (7 items) and self-blame for the trauma (5 items). Respondents are asked to rate each item on a 7-point Likert type scale, ranging from 1 ("totally disagree") to 7 ("totally agree"). The Turkish version of the scale was demonstrated to have excellent reliability and validity (Gulec, Kalafat, Boysan, & Barut, 2013).

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is a reliable and valid instrument assessing sleep quality and disturbances over a 1-month time interval (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The measure consists of 19 self-report questions. The PSQI yields seven components representing the dimensions of sleep quality: Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The Turkish version of the PSQI adapted by Agargun, Kara, and Anlar (1996). A cut score of PSQI ≥ 5 discriminates well poor from good sleepers, and is an excellent general screening measure of sleep disturbances (Yildirim & Boysan, 2017).

Insomnia Severity Index (ISI)

The ISI is a reliable and valid instrument designed to assess severity of insomnia. Participants are asked to rate 7 self-reported items relevant to severity of difficulties with sleep onset, sleep maintenance, early-morning awakening, sleep problem interference with daily functioning, indications to others of impairment due to sleep problems, degree of concern about the current sleep problem, and satisfaction/dissatisfaction with current sleep pattern (Bastien, Vallieres, & Morin, 2001). Each item is rated on a scale ranging from 0 to 4 and the scale yields scores ranging from 0 to 28. Higher scores are attributable to more severe insomnia. The Turkish version of the ISI revealed promising psychometric properties with an internal reliability of $\alpha = 0.79$ and two-week test-retest reliability of $r = 0.82$

(Boysan, Gulec, Besiroglu, & Kalafat, 2010).

Morningness–Eveningness Questionnaire (MEQ)

The MEQ (Horne & Ostberg, 1975) is the most widely used tool to identify sleep chronotype preferences. The screening tool has 19 self-reported items and yields scores ranging from 16 to 86. Participants who score between 59 and 86 are classified as morning-type, who score between 42 and 58 are classified as neither-type, and who score between 16 and 41 are classified as evening-type. The Turkish version of the MEQ was demonstrated to have good validity and reliability. Cronbach's alpha coefficient for 19 items was $r = 0.81$ (Agargun et al., 2007).

Data Analysis

We commenced with performing descriptive statistics for clinical and socio-demographic characteristics of the prisoners. We classified participants into four groups including prisoners having a probable DSM-5 PTSD with ($DES \geq 30$) and without ($DES < 30$) pathological dissociation, and prisoners having no DSM-5 PTSD with and without pathological dissociation. Using one-way analysis of variance we compared differences in the mean scores on the subscales of the PCL-5, DES, PTCI, PSQI, as well as on the ISI and MEQ total across these four groups. Then, we run a multiple logistic regression analysis and a stepwise regression analysis separately, in which DSM-5 PTSD diagnosis was dependent variable in each model. In the multiple logistic regression model, total scale scores on the LEC-5, DES, PTCI, MEQ, ISI, and PSQI were regressed onto probable DSM-5 PTSD caseness after controlling for age, duration of incarceration, sex, marital status, having child, levels of education, and incarceration status. In the stepwise regression analysis, adhering to forward conditional procedure, we regressed subscales of the DES, PTCI, PSQI, as well as the total scores of the LEC-5, ISI, and MEQ onto DSM-5 PTSD caseness after controlling for socio-demographic variables (age, duration of incarceration, sex, marital status, having child, levels of education, and incarceration status). The statistical threshold was set at $p < 0.05$.

RESULTS

The mean PCL-5 total score was $37.70 (\pm 20.65)$. Based on DSM-5 criteria for PTSD diagnosis including at least one re-experiencing symptom, one avoidance symptom, two negative alterations in cognitions and mood, and two hyper-arousal symptoms of at least moderate severity (2 or higher) DSM-5 PTSD caseness in the sample was determined. Accordingly, 59.4% of the respondents were allocated in probable DSM-5 PTSD sub-group. Based on the DES total scores, we also splitted the sample into two subgroups: high dissociators ($DES \geq 30$) and low dissociators ($DES < 30$).

When we cross tabulated prisoners with and without probable DSM-5 PTSD and those prisoners with and without pathological dissociation, we obtained four subgroups: dissociative PTSD, pure PTSD, pure dissociators, and no PTSD or dissociation. 115 cases were classified into dissociative PTSD subgroup (28.82%), 112 cases had pure PTSD (30.58%), 32 prisoners were pure dissociators (8.02%), and 130 had neither PTSD nor pathological dissociation (32.58%). We run one-way analysis of variance across these four subgroups to investigate differences in the mean scale scores on the PCL-5, LEC-5, DES, PTCI, MEQ, ISI, and PSQI. The post hoc comparisons were conducted using Bonferroni multiple group comparison test.

As can be seen in Table 2, dissociative PTSD group reported significantly greater scores on the PCL-5 total and four subscales of the PCL-5 (intrusions, negative alterations in cognitions and mood, hyper-arousal) than other three groups (pure PTSD, pure dissociators, and no PTSD or dissociation). Irrespective of dissociative tendency, prison inmates with probable DSM-5 PTSD reported higher scores on the avoidance subscale of the PCL-5 than did prisoners without PTSD. We observed that pure dissociators had the lowest scores on prior traumatic experiences as indexed by the LEC-5 which was statistically significantly differentiated from the dissociative PTSD group with highest trauma exposure scores. High dissociators reported significantly higher scores on the total and subscales of the DES compared to

Table 2. ANOVA comparisons across groups

	DSM-5 PTSD Caseness												P	η ²	Post Hoc ^a	
	No PTSD						PTSD									
	Dissociative Experiences Scale			Dissociative Experiences Scale			Dissociative Experiences Scale			Dissociative Experiences Scale						
	DES<30	DES≥30	DES≥30	DES<30	DES<30	DES≥30	DES<30	DES<30	DES<30	DES<30	DES≥30	DES≥30				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD				
	G1=Normal n=130	G2=Pure Dissociators n=32	G3=Pure PTSD n=122	G4=Dissociative PTSD n=115												
PTSD Checklist for DSM-5	17.79	10.80	19.72	11.99	47.37	14.55	54.94	12.25	227.354	<0.001	0.633	G1 = G2 < G3 < G4				
Intrusions	5.13	3.78	5.06	4.12	11.75	4.35	13.59	4.26	110.529	<0.001	0.456	G1 = G2 < G3 < G4				
Avoidance	1.52	1.56	2.19	2.21	4.98	1.87	5.46	1.68	135.710	<0.001	0.508	G1 = G2 < G3 = G4				
Negative Alterations	6.75	5.19	7.31	5.72	16.91	5.67	19.55	4.91	150.937	<0.001	0.534	G1 = G2 < G3 < G4				
Hyper-arousal	4.38	4.06	5.16	4.06	13.73	5.12	16.34	4.83	170.271	<0.001	0.564	G1 = G2 < G3 < G4				
Life Events Checklist for DSM-5	6.38	4.76	5.00	5.24	6.74	4.61	7.88	4.74	3.843	0.010	0.028	G2 < G4				
Dissociative Experiences Scale	11.14	7.98	44.56	16.40	14.90	9.18	47.90	13.87	297.239	<0.001	0.693	G1 < G3 < G2 = G4				
Depersonalization/Derealization	7.22	7.70	42.42	18.73	11.75	10.70	43.61	18.25	202.535	<0.001	0.606	G1 < G3 < G2 = G4				
Absorption/Imaginative Involvement	15.17	11.29	46.48	17.81	19.41	12.65	52.91	15.55	200.172	<0.001	0.603	G1 = G3 < G2 = G4				
Amnesia	9.31	9.39	44.06	18.36	11.48	8.97	44.71	17.57	214.976	<0.001	0.620	G1 = G3 < G2 = G4				
Posttraumatic Cognitions Inventory	8.81	3.12	10.41	4.71	9.86	3.26	12.60	3.64	25.615	<0.001	0.163	G1 = G2 = G3 < G4				
Negative Cognitions about Self	1.98	0.96	2.96	1.67	2.49	1.11	3.70	1.36	44.197	<0.001	0.251	G1 < G2 = G3 < G4				
Negative Cognitions about the World	3.96	1.69	4.26	1.94	4.32	1.56	5.08	1.52	10.068	<0.001	0.071	G1 = G2 = G3 < G4				
Self-Blame	2.86	1.28	3.19	1.71	3.05	1.35	3.82	1.41	10.778	<0.001	0.076	G1 = G2 = G3 < G4				
Morningness-Eveningness Questionnaire	57.92	8.10	55.03	7.14	57.25	8.03	53.46	8.76	7.072	<0.001	0.051	G1 = G3 > G4				
Insomnia Severity Index	7.79	6.15	8.84	7.94	14.44	6.81	16.10	7.65	36.105	<0.001	0.215	G1 = G2 < G3 = G4				
Pittsburgh Sleep Quality Index	5.61	3.54	5.19	3.91	9.08	4.26	9.17	4.55	24.777	<0.001	0.158	G1 = G2 < G3 = G4				
Subjective Sleep Quality	0.95	0.98	0.81	1.03	1.74	1.05	1.81	1.10	21.448	<0.001	0.140	G1 = G2 < G3 = G4				
Sleep Latency	1.44	0.84	1.50	0.72	1.93	0.84	1.71	0.90	7.423	<0.001	0.053	G1 < G3				
Sleep Duration	0.45	0.90	0.41	0.91	0.93	1.23	0.96	1.24	6.573	<0.001	0.048	G1 = G2 < G3 = G4				
Habitual Sleep Efficiency	0.42	0.83	0.38	0.83	0.53	0.95	0.54	0.93	0.621	0.602	0.005					
Sleep Disturbances	1.28	0.68	1.19	0.90	1.90	0.77	2.02	0.77	27.707	<0.001	0.174	G1 = G2 < G3 = G4				
Use of Sleeping Medication	0.52	0.92	0.34	0.75	0.93	1.23	0.93	1.18	5.648	0.001	0.041	G1 = G2 < G3 = G4				
Daytime Dysfunction	0.55	0.72	0.56	0.80	1.13	1.00	1.20	1.09	14.197	<0.001	0.097	G1 = G2 < G3 = G4				

Note. ^aPost hoc analyses were conducted using Bonferroni multiple group comparison test. Significant P values are boldfaced.

low dissociators. In comparison to other three groups, high dissociators with PTSD had statistically significantly higher scores on total and subscale scores of the PTCI. Individuals classified in dissociative PTSD subgroup were more prone to have eveningness diurnal preferences. Prisoners with probable DSM-5 PTSD had significantly worst sleep quality than prisoners without PTSD whether they had pathological dissociation or not.

Using multiple logistic modeling approach, after controlling for socio-demographic variables (age, duration of incarceration, incarceration status, sex, marital status, having child, and levels of education), total scores on the LEC-5, DES, PTCI, MEQ, ISI, and PSQI were regressed onto binary dependent variable (probable DSM-5 PTSD caseness vs no PTSD). The multiple logistic regression analysis showed that being male (OR = 9.192, $p=0.042$, 95% confidence interval =

1.084-77.923), the DES (OR = 1.038, $p<0.001$, 95% confidence interval = 1.022-1.055), the ISI (OR = 1.120, $p<0.001$, 95% confidence interval = 1.071-1.170), and the PSQI (OR = 1.151, $p<0.001$, 95% confidence interval = 1.071-1.237) scores significantly contributed to the development of PTSD among prisoners. Findings are presented in Table 3.

Next, we run a stepwise logistic regression analysis using forward conditional method in which probable DSM-5 PTSD caseness was the dependent variable. Socio-demographic variables (age, duration of incarceration, incarceration status, sex, marital status, having child, and education level), the LEC-5, MEQ, ISI total scores, as well as depersonalization / derealization, absorption / imaginative involvement, amnesia subscale scores of the DES, negative cognitions about self, negative cognitions about the world and self-blame subscale

Table 3. Logistic regression analysis on DSM-5 PTSD caseness

	Odds Ratio	P	95,0% C.I.
Age	0.985	0.373	0.953-1.018
Duration of Incarceration	0.996	0.479	0.986-1.007
Sex	9.192	0.042	1.084-77.923
Marital status	1.629	0.278	0.675-3.934
Having child	0.775	0.587	0.309-1.943
Education	1.024	0.828	0.824-1.273
Incarceration Status	1.634	0.095	0.919-2.905
Life Events Checklist for DSM-5	1.037	0.177	0.984-1.093
Dissociative Experiences Scale	1.038	<0.001	1.022-1.055
Posttraumatic Cognitions Inventory	1.047	0.225	0.972-1.126
Morningness-Eveningness Questionnaire	1.029	0.090	0.996-1.064
Insomnia Severity Index	1.120	<0.001	1.071-1.170
Pittsburgh Sleep Quality Index	1.151	<0.001	1.071-1.237

Note. Significant P values are boldfaced.

Table 4. Stepwise logistic regression on DSM-5 PTSD caseness

	Nagelkerke's R ²	Odds Ratio	P	95% C.I.
STEP 1	0.278			
Insomnia Severity Index		1.158	<0.001	1.119-1.199
STEP 2	0.350			
Insomnia Severity Index		1.124	<0.001	1.085-1.166
Sleep Disturbances		2.309	<0.001	1.676-3.180
STEP 3	0.402			
Absorption/Imaginative Involvement		1.030	<0.001	1.017-1.044
Insomnia Severity Index		1.118	<0.001	1.077-1.161
Sleep Disturbances		2.130	<0.001	1.535-2.956
STEP 4	0.411			
Sex		9.005	0.033	1.197-67.736
Absorption/Imaginative Involvement		1.033	<0.001	1.019-1.048
Insomnia Severity Index		1.124	<0.001	1.081-1.168
Sleep Disturbances		2.143	<0.001	1.540-2.981

scores on the PTCI, and seven components of the PSQI were independent variables. The hierarchical logistic stepwise regression model converged at the fourth step. In the final step we observed that being male (OR = 9.005, $p=0.033$, 95% confidence interval = 1.197-67.736), the ISI (OR = 1.124, $p<0.001$, 95% confidence interval = 1.081-1.168), and the sleep disturbances component of the PSQI (OR = 2.143, $p<0.001$, 95% confidence interval = 1.540-2.981), and absorption / imaginative involvement subscale of the DES (OR = 1.033, $p<0.001$, 95% confidence interval = 1.019-1.048) statistically significantly contributed to development of PTSD in adult prisoners. These four independent variables accounted for 41% of the unique variance of dependent variable. Results are reported in Table 4.

DISCUSSION

Trauma exposure is increasingly being recognized as a crucial risk factor emphasized in mental health models of criminal justice system. High prevalence rates of individuals with PTSD in relation to trauma exposure among incarcerated populations and its significant relations with co-occurrence of other psychiatric disorders, particularly substance use disorder and recidivism highlight the importance to understand underpinning factors conferring risk for development and maintenance of the PTSD in criminal justice system (Choe et al., 2008; Constantine et al., 2010; Scott, McGilloway, Dempster, Browne, & Donnelly, 2013). The present study investigated the relations of DSM-5 PTSD caseness with prior trauma exposure, dissociation, posttraumatic cognitions, circadian preferences and sleep disturbances. We found that 59.4% screened positive for DSM-5 PTSD as measured by PCL-5 with a high prevalence of at least one type of reported prior trauma exposure (92.0%), 36.8% had pathological levels of dissociation, 70.4% had poor sleep quality, and 37.8% had clinical level of insomnia. The high rates of probable DSM-5 PTSD caseness and multiple trauma exposure, as well as significant relations with dissociative symptomatology were comparable with the previous studies (Akyuz et al., 2007; Briere et al., 2016; Cusack et

al., 2013; DeCou et al., 2016; Henrichs & Bogaerts, 2012; Karatzias et al., 2017; Sindich et al., 2014; Steiner et al., 1997).

We used pathological DES scores (≥ 30) to detect dissociative PTSD cases among prison inmates and found a sizable minority of the respondents were classified as having dissociative PTSD (28.8%, $n=115$), the proportion of high dissociators with PTSD which was comparable to most of previous studies using taxometric models to detect dissociative-PTSD cases (Hansen et al., 2017; Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012). In keeping with the previous findings observed for individuals with dissociative PTSD (Ginzburg et al., 2006; Hansen et al., 2017; Lanius et al., 2012; Steuwe et al., 2012; Wolf, Lunney, et al., 2012), in the current data, members of dissociative PTSD group reported significantly greater number of average prior trauma exposure relative to pure PTSD, pure dissociators, or non-symptomatic baseline group.

The results of relatively sparse number of studies concerning the discrepancies between subtypes of PTSD have consistently pointed out that individuals with dissociative-PTSD revealed a more complicated clinical expression of the disorder: greater comorbidity (Steuwe et al., 2012; Wolf, Lunney, et al., 2012), a tendency to cope emotionally (Hansen, Mullerova, Elklit, & Armour, 2016), more severe substance use problems (Mergler et al., 2017; Tsai, Armour, Southwick, & Pietrzak, 2015), greater suicidality (Lanius et al., 2012; Lanius et al., 2014; McFarlane, 2013; Stein et al., 2013), memory and attention deficits (Roca, Hart, Kimbrell, & Freeman, 2006; J. Ross, Banik, Dedova, Mikulaskova, & Armour, 2017), more severe depressive and anxious symptomatology, greater risk for hostility and sleeping difficulties (Armour, Elklit, et al., 2014). In an attempt to add prior work we evaluated whether individuals with dissociative-PTSD significantly differed in sleep quality, insomnia, circadian preferences and posttraumatic cognitions compared to individuals with pure PTSD, pure dissociation or without trauma-induced stress reactions. We hypothesized that these factors may be pertinent given the previously noted associations between PTSD and sleep (Casement & Swanson, 2012; Ho, Chan, & Tang, 2016; Khachatryan,

Groll, Booij, Sepehry, & Schutz, 2016; Nappi, Drummond, & Hall, 2012) dissociation and sleep (Selvi et al., 2017; Van Der Kloet et al., 2013; van der Kloet, Giesbrecht, Lynn, Merckelbach, & de Zutter, 2012; van der Kloet, Merckelbach, Giesbrecht, & Lynn, 2012; van Heugten-van der Kloet, Giesbrecht, & Merckelbach, 2015; van Heugten-van der Kloet, Huntjens, Giesbrecht, & Merckelbach, 2014; van Heugten-van der Kloet, Merckelbach, et al., 2014), trauma-related stress responses and posttraumatic cognitions (Diehle, Schmitt, Daams, Boer, & Lindauer, 2014; Swopes, Davis, & Scholl, 2017; Woud, Verwoerd, & Krans, 2017). Previous PTSD literature has suggested significant relationships between PTSD, dissociation, posttraumatic cognitions, sleep quality, insomnia and circadian preferences.

Keeping with the previous compelling evidence, results showed that those of individuals with dissociative PTSD reported the most severe levels of posttraumatic response symptoms, with the highest scores on intrusions, negative alternations on mood and cognition and arousal and startle responses as indexed by the PCL-5 relative to pure PTSD, pure dissociators and normal groups. As expected, jail inmates with dissociative PTSD were statistically distinguishable from other three groups with pronounced levels of posttraumatic cognitions scores on the PTCI total and sub-scales of negative cognitions about self and the world, and a tendency to self-blame. Turning to the sleep related variables, we observed that dissociative PTSD cases were more prone to evening-type circadian preferences than individuals classified in other three subgroups. Participants with probable DSM-5 PTSD, whether they had pathological levels of dissociation or not, reported significantly worse sleep quality and more severe insomnia compared to prisoners without PTSD. These findings confirmed and extended the extant research on discrepancies between dissociative and non-dissociative PTSD subtypes (Armour, Elklit, et al., 2014; Hansen et al., 2017; van Huijstee & Vermetten, 2017).

Using logistic regression analysis, we found that dissociative symptomatology, insomnia severity and poor sleep quality significantly contributed to the unique variance of probable DSM-5 PTSD caseness after

controlling for socio-demographic variables (age, duration of incarceration, sex, marital status, having child, level of education, incarceration status and number of trauma exposure prior to incarceration). When considering for the sub-scales of the DES, PTCI, and PSQI, as well as the MEQ and ISI after controlling for the demographic covariates, we found that absorption/imaginative involvement as indexed by the DES, sleep disturbances component of the PSQI, and insomnia severity were significant antecedents of the heightened posttraumatic stress reactions in justice-involved criminal adults.

Given the high rates of clinically significant PTSD cases among jail inmates with a greater dissociative tendency and disproportionately greater risk for development of PTSD for incarcerated adults with sleep disturbances, healthcare providers should be aware of the high risk of trauma and stressor-related disorders in relation to sleep problems in correctional units. Providing psychiatric screening at the time of imprisonment and follow-up assessments with certain time intervals may facilitate detecting probable PTSD caseness and psychiatric comorbidities among these risky populations and referral to mental health resources and appropriate treatment plans. Continuity of health care programs for inmates afflicted with psychiatric conditions may be implemented to more accurately meet the mental health care among prisoners (Baillargeon, Binswanger, Penn, Williams, & Murray, 2009). Treatment plans for PTSD concurrent with dissociative symptomatology targeting sleep disruptions can help to improve symptoms of trauma- or stress- induced psychological responses and other psychiatric conditions, as well as general health and psychological well-being in correctional units.

Several drawbacks should be considered when interpreting the present findings. First, this investigation was a cross-sectional study. Further explorations with longitudinal research design are needed to expand our understanding of the role of interactions between dissociative symptomatology and sleep disturbances in the onset and perseverance of PTSD in prisoners. Second, the study was conducted in a correlation institution among a relatively small sample of jail inmates

and the number of women was excessively small that may limit the generalizability of the results and may lack adequate power to identify significant discrepancies. Third, self-report measures of psychiatric conditions and related psychological constructs were utilized instead of clinician interviews. Similarly, objective measures of sleep such a polysomnography could have provided more reliable and profound assessments relative to subjective measurement procedures as adopted in the present study. Forth, although objective diagnostic data emerged in polysomnography studies indicate widely varying prevalence rates, more recent studies have provided compelling evidence that increased frequency of sleep-disordered breathing in PTSD patients (Krakow, Ulibarri, Moore, & McIver, 2015). Nevertheless, in the present data, we did not address sleep-disordered breathing in relation to PTSD. Finally, the fact that comorbid PTSD and substance use disorders are common in jail inmates and linked to a more complicated expression of the trauma-related symptomatology, and behavioral inhibition disturbances, particularly relevant to recidivism (N. Messina, Burdon, Hagopian, & Prendergast, 2004; Salgado et al., 2007; Sindicich et al., 2014; Wallace et al., 1998; Wolff, Frueh, Shi, & Schumann, 2012; Wolff & Shi, 2011). However, we did not make an assessment concerning history of substance use disorder in the current investigation.

CONCLUDING COMMENTS

The robust evidence emerged in review of the literature was that the frequency of traumatic experiences preceding incarceration far exceeds the respective prevalence rates in general population, and it seems, despite unconfirmed in the present data, prior trauma exposure pose significant risk for development of PTSD as well as other psychiatric morbidities which are tentatively mediated by posttraumatic symptoms in prison population (Greene, Ford, Wakefield, & Barry, 2014). Untreated PTSD may further complicate the clinical picture of other psychiatric disorders particularly among women inmates, thereby compromising the efficiency of psychological and psychopharmacological

interventions (Kubiak, 2004). Presence of severe posttraumatic symptomatology appears to be significantly affecting interpersonal relationships, regulation of affect, arousal and impulsivity during conviction and post-incarceration that results in increased rates of aggressive and violent behaviours and substance use disorders, which in turn are substantially associated with recidivism (Asberg & Renk, 2012; Ford, Chapman, Mack, & Pearson, 2006; Ford, Grasso, Hawke, & Chapman, 2013; N. Messina et al., 2004; Sindicich et al., 2014). On the other hand, successful interventions targeting PTSD symptomatology were identified to be associated with resolution of victimization and significant improvement in substance use and recidivism (Ford, Chang, Levine, & Zhang, 2013; N. Messina & Calhoun, 2014; Zlotnick, Johnson, & Najavits, 2009). Early prevention and intervention programs might help alleviate burden of physical and mental health problems experienced by offenders with a history of trauma (Gosein et al., 2016; Green et al., 2016; Green, Miranda, Daroowalla, & Siddique, 2005; Maschi, Morgen, Zgoba, Courtney, & Ristow, 2011; N. Messina & Grella, 2006; N. Messina, Grella, Burdon, & Prendergast, 2007; N. P. Messina, Burdon, & Prendergast, 2003).

The role of sleep in the development and maintenance of PTSD appears to be complex, but sleep studies in PTSD is an important avenue for understanding the nature and treatment of the disorder. The premise that that sleep disturbances in the aftermath following adverse life events contribute to poor psychological outcomes may facilitate the provision of management strategies aim to enhance resilience and recovery in PTSD. Cognitive-behavioral interventions targeting post-traumatic nightmares and insomnia contribute to very significant improvement in sleep and daytime PTSD symptom severity (Davis, 2008; Germain, Shear, Hall, & Buysse, 2007; Krakow & Zadra, 2010). In a related vein, cognitive behavioral interventions and psycho-education programs resulted in comparable improvement in PTSD severity were significantly associated with improvement in sleep symptoms (McHugh et al., 2014). Furthermore, continuous positive airway pressure treatment in PTSD patients with sleep-disordered breathing reduces sleep

fragmentation and psycho-physiological arousal (Krakow, Melendrez, Warner, et al., 2002). Psychopharmacological and behavioral treatments targeting sleep disturbance in PTSD have demonstrated to be beneficial to improvements in nightmares and insomnia, which are often more resistant relative to subjective complaints of sleep in PTSD, concomitant with severity of daytime PTSD symptoms and other stress-related psychiatric comorbidities (Germain, 2013). This study provided further evidence supporting the pivoting role of sleep disturbances, particularly poor sleep quality and insomnia along with pathological dissociation in PTSD. The current findings suggested that incorporation of sleep-related interventions targeting nightmares and insomnia may provide significant improvement in the clinical outcomes of trauma-informed treatment approaches for prisoners with PTSD.

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